# Contents

## Goa University

### A brief introduction

Goa University was established in the year 1985 around the nucleus of the Post Graduate Centre and 17 Colleges affiliated to the Bombay University. Over the past decade, the University has grown steadily in size, and the scope of its academic programmes.

Presently the University has 11 Faculties encompassing a wide range of disciplines from Languages, Music and Art, Law, Natural Sciences, Life Sciences and Environment, Medicine, including Ayurveda, and Engineering, spread over 23 University Departments, 4 centres of studies, one UGC academic Staff College, 45 affiliated colleges and 7 recognized institutions.

The University is located on a beautiful campus spreading over nearly 173 hectares on the Taleigao Plateau, overlooking the river Zuari joining the Arabian Sea. The Taleigao Plateau is located at a distance of 5 km from Panaji city, which is the capital of Goa. The various faculties of the University are housed in separate buildings, possessing considerable architectural distinction. The University Campus is serviced by numerous infrastructure facilities such as Hostels, Health centre, Post-office, Direct Inward Dialling, STD-ISD booths, Bank, Guest house, Kiosks and Canteens.

### Hostel Accommodation

The University has full fledged hostels both for the men and women students. The hostels are located in close proximity to the Department and are well equipped with all modern facilities. There is a separate hostel for research students with limited accommodation. The students interested in seeking admission to the hostel are required to apply separately in the prescribed application form available from the respective Hostel Wardens.

## Department of Computer Science and Technology (DCST)

### A brief introduction

Anticipating the importance of Information Technology in present times, Goa University established the Department of Computer Science and Technology in the year 1987, with the financial assistance from DOE/UGC under the Manpower Development Scheme. A full time, 3- year degree programme leading to the "Master of Computer Applications" (MCA) degree was started in the academic year 1987-88. Goa University thus became one of the select universities of our country imparting training and education in the field of Computer Science and Application at the post graduate level.

Presently the department has seven full-time faculty members. The alumni of the Department are well placed and currently hold leading positions in reputed IT organizations in the country and abroad.

From the academic year 2007-2008, the department in collaboration with the Department of Mathematics initiated a two year postgraduate degree program called M.Sc. Mathematics (Computer Science).

### Laboratory Facilities

The Laboratory facilities in the Department are constantly upgraded to cater to the growing needs of students. Currently around fifty Intel Core 2 nodes spread over the Department area – the laboratory as well as faculty offices – are served by Linux and Windows servers. About fifty students can simultaneously work on MS WINDOWS/UNIX/X-Windows platforms. Presently, the laboratory supports all computer languages, Integrated Development Environments and software tools available on Open Source Linux Platform. In addition to the usual Office suites, such as Microsoft Office, the laboratory also provides students and faculty with the latest versions of development tools and application platforms such as Oracle,

Visual Studio, Rational suite, IBM RSA, MATLAB and Adobe eLearning suite. The Department subscribes to the Microsoft's MSDN Academic Initiative which provides legal copies of all Microsoft software available on workstation and Server platforms. Legal copies of Microsoft Software including operating systems and development tools are available for students for download under MSDN Academic Licence program.

The Department rides on a Campus-wide fibre-optic backbone and has full TCP/IP connectivity to the Internet. The students of the department have 24 hour access to all Internet services and laboratory infrastructure.

## Library Facilities

The Goa University Library started in June 1985 with a modest collection of 37678 books. Today the University Library is fully operational in a magnificent building of its own with holdings over 1,30,000 books and subscribes to over 458 technical journals and periodicals including over fifty online journals in the field of Computer Science and Application. It houses a collection of rare books and documents and has been recognized as one of the repositories for all publications of the United Nations. A searchable online catalogue of titles in the Library as well as Abstracts of Technical articles from over 100 journals is currently available on the Campus wide network. On the subject of Computer Science alone there are over 4,000 books, technical journals and magazines. Resources from digital library of prestigious societies like Kluwer, Elsevier & Springer Verleg are now available inside the campus under INFLIBNET scheme.

## Teaching Faculty

 Presently the department has seven full-time faculty members. As and when necessary the department invites resource persons from prestigious institutions and industry to conduct guest lectures on the specialized topics. The list of faculty members along with their area of interest and contact details is listed below:

1.   P. R. Rao,  M.Sc,  Ph.D
      Professor and Head
      (Theoretical Computer Science, Data mining, Data Warehousing, Information Systems Security)
      Email:  pralhadrrao@gmail.com / rao@unigoa.ac.in
      Contact no:  0832-6519087/ 6519323

2.   V. V. Kamat, M.Sc., M.Phil, Ph.D
      Associate Professor
      (Computer Graphics & CAD, Software Engineering, eLearning)
      Email:  vvkamat@unigoa.ac.in
      Contact no:  0832- 6519072

3.   Jyoti D. Pawar, B.Sc, M.C.A Ph.D.
      Associate Professor
      (Data Structures, Data Mining)
      Email: jdp@unigoa.ac.in / jyotidpawar@gmail.com
      Contact no: 0832- 6519325

4.   Yma F. Pinto, B.Sc., M.C.A.
      Associate Professor
       (Data Base Management Systems, Operating Systems, Computer Science Education)
      Email:  yp@unigoa.ac.in
      Contact no:  0832- 6519324

5. Ramdas Karmali, B.Sc., M.C.A.
   Associate Professor
   (Computer Networking, NLP)
   Email: rnk@unigoa.ac.in
   Contact no: 0832-6519327

6. S. Baskar, M.Sc. (Comp. Sc.) (currently pursuing Ph.D degree)
   Associate Professor
   (Artificial Intelligence, Energy aware computing & Embedded Systems)
   Email: baskar@unigoa.ac.in
   Contact no: 0832- 6519326

7. Ramrao Wagh, B.Sc, MCA.(currently pursuing Ph.D degree)
   Associate Professor
   (Software architecture, Object oriented Technology)
   Email: ramrao@unigoa.ac.in
   Contact no: 0832 - 6519328

## Research Activity of the department

The department conducts Ph.D degree program in Computer Science. At present, eight students have been registered for the Ph.D degree in the area of Data mining, Computer Aided Design (CAD) and Natural Language Processing(NLP). The department has been sanctioned three projects by the All India Council of Technical Education (AICTE) during last five years. The Department of Information Technology (DIT), New Delhi has sponsored two projects which are being carried out in consortium mode at the department. The first project is on Indian Language Corpora Initiative(ILCI) and involves developing a annotated Corpora for Konkani in tourism and health domain and second project is on the Wordnet development for Konkani Language. The Staff members of the department guide the students for M.Phil, M.Sc(I.T) and B.E degree dissertation work.

The thrust areas of the department are data mining & data warehousing, computer graphics, data base management system, computer networks, software engineering and embedded system. The upcoming areas are Natural Language Processing and Computer Science Education.

## M.C.A Programme
### Course Objective
The MCA course conducted by the University is aimed at imparting comprehensive knowledge and practice covering all aspects of computer use in the industry. The course content has been revised from the academic year 2006-07.

The Curriculum includes a combination of three types of courses: Computer Science, Mathematics and Management Science. Semester-wise courses in the above-mentioned three disciplines are listed below. Every student is required to take up a system development project or Industrial Training work in the final (that is sixth) semester.

### Course Structure

#### First Semester

| Course code | Course Name | Lecture | Tutorial | Practical | Total |
|---|---|---|---|---|---|
| | | Contact hours | | | |
| CS 11 | Problem Solving with C Language | 3 | 1 | 0 | 4 |
| CS 12 | Computer Organization and Architecture | 3 | 1 | 0 | 4 |
| BM 13 | Communication Skills | 3 | 1 | 0 | 4 |
| BM 14 | Management Fundamentals and Information Systems. | 3 | 1 | 0 | 4 |
| MT 15 | Discrete Mathematical structures | 3 | 1 | 0 | 4 |
| PL 16 | Programming Lab | 0 | 1 | 3 | 4 |
| PL 17 | Software Foundation Lab | 0 | 1 | 3 | 4 |
| Total | | 15 | 7 | 6 | 28 |

#### Second Semester

| Course code | Course Name | Lecture | Tutorial | Practical | Total |
|---|---|---|---|---|---|
| CS 21 | Data and File Structure | 3 | 1 | 0 | 4 |
| CS 22 | Operating System | 3 | 1 | 0 | 4 |
| CS 23 | Design and Analysis of Algorithms. | 3 | 1 | 0 | 4 |
| BM 24 | Accounting & Financial Management | 3 | 1 | 0 | 4 |
| MT 25 | Probability and Statistics | 3 | 1 | 0 | 4 |
| PL 26 | Data and File Structure Lab | 0 | 1 | 3 | 4 |
| PL 27 | UNIX and Shell Programming Lab | 0 | 1 | 3 | 4 |
| Total | | 15 | 7 | 6 | 28 |

#### Third Semester

| S. No. | Course | Lecture | Tutorial | Practical | Total |
|---|---|---|---|---|---|
| CS 31 | Data Base Management Systems. | 3 | 1 | 0 | 4 |
| CS 32 | Computer Communication Networks | 3 | 1 | 0 | 4 |
| CS 33 | Object-Oriented Programming | 3 | 1 | 0 | 4 |
| EL 1 | Elective Paper 1 | | | | 4 |
| EL 2 | Elective Paper 2 | | | | 4 |
| PL 36 | Data Base Management lab | 0 | 1 | 3 | 4 |
| PL 37 | Object Oriented Programming lab | 0 | 1 | 3 | 4 |
| Total | | | | | 28 |

## Fourth Semester

| S. No. | Course | Lecture | Tutorial | Practical | Total |
|--------|--------|---------|----------|-----------|-------|
| CS 41 | Object Oriented Analysis & Design | 3 | 1 | 0 | 4 |
| CS 42 | Web Technology | 3 | 1 | 0 | 4 |
| MT 43 | Applied Operational Research | 3 | 1 | 0 | 4 |
| EL | Elective Paper  3 | | | | 4 |
| EL | Elective Paper  4 | | | | 4 |
| PL  46 | CASE Tools lab | 0 | 1 | 3 | 4 |
| PL  47 | Web Technology Lab | 0 | 1 | 3 | 4 |
| Total | | | | | 28 |

## Fifth Semester

| S. No. | Course | Lecture | Tutorial | Practical | Total |
|--------|--------|---------|----------|-----------|-------|
| CS 51 | Software Engineering | 3 | 1 | 0 | 4 |
| CS 52 | AI and Applications | 3 | 1 | 0 | 4 |
| BM 53 | Decision Support Systems | 3 | 1 | 0 | 4 |
| EL | Elective Paper  5 | | | | 4 |
| EL | Elective Paper  6 | | | | 4 |
| SM | Seminar | 0 | 2 | 0 | 2 |
| PL 57 | Software Engineering Lab | 0 | 1 | 3 | 4 |
| PL 58 | AI and Applications Lab | 0 | 1 | 3 | 4 |
| Total | | | | | 30 |

## Sixth Semester

| S. No. | Course |
|--------|--------|
| | Software Project Development/Industrial Training |

**Academic Calendar[1]**

The academic year consists of two semesters referred to as odd and even semesters. The semesters start every year in the beginning of the month of July and January and each semester is of about 17 weeks duration. Students are required to attend at least 75% of the classes held in each course/subject and actively participate in study-seminars, tutorials and laboratory work prescribed from time to time to the satisfaction of the Department. The schedule for the academic year 2011-2012 is as follows -

**Odd Semester – (I, III, V)**

1. Semester begins …………....................…………………………………. 6th June 2011

2. Non – instructional days …………...................……………………….....6th – 24th June, 2011

3. Third year project viva-voce examination...................…………………..25th - 29th June, 2011

4. Classes commence ……………………………………………………...…..1st July 2011

5. Supplementary examination …………………. …….…….................. .4th July to 9th July, 2011

6. Class test I …......…………………….……………………  ...…....  .. 8th – 13th August, 2011

7. Class test II ………...............………………….…...............................19th–24th October, 2011

8. Last day of Instruction ………....….……………….….……………...5th November 2011

9. End – semester examination ……………………………….…….…..  .7th – 26th November 2011

10. End Semester Answer Papers showing  …………………………..by  28th November, 2011

11. Announcement of Grades  ………………………………………… .by  30th November, 2011

12. Winter vacation..………………………………… .............1st December 2011 – 1st January 2012

**Even Semester – (II, IV, VI)**

1. Classes commence …………...................................................................  2nd January, 2012

2. Supplementary examination …………………………….….……2nd  to 7th  of January 2012

3. Class test - I ………......................................................................13th – 18th February, 2012

4. Class test – II ………...................................................................26th March  – 31st March  2012

5. Last day of Instruction ………………………………….….…………….....  ..5th May 2012

6. End-semester examination …………………………......……....  …….........7th – 26th  May, 2012

7. End Semester Answer Papers showing  ………………………………..by  28th May, 2012

8. Announcement of Grades ………………………………………….. ....by  30th May, 2012

9. Summer vacation …………...................................................................1st June – 24th June, 2012

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[1] This academic calendar is subject to approval by the University

## Instructional Scheme

Instructional scheme for the MCA programme is based on a system of integrated units called courses. Each course shall mean one paper. Semester I to V shall have 5 theory papers and 2 lab papers. Semester VI shall be exclusively dedicated to project / training.

**Course Credit**: Each course will be of 100 marks and will have credits depending upon number of contact hours per week. The project will have no credits associated with it.

**Cumulative Credits**: The sum total of all the credits of all the courses taken in a semester.

**Contact Hours**: The total number of Lecture hours, Tutorial hours and Practical hours. Minimum of 45 contact hours are recommended for a 4 credit course, with 4 contact hours per week.

**Instructor-in-Charge**: Each course may have one or more instructors teaching the course. One of these is to be appointed as Instructor-in-charge.

**Course coordinator:** In case of courses taught by Visiting Faculty, one faculty member from the department/College shall be associated with the course as course-coordinator

**Course File:** For each course taught, a file shall be maintained by the Instructor-in-charge comprising of course plan, reading/teaching material used in class, assignments, question papers, answer papers, student feedback, student attendance record along with final evaluation and grading.

**Academic Audit Committee**: The task of the academic audit is to ascertain that all in-semester an end-semester evaluation is done in transparent and fair manner. The committee shall comprise of two members appointed by the Vice-Chancellor, one from the University Department and one expert from Industry. It shall meet every semester end and shall examine the course file. Any aberrations shall be reported to the Vice-chancellor for further action

## Scheme of Evaluation

There shall be both an in-semester element and an end-semester element in the evaluation of the performance of candidates. The weight-age for in-semester evaluation will be 60% and end-semester evaluation will be of 40%

For a theory course, in semester evaluation is a continuous assessment worth 60 marks. At least 40 marks of the in-semester evaluation will be graded through one or more class test. The remaining could be evaluated through quizzes, assignments etc.

For a theory course, the end-semester evaluation consists of an 'end-semester' examination of 40 marks of 2 hour duration conducted by the college/department. A candidate is eligible to appear for the end-semester examination if she/he has a minimum of 75% attendance in the theory course.

For a laboratory course, the assessment will be continuous with 60 marks for the in-semester evaluation consisting of lab experiments, assignments etc. and 40 marks being reserved for the end-semester examination which includes a viva-voce and an online examination jointly conducted by an internal and external examiner. An external examiner is to be appointed from the panel of examiners approved according to the University ordinance OB-4. A candidate is eligible to appear for the end-semester examination if he has a minimum of 75% attendance in the laboratory course.

The final grades for the course would be awarded by the Instructor-in-charge/course-coordinator taking into account the total performance.

Project viva would be jointly conducted by an internal and an external examiner as per the guidelines of the project evaluation. An external examiner is to be appointed from the panel of examiners approved according to the University ordinance OB-4.

There shall be no revaluation. The students can make an appeal to the Chairman Departmental Council through the Principal of College in case of any discrepancies in evaluation. The Chairman shall refer the matter to academic audit committee who shall decide and recommend appropriate action to the Vice-Chancellor.

**Grading Scheme**

For each course taken by a student, a letter grade is assigned based on the performance in all assessments. These grades are defined as:

AA, AB, BB, BC, CC, CD, DD, EE, II and FF

Each grade not only indicates a qualitative assessment of the student's performance but also carries an equivalent number called the grade point.

The grade points corresponding to different letter grades are defined below:

| Letter Grade | Grade point | Letter Grade | Grade point |
|---|---|---|---|
| AA | 10 | CD | 5 |
| AB | 9 | DD | 4 |
| BB | 8 | EE | 0 |
| BC | 7 | II | 0 |
| CC | 6 | FF | 0 |

A student passes the courses if he/she gets any grades in the range AA to DD.

The letter grade EE and the letter grade II makes the student eligible to take a supplementary examination in that course.

The letter grade II is given to a student on account of absence from the end-semester examination for valid reason.

The letter grade EE is given to a student on account of poor performance in the end semester examination. The letter grade EE and II are not awarded in supplementary examination

A student who fails in the supplementary examination is awarded FF grade and has to repeat the entire course. The student who fails to appear for the supplementary examination or remains absent is awarded FF and has to repeat the entire course

A student shall be considered to have passed a course at first attempt, provided he/she passes with a letter grade of DD or better, at the regular examination.

In addition to the above, a student getting a letter grade of II at the regular examination and subsequently passing the course at the supplementary examination with letter grade of DD or better, will be considered to have passed the course at first attempt. However a candidate getting a letter grade of EE at the regular examination shall be deemed to get letter grade DD in the supplementary examination, if successful.

All other cases would be treated as second attempts.

The final year Project shall carry only qualitative evaluation such as Excellent, Good, Satisfactory, Pass and Fail. A student getting a Fail grade shall have to repeat the project.

Supplementary Examination shall be held at the beginning of every semester.

A student is allowed to repeat a year or a semester in order to improve the performance. In such a situation his previous performance in that year or a semester shall be considered null and void.

## Performance Indices

**Semester Performance Index (SPI):** The performance of a student in a semester is indicated by a number called SPI. The SPI is the weighted average of the grade points obtained in all the courses during the semester. For example, with five courses in a semester, having credits C1, C2, C3, C4, C5 and the grade points in the semester being g1, g2, g3, g4 and g5 respectively then the SPI is equal to (up to two decimal places).

$$\frac{\sum_{i=1}^{5} C_i\, g_i}{\sum_{i=1}^{5} C_i}$$

**Cumulative Performance Index (CPI):** The overall performance of a student for the entire programme is obtained by calculating a number called CPI. The CPI is the weighted average of the grade points obtained in all the courses for the programme. The CPI is also calculated to two decimal places.

## Award of Class

Each semester grade report for the student shall carry his/her SPI. The final semester mark-sheet will indicate the CPI and the project performance. The final class for the MCA degree would be awarded as per the following scheme -
- Distinction: CPI equal to or greater than 8.5 and a minimum "Good" performance in the project
- First class: CPI equal to or greater than 6.5 but less than 8.5 and a minimum performance of "Satisfactory" in the project
- Second Class: CPI equal to or greater than 5.0 but less than 6.5 and a minimum performance of "Pass" in the Project
- Pass Class: CPI equal to or greater than 4.0 but less than 5.0 and a minimum performance of "Pass" in the project.

There is no provision for gracing in the individual paper. However, for candidates representing University in the National / State level event, a maximum of 7 grade points could be awarded before calculating CPI and Class.

## Placement activity

The Department has a very active placement cell and many reputed companies come for campus recruitment almost one and half year in advance.  Majority of the students get their placement offers in the fourth semester itself.

Companies that visited for campus recruitment in the past include the following -

1.  TCS, Mumbai
2.  Cognizant Technology Solution, Pune
3.  Infosis, Pune
4.  IBM, Bangalore
5.  PSPL, Pune / Goa
6.  Zenzar, Pune
7.  HSBC, Pune
8.  Torry Harris, Bangalore
9.  BMC Software, Pune
10. Light Bulb, Pune
11. Wipro, Banglore
12. Accenture, Bangalore
13. Hexaware
14. L & T Infotech, Mumbai
15. HONEYWELL Bangalore
16. Carritur, Bangalore
17. ADOBE, Bangalore
18. Sabre Technologies, Bangalore

## Ragging

Ragging is considered a definite menace by society. Accordingly, the  U.G.C. has instructed that ragging in all forms be strictly banned by the institutions and to ensure that the campus environment be made free from ragging. All the students are strictly instructed not to indulge in ragging of any form. Strict disciplinary action will  be taken against any student found guilty of ragging. The residents of the Goa University hostels are required to take special note of the above.

Further, under the Goa Prohibition of Ragging Bill 2007 strict, disciplinary action will be taken against those convicted for ragging directly or indirectly, so also those who commit, participate in abet or propagate ragging within or outside any educational institution, which may include removal from the roll of the institution for three years. Any student removed for such offence shall not be admitted in any other educational institution in the state.

Students indulging in ragging shall also be debarred from claiming scholarships or other benefits, representing in events, examinations. In case individuals committing or abetting ragging are not identified, collective punishment shall be imposed against those involved.

Head of Post Graduate Department, will obtain an annual undertaking from every student stating that they have read the relevant instructions / regulations against ragging as well as punishments detailed therein.

## Guidelines for Project Placement and Evaluation

**Project Selection (Placement)**

**PS1**        Internal guiding teachers for projects will, as far as possible, be the same as those assigned for the Seminar Course. All project placement letters will go through the respective internal guides with a copy to the Project Coordinator. It would be advisable to assign all students working on a common group project to a single guiding teacher

**PS2**        Projects should be selected so as to be of 5-6 months duration. The student must be involved in Analysis, Design and Implementation phases of the project.

**PS3**        A copy of all correspondence related to a project between the student and the internal guiding teacher must be sent to the Project Co-dominator.

**Project Training**

**PT1**        Work on projects must commence by the 1st week of January

**PT2**        Students must submit the following reports on the progress of their work to the internal guiding teacher. All reports should be neatly typed on A4 size paper and sent through the on-site project guide.

| Report | Submission Period | Contents |
|---|---|---|
| Initial Project Report | 1st week of February (submitted) to the internal guiding teacher) | 1. Project Organization<br>2. Project Specification<br>  • Existing System.<br>  • Proposed System.<br>  • Hardware and Software Platform<br>  • (DFDs (if possible) |
| Mid-term Report | 2nd week of March – 1st week of April to be submitted to the Internal guiding teacher. (may be relaxed by the internal guiding teacher in special circumstances) | 1. ERDs, DFDs, UMLs<br>2. File/Database Design and expected Data size<br>3. Hierarchy Chart (Decomposition Diagram) |
| Final Report | 15th June (Two copies of the report to be submitted to the Department) | As specified in next section. |

**Contents of Final Project Report**

The following certificates and information must be included in the project report-
1. Certificate from the Department. This certificate is issued by the Internal guiding teacher and may be collected from the Department Office a day before the viva-voce examination. The format of the certificate is available with the Department Office. The signatures of the external examiner and the Head of the Department must be obtained immediately after the viva-voce examination.
2. Certificate from the Company/Institution where the work was carried out and signed by the on-site guiding teacher.
3. Acknowledgements
4. Index pages.

The detailed contents of the report may include the following general points (detailed contents may differ depending on the nature of the project, students should finalize this section in consultation with external and internal guides.)

1. Introduction
    (a) About the Company/Institution
2. About the Project –
    (a) Data Flow Diagrams, UML diagrams
    (b) Hierarchy Charts
    (c) Entity Relationship Diagrams, File/Database design
    (d) Expected Data size
3. Implementation Details
    (a) List of Screens and menus designed
    (b) List of Programs, queries written
    (c) List of Reports
4. Testing Details
    (a) Testing techniques used
    (b) Details of Test data (amount and nature – real or generated)
    (c) Errors encountered and their treatment
5. Limitations and drawbacks.
6. Manual Details – List of manuals prepared

## M.C.A Admissions

### Eligibility for Admission

Admission to the three year, six semester, full time course leading to the degree of "Master of Computer Applications" (MCA), is open to any candidate satisfying all of the following conditions:

1.  A score of 50 percentile or more in the General Aptitude paper of the E/I/D/G-levels of CST examination. The CST examination should have been taken within 29 months of the last date announced by the University for the receipt of application forms.

2.  Graduate in any discipline with at least 55% aggregate marks at the first degree examination (50% for candidates in reserved category-OBC, ST, SC, PH, FF).
    <div align="center">or</div>
    Minimum CPI must be 6.00 in the scale of 1 to 10 at the first degree examination (minimum CPI must be 5.5 in the scale of 1 to 10 for candidates in reserved category –OBC, ST, SC, PH, FF).
    <div align="center">or</div>
    For any other method of declaration of the result, the equivalent percentage of the above cases will be decided by the University as and when such applications are received.

3.  Candidate must have taken mathematics as one of the subjects at HSSCE (10+2) level or at a higher level (documentary proof is essential).

Candidates who have appeared for a degree examination and are awaiting results are also eligible to apply. In case such candidates are selected and their results are not available at the time of admission, these candidates will be given provisional admission.

The qualifying examination in Item 1 above is held every year in the month of January/February. The score reports of these tests are valid for 29 months from the date of the examination. Only those candidates will be considered for admission, who have a valid score of 50 percentile and above at the time of admission.

Students are admitted to the MCA programme once a year. Candidates who have appeared for degree examination and are awaiting results are also eligible to apply. In case such candidates are selected and their results are not available at the time of admission, these candidates will be given provisional admission and confirmed on submission of required valid documents.

### Tie Breaking

The method of breaking the tie in case of candidates having equal score in the General Aptitude (GA) paper in the E/D/I level examination conducted by CDAC, Mumbai, is as follows.

1.  When the GA score is equal, the percentage of marks obtained in XIIth Std. examination will be used for breaking the tie.
2.  In case percentage of two candidates at XIIth Std. is equal, such tie breaking is done as follows:
    Determine the first time (from and including XIIth Std. onwards), the candidate has taken Mathematics paper. Determine the percentage of marks obtained in the Mathematics paper in that year of examination. The candidate with higher percentage of marks will be given priority

### Availability and Reservation of Seats

Thirty (30) seats, of which 24 seats are reserved for students graduating with first degree from colleges affiliated to Goa University, are admitted every year. The distribution of these 24 seats will be, 11 for General Category, 6 for OBC[1], 4 for ST[1], 1 for SC[1], 1 for Physically Handicapped(PH) student and 1 for son/daughter of Freedom Fighter(FF)[2]. In the event that sufficient number of students satisfying eligibility

criteria is not found in any one of the reserved category, these vacancies would be filled with students according to the existing rules of the university at the time of admission. The remaining 6 seats are open to students graduating with first degree from Indian Universities outside Goa. In case sufficient number of students satisfying eligibility criteria is not found in any one of the above categories, (i.e. Goa University category or Outside University category,) then these vacancies would be filled with students from other category and vice-versa.

Foreign students interested in seeking admission to the course may write/e-mail to the Admission Co-ordinator along with their bio-data and details of academic qualification at following address.

> The Admission Coordinator, 2011 - 2012
> Department of Computer Science & Technology,
> Goa University, Taleigao Plateau,
> Goa 403 206.
> E-mail: dcst@unigoa.ac.in / vvkamat@unigoa.ac.in
> Ph: 6519272 / 6519072 / 6519087

1 **Only candidates from Goa would be eligible under OBC, ST and SC categories as recognised by Govt. of Goa.**
2 **Only registered Freedom Fighters from Goa as recognised by Govt. of Goa.**

## CST Examination

The dates and other details about CST examination can be obtained by writing to:

Co-ordinator, CST Examination
C-DAC, Mumbai (formerly NCST)
Gulmohar Cross Road 9
Juhu, Mumbai – 400 049
Tel: (022) 2670 3251, 2620 1606,2620 1488 Ext. 304 / 305
Fax: (022) 2623 2195, 2621 0139
E-mail: entrance@cdacmumbai.in   Website : www.cdacmumbai.in

## Important Dates for Admission to the Academic Year 2011 – 2012

- Issue of Prospectus & application form ……................……...…………………………... 15th April 2011

- Last date for receipt of completed application form …...………………..... ..3rd June 2011 (by 4:00 pm)

- Display of merit list and waiting list ……................…....... …………………………..….. 7th June, 2011

- Last date for registration by merit list candidates…...…………………………………21st June, 2011

- Complete First round of admissions to waiting list candidates. ………………………… 28th June 2011

- Complete Second round of admissions to waiting list candidates ………...…………... .5th July 2011

- Final round of admission to waiting list candidates ……...…………...……………...12th July, 2011

For any details contact -

> The Admission Coordinator, 2011 - 2012
> Department of Computer Science & Technology,
> Goa University, Taleigao Plateau,
> Goa 403 206.
> E-mail: dcst@unigoa.ac.in / vvkamat@unigoa.ac.in
> Ph: 6519272 / 6519072 / 6519087

## Admission Procedure

The following procedure will be followed in selection of candidates for admission.

1.  A separate merit list and waiting list will be prepared for candidates graduating from Goa University and those graduating from other universities. These lists will be prepared in the descending order of the percentile score in the General Aptitude paper and rules applied for breaking the tie. All the candidates whose names appear in either the merit list or the waiting list, will be sent a letter on **7<sup>th</sup> June 2011** and the same would be displayed on the notice board of the department and the University website (http:// www.unigoa.ac.in)

1.  Candidates in merit list who fail to deposit fees by 21<sup>st</sup> June 2011 (1.00 pm) will loose their claim to admission and the same seat would be offered to the candidate in the waiting list.

2.  On 22<sup>nd</sup> June, 2011, admissions will be offered to candidates in the respective waiting list against vacancies in the merit list in the order of merit. The names of these candidates will be displayed on the notice board of the department. An email will be sent to these candidates to make the payment of fees on or before 28<sup>th</sup> June, 2011 (1.00 pm), failing which the same seat will be offered to the next candidate in the waiting list. The list will also be put up on the University website

3.  On 29<sup>th</sup> June, 2011, admissions will be offered to candidates in the respective waiting list against vacancies, in the order of merit. The names of these candidates will be displayed on the notice board of the department. An email will be sent to these candidates to make the payment of fees on or before 5<sup>th</sup> July 2011, failing which the same seat will be offered to the next candidates in the waiting list. The list will be put up on the university website.

4.  On the last date of admission, i.e. 12<sup>th</sup> July, 2011, admission will be offered to candidates in the waiting list, provided there are vacant seats. **All the waiting list candidates who have not been offered admission earlier should report to the department office at 11.00 am sharp.** Admission will be offered according to the merit in the waiting list to only those candidates who report to the department **along with the original certificates**. First attempt will be made to fill these seats from the respective waiting list in the order of merit. In case, one of the waiting list is over, the seats will be filled by the candidates from the other waiting list. The students who have been offered admission should pay their fees on the same day. No further admissions will be given after 12<sup>th</sup> July, 2011 and seats falling vacant after this date will not be filled.

5.  The candidates who are offered admission and fulfil the eligibility criteria should deposit full fees through challan available in the Department. Students whose results are not available at the time of admission, should also make the full payment of the fees after giving an undertaking that they are paying fees at their own risk and would be able to fulfil the eligibility criteria by 15<sup>th</sup> October, 2011. **These candidates will be admitted provisionally**.

6.  All those candidates who are admitted provisionally should submit the relevant mark sheets and passing certificates by 15<sup>th</sup> October 2011, failing which their admission will be cancelled.

7.  The original copies of all mark sheets and relevant documents should be produced by the candidate at the time of admissions and will be retained in the department till the admission procedure is completed.

**Fees**

The total fees prescribed for the academic year 2011 – 2012 is Rs. 32,500/- for Goa University graduates and Rs. 34,100/- for graduates other than Goa University

For Students requiring hostel accommodation, the University has full fledged hostels both for the men and women students.

| Hostel Fees[2] | Amount (in Rs.) |
|---|---|
| Per Semester | 2,150 |
| Deposit (Refundable) | 3,000 |
| **Total fees** | **5,150** |

Hostel Mess charges would be approximately Rs. 1500/- per month

## Refund of Fees

All the fees remitted will be refunded after deducting Rs. 1000/- towards administrative charges, if the admitted candidate informs the Head of the Department in writing on or before 10th July, 2011 that he/she desires to withdraw his/her application. No request for refund of fees would be admitted if the candidate withdraws after this date.

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[2] Hostel fees are likely to be revised

**APPENDIX A**
**DETAILED SYLLABUS**
(CORE COURSES)

## CS 11 - PROBLEM SOLVING WITH 'C' LANGUAGE

**Introduction to Programming**
The Basic Model of Computation, Algorithms, Flow-charts, Programming Languages,     Compilation, Linking and Loading, Testing and Debugging, Documentation.

**Algorithms for Problem Solving**
Exchanging values of two variables. summation of a set of numbers, Decimal Base to Binary Base conversion, Reversing digits of an integer, GCD (Greatest Common Division) of two numbers. Test whether a number is prime, Organize numbers in ascending order. Find square root of a number, factorial computation, Fibonacci sequence, Evaluate 'sin x' as sum of a series, Reverse order of elements of an array, Find largest number in an array, Print elements of upper triangular matrix, multiplication of two matrices, Evaluate a Polynomial

**Introduction to 'C' Language**
Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmetic operators and Expressions, Precedence of evaluation, Constants and Literals, Simple assignment statement, Basic input/output statement, Simple 'C' programs , preprocessor command: #define, #include, #ifdef.

**Conditional Statements and Loops**
Decision making within a program, Conditions, Relational Operators, Logical Connectives, *if* statement, *if-else* statement, Loops: *while* loop, *do while*, *for* loop, Nested loops, Infinite loops, *Switch* statement, continue and go to statements, Structured Programming

**Arrays**
One Dimensional arrays: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; Two dimensional arrays, Addition/Multiplication of two matrices, Transpose of a square matrix; Null terminated strings as array of characters, Representation of sparse matrices.

**Functions**
Top-down approach of problem solving, Modular programming and functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, Passing arguments to a Function: call by reference, call by value, Recursive Functions, arrays as function arguments, Standard Library of C functions.

**Structures and Unions**
Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions.

**Pointers**
Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays

**Self Referential Structures and Linked Lists**
Creation of a singly connected linked list, Traversing a linked list, Insertion into a linked list, Deletion from a linked list

**File Processing**
Concept of Files, File opening in various modes, closing of a file, Reading from a file and Writing onto a file.

## RECOMMENDED BOOKS
**Main Reading**
   **Byron Gottfried "Programming with C" second edition, Tata McGraw Hill, 2000**
1.   R.G. Dromey, "How to solve it by Computer", seventh Edition, 2001, Prentice, Hall of India.

**Supplementary Reading**
1.   E. Balaguruswami, "Programming with ANSI-C", First Edition, 1996, Tata-McGRaw Hill.
2.   A. Kamthane, "Programming with ANSI & Turbo C", First Edition, 2002, Pearson Education.

3. Venugopal and Prasad, "Programming with C", First Edition, 1997, Tata McGraw Hilll
4. B.W. Kemighan & D.M. Ritchie, "The C Programming Language", Second Edition, 2001, Prentice Hall of India.

## CS 12 COMPUTER ORGANIZATION AND ARCHITECTURE

**Basic Structure of Computers**
Computer types, Functional Units, Basic Operational Concepts, Bus Structures, Performance, Multiprocessors, Multicomputers and Evolution of Computers.

**Data Representation**
Number representation, Addition of positive numbers, Addition and Subtraction of Signed Numbers, Overflow in Integer Arithmetic, Character representation.

**Memory Locations, Addresses and Operations**
Byte Addressability, Big-endian and Little-endian address assignments, Word Alignments, Accessing Numbers, Characters and Character Strings, Memory Operations.

**Instructions and Instruction sequencing**
Register Transfer Notation, Assembly language Notation, Basic Instruction types, Instruction Execution and Straight-Line Sequencing, Branching, Condition Codes, Generating Memory Addresses.

**Addressing Modes**
Implementation of Variables and Constants, Indirection and Pointers, Indexing and Arrays, Relative Addressing, Additional Modes.

**Intel Instruction Set (IA-32 Pentium Example)**
Registers and Addressing, Instructions, Assembly Language, Program Flow Control, Logic and Shift/Rotate Instructions, I/O Operations, Subroutines, Multiply and Divide Instructions, Multimedia Extension(MMX) Instructions, Vector (SIMD) Instructions, Some Assembly Program Examples.

**Input/Output Organization**
Accessing I/O devices, Interrupts, Pentium Interrupt Structure, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.

**The Memory System**
Basic memory Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

**Arithmetic**
Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-Operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations.

**Basic Processing Unit**
Fundamental concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, Micro programmed Control.

**Pipelining**
Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets, Datapath and Control Considerations, Superscalar Operation, Performance Considerations.

**Computer Peripherals**
Input Devices, Output Devices, Serial Communication Links.

**Processor Families**
The Inel IA-32 and IA-64 Family Overview.

**Large Computer Systems**
Forms of Parallel Processing, Array Processors, The Structure of General-Purpose Multiprocessors, Memory Organization in Multiprocessors, Program Parallelism and Shared Variables.

## RECOMMENDED BOOKS

**Main Reading**
1.  C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization", fifth edition, 2002,McGraw-Hill Publication.

**Supplementary Reading**
1.  S. Berger, Hardware and Computer Organization
2.  J. P. Hayes, "Computer Architecture and Organization", Third edition, 1998.
3.  J. L. Hennessy and D. A. Patterson, "Computer Architecture - A Quantitative Approach" third edition, Morgan Kaufmann Publishers.
4.  Stallings W., "Computer Organization and Architecture" (6th edition) Prentice Hall of India, New Delhi, 1996


## BM 13 COMMUNICATION SKILLS

**Communication Defined**
Communication, the process of communication, barriers of communication, different types of communication, characteristics and conventions of conversation, conversational problems of Second/foreign language users.

**Effective Communication**
Avoiding an unproductive discussion, avoiding disempowering communication, adjusting delivery based upon the listener's body language, employing language that builds authority and credibility, overcoming personal challenges, discussing technical topics with a non-technical audience Jargon: when it can be used safely and when it should be avoided, matching communication styles to preferred levels of technical detail.

**The Art of Listening**
Proven techniques for effective listening, verifying comprehension via feedback, differentiating between "emotional content" and message content, calibrating message content by examining nonverbal inputs, improving your listening skills, how to talk so that others will listen.

**Job Applications and Interviews**
Reading, Curriculum vitae, Preparing for an interview, Listening and Speaking in the Interviews, employment interview, informational interview, performance appraisal interview.

**Group Discussions:**
Group Discussion, Study skills, language focus, speaking. Decision making in group.

**Meetins:**
Successful meeting, One to one meeting, editing, criteria for successful meetings, Reporting verbs, memos. Taking notes, preparing minutes, grammar, writing reports, communication via Email

**Presentation Skills**:
Presentation skills, Importance of body language in presentations, pronunciation, visual aids, podium panic, understanding audience and speaking occasion, establishing presentation goals and presentation format.


## RECOMMENDED BOOKS

**Main Reading**
1.  The Chicago Manual of Style, 13th edition, Prentice Hall of India, 1989.
2.  Susan Stevenson et al "Strategies for Engineering Communication", 2002, Wiley
3.  Gowers Ernest, " The Complete Plain Words", Penguin, 1973 IEEE Transactions on Written and Oral Communication", Prentice Hall of India Pvt. Ltd. 1995.
4.  Ludlow R. and Panton F., " The Essence of Effective Communication". Prentice Hall of India Pvt. Ltd. 1995.

**Supplementary Reading**
1.  Andrea Rutherford, "Basic Communication Skills for technology", 2001, Pearson Education

2. Deborah Roach and Eileen M Perrigo: "Business and Professional communication for 21st Century", 2000, Allen and Becon.
3. Menzel D. H. Jones, H.M. and Boyd L.G., " Writing a Technical Paper", McGraw Hill, 1961.
4. Strunk W. and White E.B., " The Elements of Style", 3rd Edition, McMillan, 1979.
5. Munter M., "Business Communication : Strategy and Skill", Prentice Hall of India, New Jersey,1987.
6. Turbian K. L., " A Manual for Writers of Term Papers, Thesis and Dissertation", University of Chicago Press, 1973.

## BM 14 MANAGEMENT FUNDAMENTALS & INFORMATION SYSTEM

**Introduction to Management**
Understanding the meaning and definition of Management, Nature of Management, Importance of Management, An overview of Management processes – Planning, Staffing, Organizing, Directing, Coordinating and Controlling. Evolution of management through – the classical school, the Behavioral approach, The Management Science Approach, the Contingency approach and the Systems approach

**Planning**
Strategy, plan, policy and programs, purpose of planning, Mission Vision and Goal setting, SWOT analysis. Forecasting – The need for forecasting in planning, Types of planning and tools for forecasting – Moving Average, Exponential Smoothing and regression Model.

**Organization**
Principle and Structure of Organization, Theories and types of Organization, Concept of Authority, Responsibility Power, Delegation& centralization of Authority. Span of control.

**Staffing**
Meaning, nature and principles of staffing, Job rotation, Job enrichment and job enlargement

**Directing**
Communication in Organization, Motivational theories, Leadership and decision making.

**Production and Operation Management**
Production planning Aggregate planning, MRP, Selective Inventory control, EOQ and Ordering system, Production methods – job, batch flow, continuous production. CAM and FMS, Quality control – Quality costs, Statistical Quality control, Control charts and their uses.

**Marketing Management**
Overview of Marketing functions, Product, Price Promotion and distribution strategies Marketing research and its Role.

**Financial Management**
Accounting Principles, Balance Sheet and profit loss statement. Working capital Management. Cost concept Break even analysis, Investment decision – Pay back period NPV, IRR

**Human Resource Management**
Nature and Function of HRM, Human resource planning – HR information System, Performance appraisal system, Rewards and Incentive schemes.

**Information Systems, Organization Management & Strategy**
Information need of Management at various level of Organization, flow of information in organization: top down bottom and up and integrated.
Information System: Meaning, Nature and their role. Types of Information systems: DSS, MIS, Expert systems, Knowledge Management systems Transaction processing Systems. Importance of Information Systems in Supporting various levels of business strategy formulation and decision making in different Managerial Functional areas: Production and Operations, Sales and Marketing, Personnel Management.

**Current Issues**
Role of Internet and intranet in development of various information systems: E-Commerce, ERP, CRM, SCM.

### RECOMMENDED BOOKS

**Main Reading**
1. Harold Koontz and Heinz Weihrich, "Essentials of Management" 5th Edition Tata McGraw-Hill Publishing New Delhi
2. C.B. Gupta "Management Concepts and Practices" 2002 Sultan Chand, New Delhi.
3. W.S. Jawadekar, "Management Information Systems", 1 st Edition 1999, Tata McGraw-Hill Publishing New Delhi
4. K. C. Laudon and J. P. Laudon, " Management Information Systems: Organization and Technology" 4th Edition, Prentice Hall India New delhi

## MT 15  DISCRETE MATHEMATICAL STRUCTURES

**Methods of Proof**
Different methods of proof – Direct Proof, Indirect Proof, Counter examples, Principle of Induction.

**Propositional Calculus**
Propositions, Logical Connectives – Disjunction, Conjunction, Negation, Conditional Connectives, Precedence Rule, Logical Equivalence, Logical Quantifiers, predicate logic

**Boolean Functions**
Min & Max terms, Simplification of Boolean function with Karnaugh map and Quine Mcclusky method.

**Sets & relations** :
Sets, Subsets, Operations on sets, semi groups, finite and infinite sets, Relations and properties of relations, Equivalence relation, venn diagrams,

**Boolean algebra, Posets, Lattices**
Partial ordered relation, poset, lub, glb, maximal & minimal elements of a poset. Definition and examples of Boolean algebra. Lattices, Distributive laws on Lattices, Complemented Lattices. Propositional Calculus

**Inroduction to Combinatorics**
Basic theorem on permutations and combinations, pigeon hole principle, principle of inclusion and exclusion, Ordinary & Exponential generating functions, Recurrence relations Applications, to Combinatorial Probability, Elements of Classical Probability Theory, and Addition Theorem in Probability.

**Graphs & Algorithms :**
Basic Definitions of graphs Connectivity of a Graph, cut points, cycles, Hamilton Graphs trees, different characterization of trees, bipartite graphs, Planar and Dual graphs, Euler's theorem Algorithms on Graphs : Breadth-first Search, Depth-first search, Dijkastras's algorithm for shortest path, Floyd's algorithm for all pairs of shortest paths, kruskal's and Prim's algotihms for minimum spanning tree.

### RECOMMENDED BOOKS

**Main Reading**
1. Discrete Mathematical Structures. Trembley and Manohar
2. Graph Thoery with Applications to Engg & Comp. Sci. :Narsingh Deo-PHI 1986
3. Graph Theory : F Harary – AWL

**Supplementary Reading**
1. Elements of Discrete Structures : CL Liu – TMH
2. Discrete Computational Structures : Korfhage RR - Academic Press
3. Discrete Mathematics : KA Ross & CRB Wright - PHI 1985
4. Applied Discrete Structures for Computer Science : Alan Doer & Kenth Levasseur
5. Discrete Mathematical Structures for Computer Science : Bernard Kolman & R.C. Busby - PHI 1988

**PL 16 PROGRAMMING LAB**

**Objective**
The objectives of the course are to make the student understand and use various constructs in 'C' language to implement algorithms to solve problems. The main emphasis of the course will be on writing structured, documented, modular programs.

**List of Suggested Lab Assignments**

1. Write a 'C' program to convert polar co-ordinates to Cartesian coordinates and vice-versa.
2. Write a 'C' program to find out the maximum and minimum of three integers read as input.
3. Write a 'C' program to convert lowercase characters to uppercase characters.
4. Write a 'C' program to read an integer 'n' and print whether 'n' is a prime number or not.
5. Write a 'C' program to compute real or imaginary roots of a quadratic equation.
6. Write a 'C' program to read an array of 'n' numbers and to sort an array using selection sort algorithm.
7. Consider a matrix of 0's and 1's. A sequence of successive 1's along a row, or a column, or a diagonal is defined to be a line. The number of 1's in a line is called its length. Write a 'C' program to find out the line with the maximum length in such a matrix.
8. Write a recursive 'C' function to compute the greatest common divisor of two positive integers.
9. Define a structure for a student having name, roll number and marks obtained in six subjects. Assume that "all students" is an array of students. Write 'C' function to:
   a. Print the name and roll number of the students who have secured the highest marks in each subject;
   b. Print the name and roll number of the student who has secured highest total marks
   c. Write a 'C' program to read details of 'n' students and call the above functions to generate a report.
10. Write a 'C' function to insert a number properly into a already sorted linked list of numbers. Use this function repeatedly to sort a series of numbers provided at the input.
11. Define a self referential structure for representing a simple linked list of integers. Write a 'C' function to split the list into two lists so that the first list contains all even numbered elements and the second list contains only odd numbered elements. For example if the original list is {2, 8,1, 14, 6, 18, 0, 17} then the resultant first list would be (8, 14, 18, 17) and the second list would be {2,1,6,0}.
12. Write a 'C' program to calculate factorial of a number.(use recursion)
13. Write a 'C' program to solve Tower of Hanoi problem. (use recursion)\
14. Write 'C' functions to
   a. Copy the contents of one file to another;
   b. Count the number of words in a file; Assume that a word is a sequence of letters ending with a blank, or a tab, or an end of line marker or end of file or punctuation symbols such as ",", ".", "!" and "?".
   c. Write a 'C' program to open a file and call the above functions to count the number of words in that file.
15. Write a 'C' program to store information of cricketer's performance in the file in file. For the batsman following information should be stored. Name, number of games played, average runs scored, number of centuries and fifties scored. For a bowler the information should be: Name, number of games played, and number of overs bowled, number of times the bowler has taken five and ten wickets in a match and average runs given per wicket.
16. Given the data file created in assignment 15, Write a 'C' program that would search through the file for performance record of a given player and print it to console. The name of the player would be given as input to the program.

## PL 17  SOFTWARE FOUNDATION LAB

**Objective**

The objective of the course is to familiarize the student with MS Windows and UNIX/LINUX platforms. The main emphasis of the course is teaching student the use of various tools, programs, user level and administrative commands used on this platforms.

**List of Suggested UNIX/LINUX Assignments and Demonstrations**

**The File System**

Structure of UNIX file system. Parent-child relationship. Directory handling and navigation. Absolute and relative pathnames Use of  command: *mkdir, rmdir, pwd, ls* and *cd*. The PATH environment variable. Use of file management commands*: touch, cat, less, cp, mv* and *rm*. Viewing files using *pg, tail* and *head* commands. Concept of Home directory.

**File Attributes**

Concept of hard disk partitions, file system, Superblock and Inodes. General structure of UNIX inode. Analyzing the output of  *ls -l* command. File type and permission. Significance of directory permissions.Use of *chmod* command. Concept of ownership. Changing ownership. Use of *chown* and *chgrp* commands. Concept of symbolic links. Hard and soft links. Use of *ln* command to create hard and soft links. Modification and access times. Default file and directory permissions Use of *umask* command. Use of commands *file, which*.

**Process Management**

Concept of UNIX process. Role of *init* in process creation and in spawning user shells. Process ID and exit status of a process (*$?*). Displaying process attributes using *ps* command, Killing runaway processes using *kill* command, concept of foreground and background processes. Running commands in background using *&* and *nohup* command. Job control. Function of Ctrl-Z and Ctrl-C keys. Job control commands jobs, *fg* and *bg*, scheduling processes (cron).

**Other miscellaneous commands**

Using commands *grep, cut, wc, find, sort , dd* and *who*. Using *man* and *info* command for getting additional help and information. Using *gdb* command to debug program execution.

**The vi Editor**

The three modes of vi. Importance of TERM environment variable. Basic navigation using arrow  and h,j,k,l keys. Moving to a specific line number. The repeat factor. The input mode commands i,a,r,s and o. Commands to save and quit ZZ, :w, :x and :q. Text deletion commands DEL, x and X. Line deletion using command dd. Moving and copying text Commands d, y and p. Undoing and repeating commands u and a. Writing regular expressions to match patterns. Pattern search commands /, n and N. Local and global substitution using :s command. Bock, copy and paste commands. Moving text from one file to the other. Customization features: abbreviation (:abb), key mapping (:map) and setting vi parameters (:set). Use of .exrc file.

**The shell as Command Interpreter**

The major shells: Bourne Shell, C shell, Korn and Bash. Interactive non interactive and login shell. Use of .bashrc, bash_profile, bash_login and bash_logout files.The shell's interpretive cycle. Wild-cards. Escaping and quoting. Difference between single and double quotes. The three standard files and redirection (>, < and >>). Connecting commands  with pipes (I). Command substitution. Shell and Environment variables and how they determine system behavior. Use of export command .Aliases and command history. Writing simple Shell scripts. Input/output using read and echo.

**System administration**

Adding, deleting and disabling user accounts. Changing passwords. Importance of /etc/passwd /etc/shadow and /etc/group files. Manging user resource usage levels  using *ulimit* .Shutting  system  down using *shutdown, halt* and *reboot* commands. File system maintenances : mounting and unmounting file systems. Creating and checking file systems using *mkfs* and *fsck* commands.

Using commands *du, df, tar* and *zip*.

**LINUX Installation**

Installation of LINUX and configuration for first time use. Setup for Graphical and non Graphical boot (X – Window Configuration). Installing, upgrading and deleting packages using *rpm* command.

**The X-window system**

The X Architecture: the reversed client-server mechanism. Role of the window manager. Common Desktop Environments: GNOME and KDE. Running programs remotely using *xhost* and *telnet.* The DISPLAY variable and the display options of X clients. Common X client options. The .xinitrc initialization file.

**List of Suggested  MS Windows Assignments and Demonstrations**

**Wndow Tools and Accessories.**

Structure of Windows file system Using *Windows Explorer* to create and delete files and directories, Coping and moving and renaming files. Concept of recycle bin and restoring files. Accessing files on other machines in the local area network using network neighborhood. Folder options and concept of file associations. Using Notepad and WordPad programs to create files.  Creating shortcuts to files. Searching for information and files. Changing/customizing desktop setting and screen resolution. Managing processes using Task Manager.

**System Administration**

Shutting down Windows System. Using Standby and Hibernating  modes. Using  Tools in the control panel to manage users, add new hardware, manage disk partitions, create, check and defragment file systems. Mounting, unmounting removable storage like flash drives. Using *msconfig* utility. Using Help and MSDN documentation.

**Windows Installation**

Installation of Windows XP and configuration for first time use. Installation  and removing Window components and other application programs. Difference between Home, Professional and Enterprise editions of MS Windows Systems.

**Microsoft Office**

Using Microsoft WORD and PowerPoint software to create different documents and Presentations. Only the mostly used features and functionality may be discussed.

**Using Internet and Word Wide Web**

Using commands like ftp, telnet. Concept of domain names, host names, web sites and HTML pages. Different search engines. Using basic and advance features of search engines to search information, documents and application programs. Network etiquettes.

## CS 21 DATA &  FILE STRUCTURES

**Data Abstraction and Algorithm Analysis**

Data types/objects/structures, Abstract definition of data structures, Representation and implementation, Time requirements of algorithms , Space requirements of algorithms

**Linear Data Structures**

Array application and representation, Polynomials, Sparse matrices, String-pattern Matching, Stack and Queues, Needs and justification of the study of the structures, Representation and implementation, Multiple stacks and queues, Implementation of recursion using stack.

Linked Lists : Needs for the structure and justification of the study,  Representation and Implementation, Doubly linked list, Circular linked list, Linked list application, Memory Management, Static memory management, Dynamic memory management.

**Nonlinear Data Structures**

Trees : Definitions, terminologies and properties, Binary tree representation, traversals and applications, Threaded binary trees, Binary Search Trees , AVL Trees , M-way Search Trees , B-trees, B*-trees, B+-trees, Optimum binary search trees, Multidimensional binary search trees

Graphs: Definition, terminologies and properties ; Graph representations : Minimum spanning trees, Depth-first search, Breadth-first search , Networks

Priority Queues, Heap Structures, Binomial Heaps, Leftist Heaps

**Sort and Search Algorithms**:

Heap sort , Merge sort , Quick-sort , Hashing , General radix sort , Symbol tables, Sequential search , Binary search, Interpolation search, Tries

**File organization and processing**

Sequential files: Organization, creation, update and maintenance; Relative files: Organization, Hashing techniques: Approaches to collision problem, Creation, retrieval and update; Indexed sequential files: organization, creation, update and maintenance, Multi-key files, Inverted file, Multi-list file, Alternate key, Tree structured files: B-trees, AVL-trees, Tries

## RECOMMENDED BOOKS

### Main Reading

1.  Aho, Hopcroft, Ullman, Data Structures and Algorithms, Addison Wesley, 1983.
2.  R. L. Kruse, Data Structures and Program Design, 3rd ed., Prentice-Hall, 1994.
3.  Mary E. S. Loomis, Data Management and File Structures, 2nd ed., Prentice-Hall, 1989.
4.  Clifford A. Shaffer, A practical Introduction to Data Structures and Algorithm Analysis, Prentice-Hall, 1997.
5.  Kruse, Tondo and Leung, Data Structures and Program Design in C, 2nd edition, Prentice-Hall, 1997.
6.  Richard F.Gilberg and Behrouz A.Forouzan Data Structure - A Pseudocode Approach with C -First Reprint -Thomson,2002

## CS 22 OPERATING SYSTEM

**Introduction**
What Operation Systems Do, A brief history of Operating systems, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management , Storage Management, Protection and Security, Distributed Systems, Special-purpose Systems, Computing Environments

**Systems Structures**
Operating-systems Services, User Operating-system Interface ,System Calls, Types of System Calls, System Programs, Operating-System Design and implementation, Operating-system Structure, Virtual Machines, Operating-system generations, System Boot

**Process Management**
Process-Concept - Overview, Process Scheduling, Operations on Processes, Inter process Communication, Examples of IPC Systems, Communication in Client Server Systems

**Multithreaded Programming**
Overview , Multithreading Models, Thread Libraries, Threading Issues, Operating system Examples,

**Process Scheduling**
Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-processor scheduling, Thread scheduling, Operating-system Examples

**Process Coordination**
Synchronization - Background , The critical-section problem, Peterson's solution Synchronization Hardware, Semaphores ,Classic problems of synchronization, Monitors, Synchronization Examples, Atomic Transaction

**Deadlocks**
System Model, Deadlock characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery From Deadlock

**Memory Management**
Memory-Management Strategies – Background, Swapping ,Contiguous Memory   Allocation , Paging , Structure of the page table , Segmentation, Example: The Intel Pentium

**Virtual-Memory Management**
Background, Demand Paging, Copy-on-write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory, Other Considerations, Operating System Examples

 **Storage Management**
**File System -** File Concept, Access Methods, Directory Structure, File-system mounting, File sharing, Protection

**Implementing File Systems -** File-system Structure, File-system implementation, Directory implementation, Allocation Methods, Free-space Management, Efficiency and performance, Recovery, Log-structured file systems, NFS, Example: The WAFL File System

   **Secondary-storage Structure -**Overview of Mass-storage Structure ,Disk Structure, Disk Attachment ,Disk Scheduling ,Disk Management ,Swap-Space Management ,RAID Structure, Stable-storage implementation ,Tertiary-storage structure

   **I/O Systems**
Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O requests to hardware operations, STREAMS, Performance

**Distributed Systems**

**Distributed Operating Systems –** Motivation ,Types of Distributed Operating Systems, Network Structure ,Network Topology ,Communication Structure , Communication Protocols ,Robustness , Design Issues

  **Distributed  File Systems -** Background , Naming and Transparency ,Remote File Access ,Stateful Versus Stateless Service. An Example: AFS

<u>**RECOMMENDED BOOKS**</u>

**Main Reading**
1.   Operating systems Principles – Silberschatz ,Galvin and Gagne  - 7<sup>th</sup> edition (Wiley Asia Student Edition)

**Supplementary Reading**
1.   Deitel H.M., "An Introduction to Operating Systems", Addison Wesley Publishers Company, 1994
2.   Milenkovic M., "Operating Systems : Concepts and Design", McGraw Hill International Edition Computer Science series 1992.
3.   Tanenbaum A. S., Modern Operating Systems", Prentice Hall of India Pvt. Ltd., 1995
4.   Operating Systems – a modern perspective  - Gary Nutt , Addison Wesley

<u>**CS 23 DESIGN AND ANALYSIS OF ALGORITHMS**</u>

**Introduction**
The Role of Algorithm in computing, Framework for design and analysis of algorithms, Growth of functions: asymptotic notation; Recurrences: substitution method, recursion-tree method, master method; Probabilistic analysis and randomized algorithms, indicator random variables.

**Advanced Design and Analysis Techniques**
Dynamic programming: assembly line scheduling, matrix-chain multiplication, elements of DP, longest common subsequence;
Greedy algorithms: activity-selection problem, elements of greedy strategy, Huffman codes;
Amortized analysis: aggregate analysis, accounting method, potential method, dynamic tables

**Graph Algorithms**
Elementary graph algorithms; Minimum spanning tree: growing a spanning tree, Kruskal and Prim alorithm; Single-source shortest paths: Bellman-ford algorithm, Dijkstra's algorithm.
All pairs shortest paths: shortest paths and matrix multiplication, floyd-warshall algorithm.

**Number theoretic algorithms:**
GCD, Modular arithmetic, Chinese remainder theorem, RSA, Primality testing

**String matching**:
Naïve algorithm, Rabin-Karp algorithm

**Computational geometry:**
Line segment properties, intersection, finding convex hull, finding closest pair of points

**NP-Completeness**:
Polynomial time, polynomial time verification, NP-completeness and reducibility

**Approximation algorithms:**
The vertex cover problem, Traveling salesman problem, the set-covering problem

## RECOMMENDED BOOKS
**Main Reading**
1. Cormen Thomas, L. Charles, R. Ronald, S. Clifford, "Introduction to Algorithms", Second Edition, EEE, PHI.
2. Knuth Donald, "The Art of Computer Programming Vol I, II, III", Addison Wesley


## BM 24 ACCOUNTING AND FINANCIAL MANAGEMENT

**Financial Accounting: An Introduction**
Meaning and Nature of Accounting, Accounting as language of Business and Accounting as information system. Accounting processes and final output of Accounting system. Principles of Accounting and double entry system. Recording of Transaction in Journal, cash Book (Single column only) Sales Book and Purchase Book. Posting of transaction to Ledger and preparation of Trial Balance.

**Preparation of Final Financial Statement**
Preparation of Final Accounts – Profit and Loss account and Balance Sheet. Preparation of statement of changes in Financial Statements – Funds Flow Statement and Cash flow statement.

**Analysis of Financial Statements**
Horizontal (Trend) analysis and Vertical (Common-Size) analysis. Ratio Analysis – Liquidity ratio, Turnover ratio, Profitability ratio.


**Cost Accounting: An Introduction**
Meaning , nature and importance of cost Accounting system in an Organization. Elements of Cost and various cost Concept – Direct and indirect cost, Fixed and Variable costs, Sunk Cost Opportunity Cost, Out of Pocket and Imputed cost, Preparation of cost sheet. Understanding the nature of variable cost and fixed cost (total as well as per unit). Contribution, P/V ratio, Break Even Point. Assumptions of Cost-Volume-Profit Analysis and studying the relationship between Cost, Volume and Profit.

**Budgeting**
Meaning, Importance and Objective of budgeting in an Organization, Different types of Budgets including preparation of cash Budget, fixed and flexible budget, Zero based budgeting

**Financial Management: An Introduction**
Nature, Objective and Scope, Financial decision making and type of financial decision. Role of Finance Manager in Organization. Basic axioms of Financial Management. Risk-Return framework for Financial decision making.

**Time Value of Money and Mathematics of Finance**
Time Value of Money and Opportunity cost of Money, Present value and future value and Interest rate and discount rate Annuities and their types Numerical related to the calculation of present values and future values.

**Capital Budgeting Decisions**
Nature and kinds of Capital budgeting decisions. Techniques of evaluating Capital budgeting  decisions – Payback Period, Accounting rate of return, NPV, IRR and Profitability Index

**Cost of Capital and Sources of Finance**
Basic valuation Model, Concept of Cost Capital – Weighted average Cost and Marginal Cost, Cost of debt and cost of Equity, Various long term sources of funds for a Organization.

**Capital Structure and Dividend Decisions**
Concept of Capital Structure, Financial Leverage and Capital Structure, Determinants of Capital Structure, Dividend and its forms – cash dividend, right and bonus shares and buy-back of shares, determinants of Dividend Policy of firm.

Working Capital Management
Basics of Working Capital management: Meaning of Gross and Networking Capital, Componets of Working Capital. Risk-Return framework for Working Capital Decisions.

### RECOMMENDED BOOKS

**Main Reading**
1. Pandey i. M., "Financila Management", 7<sup>th</sup> Edition, 2002, Vikas Publishing Pvt Ltd.
2. M. Y. Khan and P.K. Jain, "Management: Accounting" 2<sup>nd</sup> Edition1995, Tata McGraw-Hill Publishing New Delhi
3. Maheshwari S.N. "Accounts" 2002, Vikas Publishing Pvt. Ltd.

### MT 25 PROBABILITY AND STATISTICS

**Introduction**
Probability models, sample space events, algebra of events, graphical methods of representing events, probability axioms, combinational problems, conditional probability, independence of events, Baye's rule, Bernoulli trials.

**Discrete random variables**
Introduction, random variables and their spaces, the probability mass function, distribution functions, special discrete distributions, analysis of program max, the probability generating function, Discrete Random Vectors, independent random variables

**Continuous random variables**
Introductions, the exponential distribution, the reliability, failure density and hazard function, some important distribution, functions of a random variable, jointly distributed, random variables, order statistics, distribution of sums, functions of normal random variables.

**Expectation**
Introduction moments, expectation of functions of more than one random variable, transform methods, moments and transforms of some important distributions, computations of mean time to failure, inequalities and limits theorems.

**Conditional Distribution and Conditional Expectation**
Introduction, Mixture distributions, conditional Expectation, Imperfect fault coverage and reliability, random sums

**Statistical Inference**
Introduction, Parameter Estimation, Hypothesis testing: z, t, chi square, F test, Regression, correlation and 'analysis of variance: Introduction, least squares curve fitting, the coefficient of Determination, confidence Intervals in linear Regression, correlation analysis, simple nonlinear regression, Higher dimensional least-squares fit, Analysis of variance;
Non parametric tests: sign test, u test, Rank test, Median test

**Statistical Quality Control**
Control charts, Mean chart, R chart, sigma chart, C chart.

### RECOMMENDED BOOKS

**Main Reading**
1. Introduction to Probability and statistics, Gupta S.C. and Kapoor V.K
   Text books :- Probability and statistics,2/e,spiegel,TMM
2. Introduction to Statistics, P. S. Mann, Willey Student Edition

**Supplementary Reading**
1. Probability & statistics with reliability, Queuing and computer applications, Kishor S.Trivadi, Prentice Hall of India.1999.

## PL 26 DATA AND FILE STRUCTURES LAB

**List of Suggested Lab Assignments**
1. Implement a function that takes two character strings as parameters, append the second string to the first string and return the pointer to the resulting string.
2. Implement a function that takes two character strings as parameters and return the number of times the second strings occurs in the first string.
3. Writea program that compresses a character string by deleting all space characters in the string.
4. Write a program to multiply two N x N matrices. The Value of N would be provided at run time.
5. Write a program to read a set of numbers from the keyboard and create a sorted linked list. Also provide the functionality to print the list, add new number to the list and remove a number from the list.
6. Write a program using recursion to
    a. Calculates and returns the length of a linked list.
    b. Convert a string containing numeric characters to an integer. Decimal point may be regarded as numeric character for the sake of this assignment.
7. Write a program to implement sparse matrix using doubly linked list.
8. Write a program for the following (use stack)
    a. Convert infix expression into postfix expression.
    b. Evaluate postfix expression
    c. Convert Infix expression into prefix expression
9. Write a program to implement a circular buffer of size N using the concept of queue. The characters should be added to the end of queue. After the buffer gets full the characters must be removed from the beginning of the queue to make space for new character as they are entered. Print the characters to console as they are removed.
10. Write a program to implement Huffman encoding using Binary tree.
11. Write a program to create a binary tree for the given infix expression.
12. Write a program that creates a binary tree given a set of numbers. Implement function to
    a. Print nodes using preorder traversal
    b. Print nodes using postorder traversal
    c. Print nodes using inorder traversal
    d. Delete all leaf nodes.
    e. Check if binary tree is complete.
    f. Rewrite the traversal functions using stack instead of recursion.
13. Write a program that reads a list of names and telephone number from a text file and inserts them into AVL tree. Write a functions that allows the user to search the tree for any name and prints the telephone number for that name if it exists in the tree..
14. Write a program to implement priority queues using heaps. Give functionality to combine two heaps and produce a single heap.
15. Write a program to implement minimum spanning tree algorithm.
16. Write programs to sort array of numbers using
    a. Bubble sort
    b. Heap Sort
    c. Quick Sort
17. Write a program that given two text file containing English words. Would sort and merge them into a third file.
18. Given a text file containing student information, write a program to build B-tree for the given set of records. Student roll number may be used as key.

**Objective**
The objectives of the course are to introduce the student to shell programming and system call API of UNIX.

**List of Suggested Lab Assignments and Demonstrations.**
**Filters and Regular  Expressions**
Revision: Concept of standard input, output and error. Use of redirection and pipelining. Using *wc*, *head, tail* and *cut* commands. Translating input using *tr* command. Pattern searching using  *grep.* Advance search patterns regular expressions.
**The sed and awk Filters**
Sed: sed commands and sed scripts. Substitute, delete, insert, modify and append operations using sed. List, transform and print operations. Next and quit operation. Writing to the file.
Awk: Selection criteria and action. Splitting a line into fields and using printf. Using regular expressions. Relational and Boolean operations. Computation  using decimal numbers. The BEGIN and END sections. Awk system variables. Using arrays  with both numeric and nonnumeric subscript. Command line parameters and environment variables. String handling using built-in functions. Programming constructs: if, for, while. Getline function and reading input from files. Writing output to file and pipes.
**Shell Programming**
Shell scripts and execution methods. The dot command, Interactive and Non Interactive  execution. Shell and environment variables. Built-in shell parameters. Command line arguments ($1, $2, etc). Meta characters – syntactic (&&,(), &, II, ;;, <,> etc), pattern matching, Wild card characters, substitution, Quoting, I/O using read, printf and echo. Test command, arithmetic expressions, Control flow: For, If, While, Case. Setting positional parameters (set command), and shift, shell functions, interrupt handling (trap). Redirection and file descriptors. Debugging shell scripts. Portability issues.
**C Programming Tools**
Compilling a C program . Multi module programs. Header files, systems calls and library functions. The I/O functions. The make utility and makefiles. Using static and shared libraries. Creating static and shared libraries. Using *strace* command for debugging.

1. Write a shell script that presents a multiple choice question gets the user's answer and reports back whether it is right or wrong. Finally it shall display the score.
2. Write shell script which simulates the important DOS commands with various switches. Write a shell script that receives a file name and informs whether it exists or not. If it exists then it shall give the details of its access permission, its size, type, etc.
3. Modify the calendar so that it knows about weekend. On Friday, tomorrow include Saturday, Sunday and Monday. Modify calendar to handle leap years. Calendar should know about our college holidays. How would you arrange it.
4. Write a shell script that accepts the name of a text file and finds
   a. No. of sentences
   b. No. of words
   c. No. of words having more than five characters
   d. No. of words that start with a vowel
   e. No. of articles in the text files.
5. Write a shell script to read an appointment file and to display the appointments for the day. Also, the script should include options to add any forthcoming events to the appointment file. The appointment should be displayed immediately, when user logs in.
6. Write a shell script to accept a password from the user terminal. The program should prompt the user for password. As it is being entered only the cursor should move and no characters should appear on the screen.
7. Write Shell script to implement a process management utility that allows you to kill processes on basis of their user ID, total elapsed time, the terminal on which the process runs, etc.
8. Text file EMPMAST contains the following data Empno, Empname, Empaddress, Dept, Basic Pay, Date Of Joining. Write a shell script that provides following  functionality.
   a. View records : Accept a pattern and display all records that match the  pattern.

b. Add records : Accept employee number. Ensure that the field is not left blank. Ensure that there are no duplicate entries.
c. Delete records: Allow the user to delete a record after accepting the corresponding employee number for the record.
d. Quit.

9. Write a shells script that would take name of a directory as command line parameter and delete all the file of size zero bytes with extension .tmp under that directory tree. In case the name of directory is not specified current working directory should be assumed.

10. Write a shell script that would take the name of any user and list the total number of files under his/her home directory with total disk space used by them. In case name of user is not specified current user should be assumed.

11. Write a script called that adds a local user to the system. This script should:
   a. Take only one argument, or else exit after printing a usage message. ¨
   b. Check /etc/passwd and decide on the first free user ID. Print a message containing this ID.
   c. Create a private group for this user, checking the /etc/group file. Print a message containing the group ID.
   d. Gather information from the operator user: a comment describing this user, choice from a list of shells (test for acceptability, else exit printing a message), expiration date for this account, extra groups of which the new user should be a member. With the obtained information, add a line to /etc/passwd, /etc/group and /etc/shadow; create the user's home directory (with correct permissions!); add the user to the desired secondary groups.
   e. Set the password for this user to a default known string.

12. Write a program to implement basic features of UNIX *ls* command.
13. Write a program to implement basic features of UNIX *ps* command.
14. Write a program to implement basic features of UNIX *who* command
15. Write a program to implement basic features of UNIX *chmod* command
16. Write a command that executes another command and returns statistics about various OS resources used by this child process, including amount of time the child process ran in user and kernel mode.
17. Write program to execute a command in background mode with lower priority.
18. Write a program that use following inter process communication mechanism to share information.
   a. Message Queues.
   b. Shared memory
19. Write a rudimentary interactive command interpreter with support for following features.
   a. Command History
   b. Command execution only in foreground mode
   c. Command pipelining
   d. Output Input redirection
20. Write a program to list all the hardware devices used by OS and resources (interrupt, i/o ports and memory) used by them. Also list all the hard disk partitions.

## RECOMMENDED BOOKS

**Main Reading**
1. Unix Concepts and Applications – Sumitaba Das  Tata MacGraw Hill.
2. Unix and Shell Programming – Graham Glass and King Ables  Pearson Education
3. C and Unix Programming – Kerningham and Pike
4. Advanced Programming in the Unix Environment – W. R. Steven

### CS 31 DATA BASE MANAGEMENT SYSTEMS

**Basic concepts**:
Database & Database Users, Characteristics of the Database Approach, Database Systems, Concepts & Architecture Data Models, Schemes & Instances DBMS Architecture of Data Independence, Data Base languages & Interfaces, Data Modelling using the Entity - Relationship approach.

**Relational Model, Languages & Systems**
Relational Data Model & Relational Algebra Relational Model Concepts Relational Model Constraints Relational Algebra/Relational Calculus SQL-A Relational Database Language Data Definition in SQL. Views & Queries in SQL. Specifying Constraints & Indexes in SQL. A Relational Database Management System.

**Relational Data Base Design**
Function Dependencies & Normalization for Relational Database Functional Dependencies Normal forms based on primary keys (1NF, 2NF, 3NF, BCNF) Covers of Functional Dependencies, Canonical covers. Loss less join and Dependency preserving decomposition algorithms.
Physical Database design and Query Optimization.

**Recovery Techniques,**
Concept of a transaction, Recovery concepts, Recovery Techniques.

**Concurrency Control**
Serialization Locking Techniques Time stamp ordering Granularity of Data items.

**Conventional Data Models & Systems**
Overview of Network Data Model, Hierarchical Data Model and their DML's.
Current trends in database.

### RECOMMENDED BOOKS

**Main Reading**
1. Korth, Silberchartz, " Database System Concepts" McGrawhill Publication.
2. Elmasri and Navathe, " Fundamentals of Database Systems", Addison Wesley, New Delhi.
3. Database Management Systems –R. Ramakrishnan, J.Gehrke – T.McGraw Hill
4. Desai B., " An Introduction to Database Concepts", Galgotia Publications, New Delhi.
5. Database Systems (Design, Implementation and Management) – Rob, Coronel
6. J. D. " Principles of Database Systems", Galgottia Publications, New Delhi.
7. Date C. J. , " An Introduction to Database Systems", Publication House, New Delhi.

### CS 31   COMPUTER COMMUNICATIONS NETWORKS

**Introduction**
Uses of computer networks. Types of Computer Networks : PAN, LAN, WAN, GAN. Topologies and design goals: Hierarchical topology, Horizontal topology, Star topology, Ring topology, Mesh topology. Point to point, multi drop and Broadcast Networks. Layered Protocols and OSI model Goals of layered protocols. Network design Problems, Interfaces and services, Connection Oriented and Connectionless Services. Service primitives, Relationship of services to protocols, communications between layers. OSI and TCP/IP reference models. Introduction to Standard organizations,

**Fundamentals of communication theory:**
Simplex, Half duplex and Full duplex Communication. Impairment to Transmission: Attenuation, Distortion, Noise. Bandwidth limited signals. Channel speed and bit rate. Maximum data rate over noiseless and noisy channel. Baud rate and Bit rate. Analogue vs. digital data. Analogue and Digital signals: Concept of Modulation : Shift Keying - FSK, PSK, ASK. QAM. Trellis Encoding. Pulse code modulation and Codec, Frequency, phase and Amplitude modulation. Digital Signal encoding: RZ, NRZ, AMI, Manchester encoding, Differential Manchester encoding,4B/5B encoding. Analogue and Digital Transmission. Multiplexing data channels :FDMA,TDMA and CDMA.. Broadband and Baseband Transmission.

**Transmission media**

Guided Media: Twisted Pair: UTP and STP, Coaxial Cable, Fiber Optics: Single mode, Multimode, Step Index, Graded Index. Unguided Media: Wireless Transmission - Radio, Microwave, Infrared and Light Wave Transmission. Satellite transmission. Copper vs. Fiber comparison, Satellite vs. Fiber Comparison. Synchronous, Asynchronous and Isochronous transmission. Packet, message and Circuit switching. , Telecommunication Network and  Telecommunication Data Hierarchies. Examples:  Modem, DSL, SONET.

**Data Link Layer**

Data Link Layer Services: Framing: Character and bit protocols, Error control and Flow Control.: Error Detection and Correction. Hamming Code and Cyclic Redundancy Check., Sliding Window protocols: Go back n and Selective Reject. HDLC: HDLC Options, Frame format and transmission process, HDCL subsets: LAP, LAPB. Point to Point Protocol: PPP Options, Frame format and Transmission Process.

**Medium Access Control Sublayer**

IEEE LAN standards. LAN topologies and protocol, CSMA/CD and IEEE 802.3 protocol: Switched Fast & Gigabit Ethernet. Token (priority) and IEEE 802.5 Protocol , Wireless Network and 802.11 Protocol: CSMA/CA. Comparison of 802.3, 802.5 and 802.11. Repeaters, Switches and Bridges. Transparent (Spanning tree)  and Source routing Bridges. Logical Link Control – IEEE 802.2. Virtual LANS: 802.1Q standard.

**Network Layer**

Virtual Circuit vs. Datagram Subnet. Store and Forward mechanism. Routing Algorithms: Optimality Principle, Shortest Path Routing, Unicast Routing – Distance Vector Routing, Link State Routing, Hierarchical Routing. Broadcast Routing – Flooding, Multi destination routing, Reverse path forwarding. Multicast Routing. Congestion Control.  Providing Quality of Service (QOS).

**Transport Layer**

Transport Layer Service Primitives. Connection Establishment and Connection release Management. Problem of old duplicates. Flow control and buffering.

**TCP/IP  protocol Suite**

TCP/IP and Internetworking, Examples of TCP/IP operations, Related protocols. Ports and sockets, IP address structure, Major features of IP, IP Datagram format, Major IP services and options, Subnets and Classless InterDomain routing. ICMP.TCP, TCP, Major features of TCP, Passive and active opens, TCP segment format, Flow and Congestion control. UDP. Route discovery protocols. Examples: RIP, OSPF and BGP.  ARP and RARP.

**Upper layer Protocols**

Domain name service. World Wide Web: HTTP protocol. Introduction  to Cryptography. Public Key and Symmetric Key Cryptography. Privacy, Authentication, Integrity and Non-Repudiation Principles. Digital signatures and Digital Certificates.

<u>**RECOMMENDED BOOKS**</u>

**Main Reading**
1.   Andrew Tanenbaum., "Computer networks", (4th  Edition) Prentice Hall of India.
2.   Stalling W., " Data and Computer Communication" (5th edition) Prentice Hall of India.
3.   Behrouz A Forouzan, "Data Communication and Networking", (3rd edition), Tata McGraw Hill.
4.   Behrouz A Forouzan, "TCP/IP Protocol Suite", (2nd edition), Tata McGraw Hill.

<u>**CS  33 OBJECT ORIENTED PROGRAMMING**</u>

**Objective:**
To provide a comprehensive knowledge of Object oriented technology and concepts and to understand their implementation in major OOP languages.

**Introduction to OO paradigm**
Functional decomposition approach and its drawbacks, object based decomposition. Criteria for Object orientation: Methods and language, implementation and environment, libraries. Run time environments- JVM, JRE; CTS and CLR in .NET

**Abstract Data Types:**
why ADT? ADT specification: Types, functions, axioms, preconditions. From ADT to classes: class, deferred class, effective class, role of deferred class; ADT and Information hiding

**Class:**
The role of classes as modules and types, uniform type system. The OO style of computation

**Object:**
definition, basic form, object references, object identity, declaring references, self-reference, run-time object structure, Object creation, References and calls. Operations on references, Object cloning and copying, deep cloning. Composite objects and expanded types. Dynamic aliasing. Class level operations-static methods. Package structure and importing.

**Memory management:**
modes of object management, space reclamation, detachment, unreachable objects, memory management in object-oriented model, approaches: casual, programmer controlled de-allocation, automatic memory management. Algorithms: reference counting, garbage collection, requirements, case studies.

**Genericity:**
horizontal and vertical type generalization, the need for type parameterization, generic classes, defining and using generic classes, type checking and rules, operations of generic type entities, cost of genericity. Generic programming in C++, Java Collections and Generics.

**Design By contract**:
software correctness, assertions, preconditions, postconditions, notion of contract, assertion violation rules, precondition principles. Class invariants: definition, properties, rules. Correctness of class, creation and correctness, ADT functions and class features. Assertion instruction; loop invariants and variants. Using assertions, monitoring assertions at runtime

**Exception handling:**
principles, exception objects, language mechanisms in Java, C++, exception nesting, hierarchies of exceptions.

**Inheritance, Polymorphism, Typing & Binding**:
inheritance concepts & rules, Deferred features and classes: deferring and effecting a feature, redeclaration, deferred classes, using the original version in a redefinition. The meaning of inheritance: module view and type view. Extension-specialization paradox. The role of deferred class. Multiple Inheritance, feature renaming, approaches to Multiple inheritance in OOP languages, multiple interface inheritance, repeated inheritance, inheritance and assertions, global inheritance-Ex. Class Object in Java, frozen features, assignment attempt, typing and redeclaration, anchored declaration, inheritance and information hiding. Typing: typing problem. Static and dynamic typing. Why static typing. Binding. Covariance and descendent hiding. Contravariance. Advanced Inheritance mechanisms: inheritance versus composition, Inheritance taxonomy

**I/O :**
streams, i/o streams input of built-in types, unformatted input, input of user defined type, ostream output of built-in types, output of user defined types, formatting of output, stream state, I /O exception, file streams, string streams, stream buffers.

**Concurrency:**
Threads, multithreading, thread synchronization

**Reflection:**
run time type interrogation, how reflection works in Java.

**Persistence:**
persistence closure principle, schema evolution, serialization in Java, using relational databases from OOP like Java, C++. OO databases.

**Advanced topics**: distributed objects, components, Aspect orientation.


**RECOMMENDED BOOKS**

**Main Reading**
1.   Bertrand Meyer:  Object Oriented Software Construction, second edition, PTR PrenticeHall Pearson.

**Supplementary Reading**
1. Ira Pohl, Object-Oriented Programming Using C++, Second Edition, Addison Wesley
2. Stanley Lippman, C++ Primer, 3rd Edition, Addison Wesley
3. Ken Arnold, James Gosling, David Holmes, The Java Programming Language, Fourth Edition, Addison-Wesley Professional, 2005
4. Bjarne Stroustroup, The C++ Programming Language by, 4th Edition, Addison Wesley


## PL_36_DATA BASE MANAGEMENT LAB

Besides the Sessional Work that needs to be done, the students undertake a live project – the analysis, design (ER diagram and normalized tables) and implementation of a real life project of their choice.

The project report that they submit consists of
(i) Feasibility study (ii) ERDiagrams (iii) Tables normalized in an appropriate normal form with integrity and domain constraints noted. (iv) User Interface Design -Form and Report design , including triggers that may need to be written (v) User Manual
Peer reviews of ERDs are held in the class.


**The Sessions include**
**Student table**
StudentId,Lastname,Firstname,MiddleInitial,Streetaddress,City,State,Zipcode,Telephone,Email,YearinSchool
**Department table**
DeptId, Description
**Instructor table**
InstructorId, DeptId,Lastname, FirstName, MiddleInit, Position,T elephone, Email
**Course table**
DeptId, CourseId,Title, Description, Units, Additional_Fees
Note: You can write your create table statements through an editor and save them in a file with a .sql extension and then run them as @filename at the SQL> prompt. You will have to keep modifying the table structures in the following session
**Session I & II**
1. Create the Student table by naming it "STUDENT". Now insert a tuple into the table. How do you address the table?
2. Create the above 4 tables with the primary key constraint. Choose some fields as mandatory in the tables.
3. Insert at least 4 tuples in each of these tables.
4. In a field that you have specified as mandatory , insert a tuple with a null value for this field. What error do you get?
5. Add a foreign key constraint to those fields that require it in the design. Does it allow you to do so? Why or why not?
6. Check if the data that you had previously inserted conformed to the FK constraint!
7. Insert more data into the table that (i) conforms to the FK (ii) does not conform to the FK
8. Alter the table by dropping a column. Does it allow you to do so?
9. Can you change a column from null to not null? What about not null to null?
10. Drop a table itself. Does it allow you?
11. Truncate a table – remove only the data and not the schema definition.
12. Add a FK to a table with values that do not conform. What happens?
13. Decrease the width of a table that has values. Does it allow you?
14. Can you alter a table by adding a primary key to the table?
15. Can you define a FK column with a data type different from the data type to which it references?
16. Can you drop a PK from a table to which a FK references?
17. Try the above with a CASCADE option.

18. Can a table have >1 primary key? Can it have >1 unique constraint defined on it?
19. Query your user tables to see what tables you have.
20. Query the schema definitions of your tables.
21. Try creating a FK on a table that references a non primary key attribute. Does it allow?
22. Establish a default value for the City attribute.
23. Create a check constraint on the Instructor table for Positions as (Prof,Reader,SrLecturer,Lecturer).
24. Enter data in the Instructor table that (i) satisfies the constraint (ii) violates the constraint
25. How do you drop a constraint once defined?

## Session III (VB.NET)

1. Familiarize yourself with the .NET IDE and the help features
2. Note ( and make a list of some) the controls and properties in .NET that differ from VB
3. Create a form which takes input from a user consisting of 2 values. Display the division of the first value by the second value. Place proper controls on the form for the above. Run the application.
4. Make a mistake in the code (say an error in declaring the variable) .See how errors can be detected and corrected. Is the code interpreted or compiled?
5. Set a breakpoint before and after the division operation. Note the values of the variables. How did you set the breakpoint?
6. Try catching errors like – division by zero
7. Create a menu interface to an application that wants you to store data about suppliers, parts and customers. The form should have options to add, modify and query the data. Before this form is invoked, have a login form that accepts a user name and password. The user can resubmit the information up to 4 times , after which you terminate the application by giving a relevant message. Please design a good interface.
8. For the application form you have created, accept and store the data in any structure. The user should be able to query the data you have stored.

## Session IV and V

These queries need to be run on the guests and guest roster tables created and populated. Your journals should have a printed output of the result of the queries for verification. The tables have been populated with data.

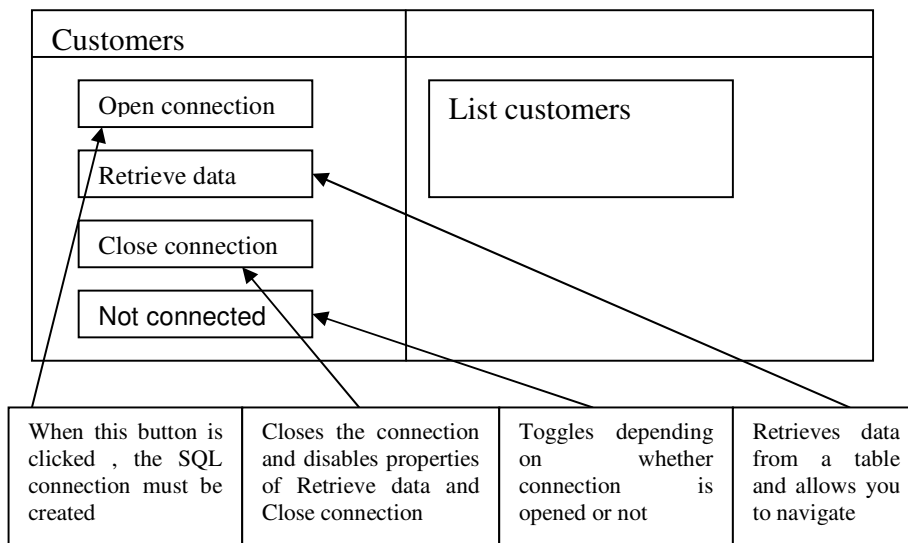Please format all output as required.

1. select all the guests whom Todd trains
2. select all those guests who have a discount between .10 and .20
3. display all guests whose departure dates are not known
4. find the min, max and avg discounts from the guest roster
5. find the number of people from the guest file who is trained by Bansal
6. find the number of guests trained by each trainer
7. modify the above query to only display those guests who have more than 4 people who train under him
8. display the names and departure dates of all guests sorted in descending order of departure
9. find the names and heights of all the guests who are trained by Todd
10. select all guests who receive the same discount as Johnny Rivulets (--- use a self join)
11. select all guests who receive the same discount as Johnny Rivulets (--- use a nested query)
12. find the names and trainers of everyone who has the same trainer as either Clint Westwood or Warren Amoroso
13. select all those guests who appear in the guest roster. output should be guest name, room no, arrival and departure date.
14. find all those guests of larger build whose maximum acceptable height is ( a value inputted by you) and who the trainers assigned to them.
15. find all those female guests who have stayed for more than 20 days
16. print the names of all guests except those who arrived before 25th Jan 1999.
17. select all those guests whose height > avg(height) of the group they belong
18. display a formatted output as follows

```
Trainer Name      Guest Name
-------------------  ------------------
     XYZ              abc
                      pqr
                      tuv

   total              3

   DEF                ghi
                      jkl

   total              2
```

19. How many different trainers are there?
20. create a view of only those guests whose departure dates are unknown. For this view, try inserting a default date of 15 days from the date of arrival.
21. add a column called weight to the table guests. for all female guests of small build, give them a weight of 40 kgs. for those with a medium build give them a weight of 45 kgs.
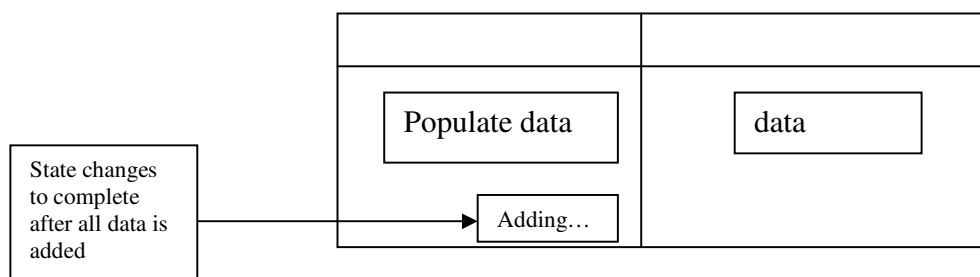
**Session VIa**

Create a Connected Data Access Application (use an Oracle database that you created in session I) – the DataReader object

| Customers | |
|---|---|
| Open connection | List customers |
| Retrieve data | |
| Close connection | |
| Not connected | |

| When this button is clicked , the SQL connection must be created | Closes the connection and disables properties of Retrieve data and Close connection | Toggles depending on whether connection is opened or not | Retrieves data from a table and allows you to navigate |
|---|---|---|---|

Buttons should be enabled or disabled depending on the state of the application. If the connection is opened successfully, then the Retrieve and close connection buttons can be enabled

2) Create an application using a Disconnected Data access –(the DataSet container object) . Populate the data base table with data (3 rows sufficient) and then tell the user it is complete

| | |
|---|---|
| Populate data | data |
| Adding… | |

State changes to complete after all data is added

**Session VIb**

Create a mini application to retrieve data from an oracle data source(tables guests and guest_roster) as follows:

Your query screen should do the following:

A list of trainers should be displayed on the LHS of the screen. When a specific trainer is selected, the screen should display the list of guests that the trainer trains

**Session VII**

1. Create a trigger that inserts into a table (call it GUEST_LOG) the fields, user name, the date and the mode of operation(I/U/D) , whenever the guest table is updated.

2. Write a trigger that automatically assigns a trainer in the guest_roster table whenever a guest tuple is added in the guest table for a male guest whose height is < 5.5
   The trainer for this guest should be the one who has the least number of guests under him at that point of time.

3. Write a package that has the following procedures:
   a. If a guest stays for more than (x) number of days – a tuple is added onto a table called HQ_GUESTS with the name of the guest, the departure date, and a discounted tariff based on
      >7 days   5% discount
      >12 days   7% discount
   b. A procedure that displays a list of all guests in the hotel and discounts for them if any

## PL 37   OBJECT ORIENTED PROGRAMMING  LAB

**Objective:**

To understand the implementation of various OO features in major OOP languages and how to use them for problem solving.

**Regular lab assignments (minimum 15 ) using Java/C++/C#**
1. Understanding OO basic concepts and use of IDE such as Eclipse, Visual Studio
2. Using command line interface for compiling and executing programs
3. Use of Inheritance: Figures
4. Use of abstract classes
5. Using interfaces
6. Using multiple inheritance
7. Performing basic I/O,
8. Handling exceptions
9. Use of arrays, lists
10. Advanced collections/generics
11. Use of STL
12. Creating and running threads
13. Use of synchronized clause in java
14. Use of reflection
15. Serialization
16. JDBC
17. Use of CTS in .NET
18. Testing for covariance, contra variance
19. Graphical toolkit such as AWT, Swing, SWT

In addition a Mini project involving implementation of OO concepts or application may be given.
IDEs such as Eclipse, Netbeans, Visual Studio as well as command line interface may be used.

## CS_41 OBJECT ORIENTED ANALYSIS AND DESIGN

**OOAD:**
Brief review of OO concepts. Assigning responsibilities. What is analysis and Design? What is OOAD?
**UML:**
Introduction.. Main UML diagrams- class diagram, sequence diagram, activity diagram, use case diagram. Requirements:
**Use case model:**
Use case diagram, use case descriptions, use case realization using sequence and activity diagrams.
**Advanced Use case modeling**:
Generalization, includes, extends
**Analysis/Domain/conceptual model:**
Concepts, attributes, operations. Aggregation, composition and containment.
**Analysis to Design:**
CRC technique and elementary GRASP patterns
**Design Model:**
Design class diagram, visibility, delegation versus inheritance. Association class, qualified associations, reflexive associations, ordered associations. Sequence diagram, activity diagram, state chart diagram, deployment diagram.  Advanced GRASP patterns.
**Implementation model:**
mapping designs to code
Brief introduction to other UML 2.0 diagrams
**Design patterns:**
reusability at design level. Principles of good design. Creational, structural and behavioral patterns.(some of the patterns to be covered)
**Unified Process:**
cycles, phases, iterations, disciplines, workflows, roles, activities, artifacts. Basis of UP: Use case driven, architecture centric, iterative and incremental.

**Goodness of  OO Design:**
OO metrics such as Chidambar & Kemerer Metrics

### RECOMMENDED BOOKS

**Main Reading**
1. Craig Larman, Applying UML and patterns, 2nd Edition, Addison Wesley, 2003.
2. Martin Fowler, UML Distilled, 2nd Edition, Addison Wesley, 2003
3. Erich Gamma, Richard Helm, Ralph Johnson,, John Vlissides, Design Patterns: Elements of Reusable Object-oriented Software, Pearson Education.

**Supplementary Reading**
1. Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Addison – Wesley Longman, 1999, ISBN 0-201-57 168 –4.
2. Rebecca Wirfs Brook, Designing Object Oriented Software, PHI
3. UML 2.0 Specification, OMG

## CS_42   WEB TECHNOLOGY

**Introduction**
Internet and its evolution. Difference between host based and client-server computing. Single tier vs. Multi-tier computing model. significance of Open standards in implementing web applications.  Hyper Text Transfer Protocol. HTTP methods and error codes. Format of HTTP Request and Reply packet. Important HTTP headers.  Cookies. Common Gateway Interface (CGI/1.1).
**HTML & XHTML**
HTML Basics: Html tags, entities, links, frames, tables, list, forms images, Background, colors. HTML Advance features:  HTML Layout, fonts, styles, head, meta, URLs, scripts, attributes, events,URL encode. XHTML Introduction. XHTML vs. HTML. XHTML systax, XHTML DTD, validation and modules.
**Cascading Style Sheet**
Introduction. CSS versions. CSS syntax, background, text, font, border, margin, padding list properties. CSS dimensions, classification, Positioning, Pseudo-classes, Pseudo-elements and Media types.

**Javascript**
Introduction, syntax, variables, Control statements, operators, functions, events, objects: string, date, array, Boolean, math. Creating user defined objects. Browser detection, Cookie handling, validation and timeout management using JavaScript. AJAX.

**HTML Document Object Model ( HTML DOM)**
Introduction. Objects, Collections, methods and events. Core vs. HTML DOM. Browser Objects: Window, Navigator, Screen, History, Location, Document. Different versions of DOM, Compatibility across various browsers. Objects representations of different HTML elements in the document.

**Server Side scripting**
Static vs. Dynamically generated HTML pages. Different server side scripting Technologies. One of the following technologies may be discussed in details ( PHP, ASP, Java Servlets, Java Server pages, etc).The discussion should include following topics - Request handling, Response creation, HTML form data processing, application data and application lifetime management. Concurrency control, Session data and session lifetime management, Cookie Management, Database connectivity – accessing and updating data in database tables.

**Extensible Markup Language**
Introduction, Syntax, Elements, attributes, well formed and valid XML document. Namespaces, creating DTD, validating XML document, Browser support, viewing using CSS, XML DOM vs. SAX parsing of XML Document.

**XSL and XSLT**
XSL language, XSLT-XPath, XSL-FO. XPath syntax, nodes, axis, operators and functions. XSLT transformation, XSLT templates and important elements. XSL-FO syntax, Using XSL-FO with XSLT.

**Web services**
Introduction to SOAP, WSDL, UDDI

## RECOMMENDED BOOKS

**Main Reading**
1. Dietel, Dietel, Nieto, "Internet and World Wide web – How to Program", Eastern Economy Edition , Pretice Hall of India.
2. Marchal Benoit, "XML by Examples", Prentice-Hall of India.

**Supplementary Reading**
1. Website http:// www.w3schools.com

## MT 43 APPLIED OPERATIONS RESEARCH

**Operation Research and its scope**.
Necessity of operations Research in Industry.

**Linear Programming-simplex Method**.
Theory of the Simplex Method. Duality and Sensitivity Analysis.

**Other Algorithms for Linear Programming**
Dual Simplex Method. Parametric Linear Programming. Upper Bound Technique. Interior Point Algorithm. Linear Goal Programming.

**Transportation and Assignment Problems**.

**Network Analysis**
Shortest Path Problem. Minimum Spanning Tree Problem. Maximum Flow Problem. Minimum Cost Flow Problem. Network Simplex Method. Project Planning and Control With PERT-CPM.

**Dynamic Programming**
Deterministic and Probabilistic dynamic programming.

**Game Theory**
Two-Person, Zero-Sum Games. Games with Mixed Strategies, Graphical Solution. Solution by Linear Programming.

**Integer Programming**
Branch and Bound Technique.

**Applications to Industrial Problems**
Optimal Product Mix and Activity Levels. Petroleum-Refinery Operations. Blending Problems. Economic Interpretation of Dual Linear Programming Problems. Input-Output Analysis. Leontief System. Indecomposable and Decomposable Economies.

**Nonlinear Programming**

One and Multi-Variable Unconstrained Optimization. Kuhn-Tucker Conditions for Constrained Optimization. Quadratic Programming. Separable Programming. Convex Programming. Non-Convex Programming

## RECOMMENDED BOOKS

### Main Reading
1.  F.S.Hillier and G.J.Lieberman. Introduction to Operations Research (Sixth Edition), McGraw Hill International Edition, Industrial Engineering Series, 1995.
2.  G.Hadley, Linear Programming, Narosa Publishing House, 1995.
3.  G.Hadly, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
4.  Mokhtar S.Bazaraa, John J.Jarvis and Hanif D.Sherali, Linear Programming and Network flows, John Wiley & Sons, New York, 1990
5.  H.A.Taha, Operations Research-An introduction, Macmillan Publishing Co.., Incl New york.
6.  Kanti Swarup, P.K.Gupta and Man Mohan, Operations Research, Sultan Chand & Sons, New Delhi/
7.  S.S.Rao, Optimization Theory Applications, Wiley Eastern Ltd; New Delhi.
8.  Prem Kumar Gupta and D.S.Hira, Operations Research-An Introduction, S.Chand & Company Ltd; New Delhi.
9.  N.S.Kambo, Mathematical Programming Techniques, Affiliated East-West Press Pvt. Ltd; New Delhi, Madras.
10. LINDO Systems Products (visit website http://www.lindo.com/products.html)
    a.  LINDO (the linear programming solver)
    b.  LINDO Callable Library (the premier optimization engine)
    c.  LINDO (the linear, non linear, and integer programming solver with mathematical modeling language)
    d.  What's Best ! (the spreadsheet add-in that solves linear, Non linear, and integer problems).
11. Optimization Modeling with LINDO (5$^{th}$ edition) by Linus Schrage.
12. Optimization Modeling with LINGO by Linus Schrage

## PL  46 CASE TOOLS LAB

**UML Assignments and Mini project:**
Use of Rational Rose or any other UML 2.0 compliant tool to draw UML diagrams such as Use Case Diagram, Class Diagram, Sequence diagram, Activity diagram with and without swimlanes, statechart Diagram, Deployment diagram, component diagram.. Generation of code from UML model. These exercises may be completed by assigning a mini-project.

1.  Assignments on designing with the help of design patterns-UML diagrams and implementation

2.  Implementing Model View Controller architecture

3.  Mini-project involving modeling using UML 2.0

## PL  47    WEB TECHNOLOGY LAB

This Lab is attached to Web Technology paper. Assignments listed here are supposed to reinforce the topics covered in that paper.  Students are also expected to implement a mini project besides these assignments. The mini project should include design and implementation of a Web application.

**List of suggested Lab Assignments**
1.  Setting up Web Server: Apache on LINUX and Microsoft Internet Server. Configuring the server to support CGI and other server side scripting Technologies supported by the respective platforms. Web-root directory and User-directory configuration. Understanding security issues.
2.  Creating HTML/XHTML Web site: Assignment should be designed so as to use all important HTML tags and Attributes. Only static HTML pages may be created. Use of FRAMES for navigation between the pages should be discussed. Use of TABLES for formatting the page contents should be encouraged. Aesthetics, contents and efficient bandwidth utilization should be stressed.  The assignment may spread across multiple Lab sessions.
3.  Creating Simple Web application using CGI Protocol: Study how the stateless behavior of HTTP is overcome to implement application logic. Study HTML tags related to forms. Use of cookies, hidden fields to carry forward session data should be demonstrated.

4. Formatting HTML pages using CSS: Pages created in assignment 2 may be used to understand how different browsers render HTML differently. Now CCS style properties may be used to format the output in similar manner across all browsers. Use different browser version to understand support provided with different versions.
5. Add JavaScript code to pages created in assignment 3 for validation of form data. Use JavaScript to recognize user browser version and generate browser specific HTML. Use objects exporter by the browser for this purpose.
6. Use HTML DOM and JavaScript to dynamically modify web page contents and CSS style properties. Use browser objects, HTML tag objects & events exported by the browser and document.
7. Advance HTML DOM assignment: Use forms to accept any data from the user multiple number of times. The user entered data should be stored locally in a TABLE. Provide facility to modify or delete records stored in the TABLE. Upon pressing a button the data should be sent to Server where it would be stored in a text file.
8. Implement a simple Web Application using Server Side Scripting. This could be the same application as done in assignment 3. Use server side scripting technology discussed in the class -( PHP, ASP, JSP, etc)
9. Implement a simple web Application. Study how database access (Addition, Modification and Deletion of records) works in Server Side Scripting. Use the database access API provided by Server Side Technology used.
10. Create a XML DTD file. Create a XML document based on the DTD and validate the XML document against the DTD. Use CSS to display XML document in the browser.
11. Transform a XML document using XSLT for viewing inside a browser. Study the support provided by browser and Server side scripting technology used.
12. Implement a Simple Web service Use the support provided by Server Side scripting technology available on Server side.

## CS 51 SOFTWARE ENGINEERING

**Introduction:**
What is Software Engineering? History and motivation and challenges. Software Quality. Software process. Characteristics of software process.
**Software development processes and methodologies**:
Waterfall, prototyping, iterative, spiral, unified process, agile methodologies.
**Requirements:**
Elicitation, specification, verification, management. Developing vision documents, identifying features, relating requirements to features. Functional and nonfunctional requirements.(Techniques such as Interviewing, Requirement workshop, brainstorming, prototyping). SRS, modern SRS, Characteristics of SRS. Use case modeling. Requirements verification & validation, Requirement change management and scope management.
**Human Computer Interaction:**
Goal-directed design, user goals, goal directed design process. Task analysis. Implementation models and mental models. User categories, contextual inquiry, personas, interaction styles, orchestration and flow, navigation, principles of visual interface design and hiding, metaphors, idioms and affordances, direct manipulation, controls, error handling, help. Usability testing.
**Software Architecture:**
Principles, benefits, views, architectural patterns-pipe & filters, layered, MVC, Broker, SOA. Frameworks.
**Design:**
Abstraction, modularity, encapsulation, simplicity, reusability, extensibility; documenting design.
**Coding:**
high quality routines, variables and control structures, developer testing, refactoring, code tuning. Layout and style, self documenting code. Test driven development.
**Verification and validation:**
Reviews-walkthroughs, peer reviews, inspection, Testing. Types of test: unit testing, integration testing, system testing, acceptance testing. Test planning, test design, test case execution and reporting. Debugging: principles, approaches, use of debuggers.
**Maintenance:**
The Context of Maintenance – Definitions -- Economics of Maintenance – Evolution of Software Products -- Maintaining Systems Effectively -- Categorizing Software products Deployment Models – Types of maintenance. Reverse engineering, reengineering, BPR. Legacy systems.

**Project Management:**
Project planning, Measures and measurements –size measure –. Software cost estimation – function point models – COCOMO model, defining a Task Network – Scheduling – Earned Value Analysis , monitoring, Risk management: risk categorization, Risk management

**Software configuration management:**
Baseline, identification, accounting, control, audit, source and version control, change control procedure. Tools used in SCM

**Process Improvement and software quality:**
Quality attributes, IEEE framework for software quality, SQA, CMM, Software product and process Metrics.

## RECOMMENDED BOOKS

**Main Reading**
1.  Hans van Vliet,  Software Engineering: Principles and Practice, Second edition, John Wiley and Sons, 2000
2.  Dean Leffingwell, Managing Software Requirements, Pearson Education.
3.  Steve McConnell, Code Complete, 2nd Edition. Redmond, Wa.: Microsoft Press, 2004
4.  Pankaj Jalote, An Integrated Approach to Software Engineering, Third Edition, Narosa Publishing House
5.  Alan Cooper & Robert Reimann, About Face 2.0: The Essentials of Interaction Design, Wiley
6.  Ian Sommerville, Software Engineering, Sixth Edition, Pearson
7.  Microsoft Manual of Style
8.  IEEE Software Engineering Standards vol 1 to 4.

## CS 52  ARTIFICIAL INTELLIGENCE AND APPLICATIONS

**Artificial Intelligence:**
History and applications
**Knowledge representation :**
Reasoning, issues and acquisition –Introduction to predicate logic-Rule-based knowledge representation – the rules- representation of knowledge using rules-predicate calculus using rules-unification-forward chaining and backward chaining –resolution.
**Symbolic reasoning under uncertainty –**
Non monotonic reasoning –truth maintance systems-sources of uncertainty –probability and bayes theorm- approaching uncertainty using fuzzy set.
**Heuristic search –**
 Search as a problem solving techniques-heuristic search-hill climbing-best-first search-evaluation of heuristic functions-admissibility, monotonicity and informed ness.
**State space search:**
strategies for state space search-implementation of graph search: Depth first search, breadth first etc - production system-application of search techniques in Game playing-Game playing-minimax –alternative to minimax-iterative deepening.
**Expert system-**
Stages in the development of expert system-probability-based expert system-expert system tools.
**Fuzzy systems –**
Basics of fuzzy logic and fuzzy control system –justification, fuzzy inference and defuzzification
**Neural networks –**
Perceptrons –feed forward neural network with back propagation algorithm –self-organizing map
**Genetic algorithms** –
Natural selection – rank method –rank space method- Genetic programming.
**Other learning algorithms –**
Winston's learning – version space algorithm.

## RECOMMENDED BOOKS

**Main Reading**
1. Artificial Intelligence by Elain Rich and Knight
2. Artificial intelligence and intelligence system by N.P.Pathy-oxford publication
3. Artificial intelligence by Patric Henry Winston –Pearson
4. Artificial Intelligence by George Lugar –Pearson

5. Artificial Intelligence –A modern approach – Stuart Russell and Peter Norwig-Pearson
6. Fundamentals of the new artificial intelligence by Toshinori Munakata -Springer

## BM 53  DECISION SUPPORT SYSTEMS

**Objective:**
To make the students familiar with the various aspects and issues involved in decision making and the latest technology developments and different types of Information Systems in place today for effective decision making. They will also learn how to collect and organize data, knowledge from different sources and use for efficient decision making.

**Introduction to Decision Support Systems:**
Managers and Decision Making, Managerial Decision Making and Information Systems,   Managers and Computerized Support, The Need for Computerized Decision Support and the Supporting Technologies, A Framework for Decision support, The Concept of Decision Support Systems**.**

**Decision Making, Decisions in the Organization, Modeling Decision Processes:**
Introduction and definitions , System Models, A Preview of the Modeling process, Decision Making: Intelligence Phase, Design Phase, Choice Phase,  Evaluation: Multiple Goals, Sensitivity Analysis, What-If, and Goal Seeking , Decision Making: The Implementation Phase, How Decisions Are Supported, Alternative Decision-Making Models,  Personality Types, Gender, Human Cognition, and Decision Styles, The decision Makers

**Group Decision Support and Groupware Technologies:**
Group Decision Making, Communication, and Collaboration, Communication support, Collaboration Support: Computer-Supported Cooperative Work, Group Support Systems, Group Support Systems Technologies, Group Systems, The GSS Meeting Process, Distance Learning, Creativity and Idea Generation, GSS and Collaborative Computing Issues and Research.

**Executive Information Systems**:
Characteristics and Capabilities of Executive Support Systems, Organizational DSS, Supply and Value Chains and Decision Support, Supply Chain Problems and Solutions, Computerized Systems: MRP, ERP and SCM, Frontline Decision Support Systems, The Future of Executives and Enterprise Support Systems.


**Expert Systems and Artificial Intelligence:**
Concepts and Definitions of Artificial Intelligence,  Artificial Intelligence Versus Natural Intelligence, The Artificial Intelligence Field ,   Types of Knowledge-based Decision Support system, Basic concepts of Expert systems,  Structure of Expert Systems, The Human Element in Expert systems, How Expert systems work,  Example of an Expert system consultation, Problem Areas Addressed by Expert systems, Benefits of Expert systems, Problems and Limitations of Expert systems, Expert System  Success Factors,   Types of Expert systems, Expert systems and the Internet/Intranets/Web.

**Knowledge Engineering and Acquisition:**
Knowledge Engineering, Scope of Knowledge, Difficulties in Knowledge Acquisition, Methods of Knowledge Acquisition: An Overview, Interviews, Tracking Methods, Observations and Other Manual Methods, Expert-Driven Methods, Repertory Grid Analysis, Supporting the Knowledge Engineer, Machine Learning: Rule Induction, Case-Based Reasoning, Neural Computing and Intelligent Agents,  Selecting an Appropriate Knowledge Acquisition Method, Knowledge Acquisition from Multiple Experts.

**The Data Warehouse, Designing and Building a Data Warehouse:**
The Nature and Sources of Data, Data Collection, Problems, and Quality, The Internet and Commercial Database Services, Database Management Systems in DSS, Data Warehouse design and implementation issues, OLAP: data Access, Querying, and Analysis.

**Data Mining and Visualization:**
Data Mining, Data Visualization and Multidimensionality, Geographic Information Systems and Virtual Reality, Business Intelligence and the Web.

**The Systems Perspective of a DSS, Implementing and Integrating Decision Support Systems:**
The Major issues of Implementation, Strategies, What is System Integration and why integrate? Generic Models of MSS Integration, Models of ES and DSS Integration, Integrating EIS, DSS, and ES, and Global Integration, Creative Decision Making and Problem Solving, Intelligent Software Agents: Characteristics of Agents, Single Task, Why Intelligent Agents? Classification and Types of Agents, Internet-Based Software Agents, Electronic Commerce Agents, Other Agents, Including Data Mining, User Interface, & Interactive, Believable  agents, Distributed AI, Multi-agents, and Communities of Agents, DSS Agents.

**Decision Support in the Twenty-First Century**:
The Future of Management Support Systems. Intelligent DSS, intelligent Modeling and model Management.

## RECOMMENDED BOOKS

**Main Reading**
1. George M. Marakas, Decision Support Systems and Megaputer, 2/e PEARSON, Prentice Hall Publication.
   (Web site : http://myphlip.pearsoncmg.com/cw/mplistres5.cfm?vbookid=403#5707 )
   For each topic, references are mentioned at the above mentioned site.

**Supplementary Reading**
1. Efraim Turban and Jay E.Aronson, Decision Support Systems and Intelligent Sytems, Pearson Education 2001.
2. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers,2001.
3. Efrem G. Mallach, Decision Support and Data Warehouse Systems, McGraw Hill International Editions.

## PL 57   SOFTWARE ENGINEERING LAB

Assignments on the use of following tools preferably using Eclipse and Rational Studio
1. Requirement Management: creating vision document, feature lists, generating baselines, comparing baselines, adding requirements and needs, defining traceability, generating documentations using tools like Requisite Pro.
2. Project management: defining project plan, assigning resources, generating Gant charts, creating schedules, estimation using COCOMO
3. Unit testing with Junit
4. Refactoring

5. Generating documentation
6. User interface testing
7. Build Tool- defining dependencies, building projects. Make and Ant
8. Source control and version control tools such as CVS/ clearcase/Sourcesafe
9. Debuggers-defining breakpoints, checking variable state
10. defect tracking systems
11. code coverage tools
12. GUI design(Swing/SWT/.NET)

## PL 58 ARTIFICIAL INTELLIGENCE AND APPLICATIONS LAB

The following is the list of  suggested assignments.
1. Implementation of Blind search methods for Games like 8-Puzzle , 8-Queens etc.
2. Implementation of Heuristics searches like hill climing , A*  and AO*
3. Implementation of Minimax with alpha & beta pruning for chess game.
4. Perceptron
5. Back-propagation algorithm
6. Genetic algorithm
7. Knowledge based deduction system with forward chaining and back-ward chaining.

The following is the list of suggested Mini projects titles.
1. Expert system for  different domains, like medicine, financial market etc
2. Neural network for predication of stock market, EEG, ECG analysis etc.
3. Neural network for face recognition, expression recognition, music analysis.

The above assignment can be carried out in C /Java programming language.
The project work can be done using tools like MatLab .

## ELECTIVE PAPERS (Electives may be offered from the papers listed below)

| | |
|---|---|
| EL 0001 | Theory of Computation |
| EL 0002 | Natural Language Processing |
| EL 0003 | Data Warehousing & Data Mining |
| EL 0004 | Programming Languages |
| EL 0005 | Compiler Design |
| EL 0006 | Computer Graphics and Animation |
| EL 0007 | Distributed Database Management Systems |
| EL 0008 | Advanced Computer Architecture |
| EL 0009 | Advanced Operating systems |
| EL 0010 | Software Architecture, Design Patterns and Frameworks |
| EL 0011 | Human Computer Interactions |
| EL 0012 | Embedded Systems (Software) |
| EL 0013 | Network Programming |
| EL 0014 | Cryptography and Network Security |
| EL 0015 | Wireless and Mobile Networks |
| EL 0016 | Middleware Technology |
| EL 0017 | Information Retrieval |
| EL 0018 | Internet Technologies |
| EL 0019 | Image Processing and Computer Vision |
| EL 0020 | Advanced UNIX programming |
| EL 0021 | Windows Programming using VC++ |
| EL 0022 | Geographical Information System |
| EL 0023 | Component Technology |
| EL 0024 | Managerial Economics |
| EL 0025 | Corporate Planning |
| EL 0026 | Investment Technology |
| EL 0027 | Business Finance |
| EL 0028 | Management Information Systems |
| EL 0029 | Electronic Commerce |
| EL 0030 | Software Project Management |
| EL 0031 | Software Testing |
| EL 0032 | Organizational Behavior |
| EL 0033 | Parallel Programming |
| EL 0034 | Java Programming |
| EL 0035 | System Analysis and Simulation |
| EL 0036 | Foundation of Decision Processes |
| EL 0037 | Taxation Practices |
| EL0038 | Multimedia Technologies |

## SYLLABUS OF ELECTIVE COURSES:

### EL 0001 THEORY OF COMPUTATION

**Automata and Language Theory**
Finite automata, regular expressions, push-down automata, context free grammars, pumping lemmas.
**Computability Theory**
Turing machines, Church-Turing thesis, decidability, halting problem, reducibility, recursion theorem.
**Complexity Theory**
Time and space measures, hierarchy theorems, complexity classes P, NP, L, NL, PSPACE, BPP and IP, complete problems, P versus NP conjecture, quantiers and games, provably hard problems, relativized computation and oracles, probabilistic computation, interactive proof systems.

### RECOMMENDED BOOKS

**Main Reading**
1. Sipser Michael. "Introduction to the Theory of Computation". Thomson/Course Technology, 1996.

**EL 0002 NATURAL LANGUAGE PROCESSING** .

**Introduction**
Ambiguity, Models and algorithm, Language, thought and understanding.

**Regular Expressions and Automata**
Regular Expressions, Basic Regular Expression Patterns, Disjunction, Grouping, and Precedence, Advanced Operators, Regular Expression substitution, Memory, and ELIZA

**Finite-State Automata**
Using an FSA for Recognition, Formal Languages, Non-Deterministic FSAs, Using an NFSA to Accept Strings, Recognition as Search

**Morphology and Finite-State Transducers**
English Morphology, Inflectional Morphology, Derivational Morphology, Finite-State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite-State Transducers, Orthographic Rules and Finite-state Transducers, Combining FST Lexicon and Rules, Lexicon-free FSTs: The Porter Stemmer

**N-grams**
Counting Words, Simple N-grams, Smoothing, Backoff, Deleted Interpolation, N-grams for Spellings, Entropy.

**Word Classes and Part-of-Speech Tagging**
English classes, tagsets POS tagging, Rule based POS tagging, Stochastic POS tagging, HMM tagging, Transformation based tagging, Multiple tags and multiple words, unknown words,

**Context-Free Grammars for English**
Context Free rules and trees, Sentence level construction, Noun Phrase, co-ordination, Agreement, Verb phrase, Auxiliaries, Grammar Equivalence and normal form.

**Parsing with Context-Free Grammars**.
Parsing as Search, A Basic Top-Down Parser, Adding Bottom-Up Filtering, Problems with the Basic Top-Down Parser, Left-Recursion, Ambiguity, Repeated Parsing of Subtrees, The Earley Algorithm, Finite-State Parsing methods.

**Features and Unification.**
Feature structures, Unification of feature structures, Feature structures in grammar, Implementing unification, Parsing with unification constraints, Types and inheritances.

**Lexicalized and Probabilistic Parsing**.
Probabilistic Context free grammars. Problems with PCFGs, Probabilistic Lexicalized CFGs, .Dependency Grammars, Human Parsing.

**Representing Meaning.**
Computational Desiderata for representation, Meaning Structure of Language, Some Linguistically relevant concepts: Categories, Events, Representing time, Aspects, Representing beliefs, Pitfalls. Alternative approaches to meaning.

**Semantic Analysis**
Syntax-Driven Semantic Analysis, Semantic Augmentations to context-Free Grammar Rules, Quantifier Scoping and the Translation of Complex-Terms. Attachments for a Fragment of English. Sentences, Noun Phrases, Verb Phrases. Prepositional Phrases, Integrating Semantic Analysis into the Earley Parser. Idioms and Compositionality, Robust Semantic Analysis

**Lexical Semantics**
Relation among lexes and their senses, WordNet, Internal structure of Words, Creativity and the Lexicon.

**Word Sense Disambiguation and Information Retrieval**
Selectional restriction based disambiguation. Robust word sense disambiguation. Information Retrieval concepts.

**Discourse**
Reference Resolution, Text Coherence, Psycholinguistic studies of reference and coherence.

**Natural Languages Generation**
An architect for generation, Surface realization, Discourse planning, Microplanning, Lexical Selection, Evaluating generation system.

**Machine Translation**

Language similarities and Differences, The transfer Metaphor, The Interlingua Idea: using Meaning, direct Translation, Using statistical techniques, Usability and system development.

## RECOMMENDED BOOKS

**Main Reading**
1.  Natural Langugage processing by Daniel Jurafsky, James H Martin, Pearson Education asia


## EL 0003  DATA WAREHOUSING AND DATA MINING

**Objective of the Course**
Data warehousing and data mining are the essential components of decision support systems for the modern day industry and business. These techniques enable the knowledge worker (analyst, manager, executive) to make better and faster decisions. The objective of this course is to introduce the student to various Data Ware housing and Data Mining concepts and techniques. A database perspective has to be used throughout the course to introduce principles, algorithms, architecture, design and implementation of data mining and data warehousing techniques.

**Introduction and Background**
Introduction to the multidisciplinary field of data mining,. Discussion on the evolution of database technology that has led to the need for data warehousing and data mining. Stress on importance of its application potential. Introduction to the different key words and techniques.

**Data Warehousing And OLAP**
Insight of data warehouse and on-line analytical processing, Aggregation Operations, models for data Warehousing, star schema, fact and dimension tables Conceptualization of data warehouse and multidimensional databases. Life cycle of data warehouse development. Relationship between data warehouse and data mining.

**Data Mining Primitives**
Data preprocessing including data cleaning, data integration, data transformation. Definition and Specification of a generic data mining task. Description of Data mining query language with few example queries.

**Association Analysis**                                    .
Different methods(algorithms) for mining association rules in transaction based data bases. Illustration of confidence and support. Multidimensional and multilevel association rules. Classification of association rules. Discussion on few association rule algorithms e.g. Apriori, frequent pattern growth etc.

**Classification and Predictions**
Different Classification algorithm, including C4.5, CART etc., use of genie index, decision tree induction, Bayesian classification, neural network technique of back propagation, fuzzy set theory and genetic algorithms.

**Clustering**
Partition based clustering, Hierarchical clustering, model based clustering for continuous and discrete data. Discussion on scalability of clustering algorithms. Parallel approaches for clustering.

**Web Mining**
Web usage mining, web content mining, web log attributes. Use of web mining in efficient surfing and personalization

**Mining Complex Type of Data.**
Data mining issues in object oriented data bases, spatial data bases and multimedia data bases, time series data bases, and text data bases.

**Applications of Data Warehousing And Data Mining.**
Exploration of web sites on data ware housing and data  mining applications including bibliography data bases, Corporate Houses and Research labs.

## RECOMMENDED BOOKS

**Main Reading**
1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques," 1$^{st}$ Edition Indian Reprint 2001, Harcourt India Private Limited, ISBN 1-55860-489-8.
2. Margaret Dunham, "Data Mining: Introductory and Advanced Topics," 1st Edition, 2003, Prentice Hall (Pearson Publication), ISBN 0-13-088892-3.
3. Arun K Pujari, "Data Mining Techniques". Universities Press.

**Supplementary Reading**
1. T. Mitchell, "Machine Learning", 1997, McGraw Hill.
2. S.M. Weiss and N. Indurkhya, "Predictive Data Mining", 1998, Morgan Kaufmann.
3. M. Jarke, M. Lenzerni, Y. Vassiliou, and P. Vassiladis, "Fundamentals of Data Warehouses", 2000, Springer Verlag, Isbn 3-540-65365-1.


## EL 0004 PROGRAMMING LANGUAGES

**A perspective**
Overview, historical perspective, application evaluation of programming languages, design.
Discussion of features of some languages (structured, Pascal, PL-1, C, LISP, prolog.)
**Language Design : Syntax.**
Character set, Vocabulary, syntactic structure, syntax semantics and compiler Design Attributes of a good language, effects of environments
**Language Design : Semantics**.
A simple machine and notational model, types, binding, operators and coercison, storage allocation central structures, control structures, data control and stored data, procedures and parameters., abstraction and encapsulation Logistics of functional languages
**Language Design; pragmatics.**
Art and Science of language design and programming, the programming environment language comparison and evaluation.

## RECOMMENDED BOOKS

**Main Reading**
1. Programming language – Allen Tucker ,McGraw Hill.
2. Programming Languages :Design and Implementation :Pratt T.W et al, Prentice Hall of India


## EL 0005 COMPILER DESIGN

**Introduction to Compilers,**
Lexical analysis, Regular Expressions, Finite automation. N.F.A., N.F.A. to D.F.A. conversion, D.F.A., minimization of D.F.A., Lex tool.
**Context Free Grammar,**
Derivations & Parse trees, Syntax analysis: Parsing, Top Down Parser, Recursive descent Parser, Predictive parsing, LL(1) Parsing table, Bottom Up Parsing, Shift Reduce parsing, Operator precedence parsing, LR Parsing methods, SLR, LRDL, LALR, YACC tool.
**Syntax directed translation** :
Syntax directed translation schemes, Implementation of syntax directed translation schemes, Intermediate codes, Post fix notation parse trees & syntax trees, three address codes, quadruples, triples, Translation of assignment statements, Boolean expression, statements that after flow of control, Post fix translation, Translation with Up down parsing.
**Error detection & recovery:**
Errors, lexical phase errors, Syntactic phase errors, semantic errors.

**Code Optimization :**
Loop optimization, DAG representation of basic block, value numbers & algebraic laws, Global data flow analysis, Dominators, Reducible flow graph, Depth first search, Loop invariant computation, Induction variable elimination.

**Data flow Analysis :**
Reaching definition, Available Expression , copy propagation, Backward flow problems, Very busy expression & code hoisting code.

**Code Generation :**
A simple code generation, code generation from DAG & labeled trees.

**Register allocation :**
coloring by implication, coalescing, graph coloring implementation, Register allocation for Trees.


## RECOMMENDED BOOKS

**Main Reading**
1.  Alfred V. Aho, Jeffreys D. Ullman & Ravi Sethi, "Principles of Computer Design" Narosa Publication.
2.  Trembley et al, " Theory & Practice of Compiler Writing ", McGraw Publication.
3.  Andrew W. Appel, " Modern Compilers Implementation in Java".
4.  Dhamdhere " Compiler Principles".


## EL 0006 COMPUTER GRAPHICS & ANIMATION

**Basic background**
2D and 3D Transformations,  Cyrus-Beck line clipping algorithm, Polygon  clipping.

**3D Viewing**
Viewing pipeline, Parallel and Perspective projections, view volumes, clipping

**Representing Curves and Surfaces**
Parametric, curves, continuity conditions, cubic splines, Hermite interpolation, Bezier curves and surfaces, B-spline Curves- uniform nonrational, cubic periodic, open uniform, uniform, nonuniform rational types (NURBS), Subdividing  curves, Displaying spline curves using forward difference scheme, parametric bicubic surfaces.

**Solid Modelling**
Sweep representation, Constructive solid geometry methods, representation through Octrees, Binary Space Partitioning trees.

**Visible Surface Determination**
Issues in Visible surface determination Coherence, perspective view, extents and    bounding volume, backface culling, Z-Buffer and A-Buffer Algorithms, use of Binary Space Partitioning trees, representing 3D data using Octrees, Boolean   operations on Octrees, marching cubes, Visible surface ray tracing.

**Illumination Models & Rendering**
Diffuse and Specular illumination model, reflection vector computation, Shading models for polygons – polygon mesh shading, Gouraud and Phong Shading,  problems with interpolated shading, Bumpd mapping, Transparency, shadows, Ray tracing.

**Introduction to Animation**
Perception, Animation production, use in film and videos, orientation representation and interpolation – Euler angle representation, motion display  considerations.

**Animation – Low Level Control**
Motion along a curve – computing are length, speed control – sine interpolatio User specified distance time functions, path following, key-frame systems –  shape interpolation, free-form deformations, Morphing – 2D object warping.

**Animation – High Level Control**
Hierarchical modeling and Kinematics – inverse kinematics, Jacobian, rigid  body simulation, collision detection, Particle systems – particle generation,  attributes, termination, rendering, Flocking behavior – interacting with other   members, leader, collision avoidance, modeling water, fire, explosions, waves, clouds.

**RECOMMENDED BOOKS**

**Main Reading**
1.  Foley, Van Dam, Feiner, Hughes, Computer Graphics – Principles and Practices 2$^{nd}$ edition, 1997, Addison Wesley.
2.  Rick Parent, "Computer Animation: Algorithms and Techniques, 2001,, Morgan-Kaufman,
3.  Hearn & Baker, Computer Graphics, 2$^{nd}$ Edition., 2003, Prentice Hall of India.

**Supplementary Reading**
1.  Woo, Neider, Davis, Shreiner,"Open GL Programming Guide" 3$^{rd}$ edition, 2000, Pearson Education.
2.  D.A. Rogers, Procedural Elements for Computer Graphics, 2001, 2$^{nd}$ Edition, Tata MsGraw Hill.
3.  Alan Watt and Mark Watt, "Advanced animation and Rendering techniques", 1992, Addison – Wasley.

## EL 0007 DISTRIBUTED DATABASE MANAGEMENT SYSTEM

**Introduction**
what is a DDBMS, advantages and disadvantages.
**Distributed DBMS Architecture**
architectural models global directory issues.
**Distributed DB Design**
Strategies, design issues, fragmentation, allocation.
**Semantic Data Control**
View management, data security, semantic integrity control.
**Query Processing**
Layers of Query Process Query Decomposition, Localization of distributed data.
**Optimization of Distributed Queries**
Search space and strategy, Distributed Cost Model, join ordering in fragment queries, distributed query Optimization algorithms.
**Transaction Management** definition to properties and types.
**Distributed concurrency control**
Serializability, Taxonomy of concurrency control mechanisms, locking based concurrency control algorithms, Timestamp based algorithms, Relaxed concurrency control, deadlock management.
**Distributed DBMS Reliability**
concepts and measures, failures and fault tolerance, reliability protocols.

**RECOMMENDED BOOKS**

**Main Reading**
1.  Principle of Distributed Database Management Systems – Ozsu and Valdurez  - Pearson Education
2.  Distributed Database Systems – Ceri and Pellagatti , McGraw Hill

## EL 0008 ADVANCED COMPUTER ARCHITECTURE

**Objective**
This course is designed for students who are already familiar with the fundamentals of the working principle of a Digital Computer and the various sub-units. The main objective of the course is to expose the students to the working of current high performance processors and systems.

Towards this objective the course covers instruction level pipelining and parallelism, multiprocessors architectures, memory hierarchy and parallel computer models and mapping of parallel programs onto these models.

**Introduction and Review**
Fundamentals of digital computer and organization.
**Pipelining**
Linear pipeline processor: Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch handling techniques, Arithmetic Pipeline design: Computer arithmetic principles, Static arithmetic pipelines, Multifunctional arithmetic pipelines
**Storage and Memory Hierarchy**
Register file, Virtual memory, Cache memories, Cache memory working principles, Cache coherence issues, Cache performance analysis, High bandwidth memories.
**I/O Organization**
High bandwidth I/O, Disk I/O, Bus specifications and Standards.
**Instruction Level Parallelism**
 Super-scalar processors, VLIW architecture
**Parallel Computer Models and Program Parallelism**
Classifications of Machines, SISD and MIMD, condition of parallelism, data and resource dependencies, hardware and software parallelism program partitioning and scheduling, grain size latency, program flow mechanism, control flow versus data flow, data flow architecture, demand driven mechanisms, comparison of flow mechanisms.
**Vector Processor And Synchronous Parallel Processing**
Vector instruction types, vector-access memory schemes, vector and symbolic processors, SIMD architecture and programming principles: SIMD parallel algorithms, SIMD computers and performance enhancement.
**System Interconnect Architectures**
Network properties and routing, staric interconnection networks, dynamic interconnection networks, multiprocessor system interconnects: Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

**RECOMMENDED BOOKS**

**Main Reading**
1. Hennessay & D.A. Patterson, "Computer Architecture: A Quantitative approach", International Student Edition, 3$^{rd}$ Edition, 2002, Morgan Kaufmann Publisher.
2. Michael J. Flynn,"Computer Architecture: Pipelined and Parallel Processor Design'" 1995, Jones and Barlett, Boston.

**Supplementary Reading**
1. Kai Hwang, "Advanced computer architecture", 1993, TMH
2. R.K. Ghose, Rajan Moona & Phalguni Gupta, "Foundation of Parallel Processing"; Narosa Publication.
3. D.Sima, T.Fountain, P.Kasuk, "Advanced Computer Architecture-A Design space
    Approach", 1997, Addison Wesley.

**EL 0009 ADVANCED OPERATING SYSTEMS.**

**Overview**
Design approaches, synchnonization, mechanisms, axiomatic verification of parallel programs.
**Process Deadlocks**
models of deadlocks, models of resources, Graph theoretic model of a system, state, systems with single-unit resources,  consumable resources, reusable resources.
**Architectures of Distributed systems**
types, issues ,communication  primitive, limitations of a distributed system, lamport's logical clock, vector clocks.
**Distributed Mutual Exclusion**
classification of  algorithms, solution to  ME, token and non-token based algorithms, comparisons

**Distributed deadlock Detection**
Resource versus communication Deadlocks, deadlock handling strategies, centralized and distributed deadlock detection algorithms.
**Distributed file systems**
mechanisms for building DFS, Design issues, case studies.Distributed shared Memory – algorithms, coherence protocols, design issues.
**Distributed scheduling**
issues in load distribution, load distribution, load Distribution algorithms.
**Failure Recovery and Fault Tolerance**
backward and forward error recovery, checkpointing, recovery in distributed database system.
**Protection and Security**
Access and Flow Control,
**Case studies**
Amoetra, Andrew, Unix, Cryptography.

## RECOMMENDED BOOKS

**Main Reading**
1. Advanced concepts in 0perating systems – Singhal and Shivaratri - Tata McGraw Hill
2. Distributed 0perating Systems – Andrew Tanenbawn ,Prentice Hall


## EL 0010  SOFTWARE ARCHITECTURE, DESIGN PATTERNS AND FRAMEWORKS

**Principles of good OO design:**
inheritance versus delegation, program to an interface.
**Design patterns:**
motivation, reusability, extendibility, cataloging patterns, "GoF" patterns
**Software architecture:**
definition, advantages, components and connectors, views, documenting, evaluating, mining
**Architectural patterns:**
layered, pipe & filter, MVC, broker, microkernel, broker, peer to peer, plug-in, event bases software, SOA, middleware architectures
**Frameworks:**
enterprise frameworks, EJBs
**Software product lines:**
economies of scope, product line development, product development
**Model driven architecture**:
PIM, PSM, transformation, software factories:
**Anti-patterns**
**Case studies**

## RECOMMENDED BOOKS

**Main Reading**
1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software, Pearson Education
2. Len Bass, Paul Clements, Rick Kazman, Software Architecture in Practice, Pearson Education
3. Frank Buchmann,  Regine Munier, Hans Rohnert, Peter Sommerland, Michael Stahl, Pattern Oriented Software Architecture-I, Pearson Education
4. Christine Hofmeister, Robert Nord, Dilip Soni, Applied software architecture, Pearson Education
5. Jack Greenfield, Keith Short, Software Factories, Wiley DreamTech

### EL 0011  HUMAN COMPUTER INTERACTION:

**Objective:**
Understand the importance of designing proper interfaces. Be able to design and evaluate user interfaces for software and electronic gadgets.

**HCI:**
Introduction, theories: perception, ergonomics, user friendliness

**Goal Directed design**
Implementation models and metal models, user categories, modeling users-Personas, contextual inquiry
Interaction categories: direct manipulations, menus and forms, command and natural, languages

**Interaction and response**:
principles, patterns orchestration and flow design, navigation, undo, document management. Data entry, Personalization, localization, globalization principles of visual design, metaphors, idioms, affordances

**Direct manipulation**-
selection, drag & drop, controls, controls and behavior design-choosing windows, window states, using controls, menus, toolbars, tooltips, dialogs.  Interface programming: event handling, widgets, forms design, report design
Style manuals and help, error- elimination, notification installation
Managing Multiple windows
Information search and visualization
HCI for Web, embedded systems
Heuristic evaluation and Usability
Social impact of user interfaces

### RECOMMENDED BOOKS

**Main Reading**
1. B. Shneiderman, *Designing the User Interface, 4th Edition*, Pearson Education, Addison-Wesley
2. Alan Cooper, Robert Reimann, About Face 2.0, The essentials of User Interaction Design, Wiley dreamtech India Pvt. Ltd.
3. Donald Norman, The Design of Everyday Things, The MIT Press, 2001

### EL 0012 EMBEDDED SYSTEMS (SOFTWARE)

**Introduction to embedded system:**
A First Look at Embedded systems- Examples of Embedded systems-applications area-categories of embedded system – recent trends in embedded system:

**Design challenge** –
optimizing design metrics Common design metrics- Processor technology- General-purpose processors – software - Single-purpose processors – hardware- Application-specific processor- IC technology

**Architecture of embedded system:**
hardware architecture –software architecture - Programming for embedded system.

**The process of embedded system development**
Interrupts-Microprocessor-Architecture-Interrupt Basics-The Shared-Data Problem-Interrupt Latency-shared data problems- survey of software architecture -Round-Robin-Round-Robin with Interrupts-Interrupt Latency –RTOS.

**RTOS**
architecture of kernel –task and task scheduler-interrupt service routines- semaphores-message queues-mail boxes-pipes –events-timer – memory management –interrupt routines in RTOS  Environment-overview of embedded /real time operating system .

**Embedded Software Development Tools**
-Host and Target Machines-Linker/Locators for Embedded Software-Getting Embedded Software into the Target System.

**Debugging Techniques-**

Testing on Your Host Machine-Instruction Set Simulators-The assert Macro-Using Laboratory Tools

**An Example System-**
What the Program Does-Environment in which the Program Operates

**Task Image creation** –
operating system software –target image creation for windows XP embedded-porting RTOS on a micro-controller based development board.

**Representative embedded systems**-
programming in Linux-programming in RTLinux-Development of Navigation System –Development of protocol converter-mobile Java applications.

**State machine and concurrent process models** –
Introduction- Models vs. languages, text vs. graphics- Models vs. languages- Textual languages versus graphical languages-An introductory example- A basic state machine model: finite-state machines (FSM)-Finite-state machines with data path model: FSMD- Using state machines- Describing a system as a state machine-Comparing the state machine and sequential program model- Capturing a state machine model in a sequential programming language-Hierarchical/Concurrent state machine model (HCFSM) and the State charts language

**Program-state machine model (PSM)** –
The role of an appropriate model and language

**Concurrent process model-**
Use of Esteral language for embedded software development.

RECOMMENDED BOOKS

**Main Reading**
1. Embedded software primer by David Simon – Pearson
2. Art of embedded system by Jack Ganssle
3. Embedded systems Architecture by Tammy Noergaard – Elsevier publications
4. Embedded /Real time systems – by DR.K.V.K.K.Prasad. – Dreamtech
5. Esterel language by Gerard Berry ( web site reference)
6. Embedded system design by Arnold S.Berger
**7.** model checking by Edmund M.clark
**8.** Embedded Systems Building Blocks by Jean LaBrosse
9. Embedded Systems Design by Arnold Berger
10. The Art of Programming Embedded Systems by Jack Ganssle

EL 0013 NETWORK PROGRAMMING

**Basic UNIX programming**
Unix processes. Creating and terminating Processes. Background and Foreground Processes. Executing new programs. Unix Signals and Signal Handling. Systems calls related to process, user and signal Management. File descriptors and inheritance. Named and unnamed pipes and related system calls.

**Elementary Socket Programming**
Berkley Sockets Overview, Introduction to sockets, Socket addresses, Basic Socket system calls, Error hadling. Concept of Reserved ports, Elementary TCP and UDP socket programming. Socket options. Name and Address Conversion functions. Interface Operations using 'ioctl'.

**I/O Operations**
Synchronous vs. Asyncronous I/O. I/O Multiplexing using 'select' and 'pselect'., Sockets and signals, Signal driven I/O. Nonblocking I/O: Nonblocked 'accept' and 'connect'. Broadcasting and Multicasting. Sending and Receiving Out of Band data using 'select' and signals. Advance I/O functions.

**Miscellaneous**
Daemon processes and *Inetd* Super Server, Unix Domain Sockets. Passing file descriptors using UNIX domain sockets.

**Winsock programming**

Introduction to Win32 programming. Difference between UNIX and MSWindows sockets. Introduction MSWindow socket API. MSWindows extension to socket API. MSWindows and blocking Socket calls. Implementing server functionality using multithreading. Synchronization using event objects. Using 'EventSelect' and 'AsyncSelect' calls. Asynchronous I/O: Overlapped I/O with scatter and gather. Creating Win32 services.

**Programming applications**

Time and date routine, Ping, Trivial file transfer protocol.

## RECOMMENDED BOOKS

**Main Reading**
1. Steven W.R., " Unix Network Programming", Prentice Hall of India.
2. Napper Lewis, "Winsock 2.0", COMDEX Computer Publishing.
3. Steven W R, " Advanced Programming in UNIX Environment" Addison Wesley.

**Supplementary Reading**
1. Microsoft Software Developers Network Documentation.
2. Davis R. " Win32 Network Programming", Addison Wesley.

## EL 0014 CRYPTOGRAPHY AND NETWORK SECURITY

**Foundations of Cryptography and Security**

Ciphers and Secret Messages, Security Attacks and Services.

**Mathematical Tools for Cryptography**

Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic.

**Design Principal of Block Ciphers**

Theory of Block ciphers, Feistel Cipher network Structures, DES and triple DES, Modes of Operation ( ECB, CBC, OFB, CFB), Strength of DES.

**Block Cipher Algorithms**

IDEA, CAST, Blowfish, AES

**Pseudo Random Numbers and Stream Ciphers**

Pseudo random sequences, Liner Congruential generators, Cryptographic generators, Design of stream Ciphers, RC4, RC5.

**Public Key Cryptography**

Prime Numbers and testing for primality. Factoring large numbers, Discrete Logarithms, RSA, Diffie-Hellman, ElGamal, Introduction of Ecliptics curve cryptosystems, Key Management, Key exchange algorithms, Public Key Cryptography Standards.

**Hashes and Message Digests**

Message Authentication, MD5, SHA-1, HMAC

**Digital Signatures, Certificate and Standards**

Digital signature standards ( DSS and DSA), Public Key Infrastructures, Digital certificates and Basics of PKCS standards.

**Authentication**

Kerberos V4 and V5, X509 Authentication Service

**Web Security protocols**

Pretty Good Privacy (PGP), IPsec and VPN, Secure Socket Layer (SSL) and Transport Layer Security (TLS).

**System Security**

Intrusion detection and Password management. Firewalls.

**Electronic Commerce Security**

Electronic Payment Systems Secure Electronic Transactions(SET), Ecash(DigiCash), Smart Card based Systems.

**RECOMMENDED BOOKS**

**Main Reading**
1. Stallings William, " Cryptography and Network Security: Principles and Practises", 3rd edition, Prentice Hall
2. Kahate Atul, "Cryptography and Network Security" Tata McGraw-HIll.

**Supplementary Reading**
1. Menezes A. J., P.C. Van Oorschot and S.A. Vanstone, "Handbook of Applied Cryptrography"


## EL 0015 WIRELESS AND MOBILE NETWORKS

**Introduction**
Overview of Mobile Networks. Evolution of Mobile radio Communication, networks, Examples of wireless communication: Paging System Cordless telephony Cellular Telephony Comparison of various wireless communication systems Different generations of wireless systems.

**Mobile Radio Propagation**
Radio Spectrum, Propagation Mechanism, Free space propagation, Land Propagation, path loss, fast and slow fading, Doppler effect, Delay spread, Intersymbol interference, Coherence bandwidth Co-channel interference.

**Wireless Access Techniques**
Multiple access techniques: FDMA, TDMA, Spread spectrum multiple Access: Frequency hipping multiple access(FHMA) Code division multiple Access(CDMA), Contention based protocols: ALOHA, CSMA/CD CSMA/CS. Modulation techniques: FSK, PSK and QSK.

**Mobile Data Communication**
Cellular Telephony, Speech coding , error coding and error correction. Mobility management hand off management: Soft handoff and hard hand off. Switching and authentication, MTSO interconnections. Circuit switched data services on cellular network. Packet switched data services on cellular network.

**Personal Wireless Communication System**
Personal communication Systems (PCS) Architecture, Cordless Telephone(CT2), Digitaly enhanced cordless Telecommunications(DECT), Personal Access Communication(PACS)

**Digital Cellular Systems and Standards – Second Generation.**
GSM communication system overview: GSM architecture European TDM, Digital Cellular standard, GSM protocol model, GSM mobility management, Short Messaging Service , Security aspects. APMS:IS-136 TDMA standard. CDMA:IS-95 Digital Cellular standard. General packet radio services: GPRS architecture, GPRS network, Interfaces and Procedures(2.5G)

**Third Generation Mobile Service**
UMTS and International Mobile Telecommunications (IMT-2000), W-CDMA, CDMA200, QOS in 3G.

**Wireless Local Area Networks : IEEE 802.11**
Components and working of WLAN, Transmission Media, Adhoc WLAN, Infrastructure WLAN. Prtotocols for WLAN : MACA and MACAW protocols. Privacy and Security Issues.

**Wireless Application Protocol**
WAP model and Architecture, WAP gateway, WAp protocols and WML, introduction to Bluetooth Technology.

**Wireless in Local Loop**
WLL architecture, WLL technologies and Products. Local Multipoint Distribution Services.

**TCP/IP over Wireless**
Mobile IP: Support for mobility on Internet. Mobile TCP, Traffic routing in wireless networks.


**RECOMMENDED BOOKS**

**Main Reading**
1. Raj Pandya, "Mobile and Personal Communication Systems and Services" , Prentice Hall of India

2. Yi-Bing Lin and Imrich Chlamtac, " Wireless and Mobile Network Architecture", John Wiley and Sons.


## EL 0016  MIDDLEWARE TECHNOLOGY:

**Fundamentals of middleware**:
Introduction to middleware, MW definition, styles of MW, key players;
**Distributed systems characteristics;**
system models-architectural and fundamental models. RPC, Distributed objects-RNI, .NET Remoting, Name services-DNS, Time and global states, synchronization, Coordination and agreement, distributed transactions and recovery, Consistency & Replication, Fault Tolerance, Security.
**Asynchronous communication and Event based systems,**
 notifications, message Queuing systems, peer to peer systems
**Middleware and enterprise services in J2EE**-
Servlets and EJBs.
**SOA & Web services**-
XML,SOAP, WSDL, UDDI & other protocols;
**Reflective middleware**
-Introduction to reflective middleware,
Middleware oriented architectural patterns for enterprise systems.

## RECOMMENDED BOOKS

**Main Reading**
1. Distributed Systems- Cocepts and Design: George Couloris, Jean Dollimore, Tim Kindberg, Tim Kindberg, Third Edition, Pearson Education, Addison Wesley


## EL 0017 INFORMATION RETRIEVAL

**Overview of Information Retrieval**
Function of an IR system, Kinds of IR system, Components of an IR system, Problems in designing an IR system.
**Introduction to IR models and methods (Boolean/vector/probabilistic):**
Preliminary stages of text analysis and document processing, Boolean IR models: Inverted files, indexing, signature files, PAT trees, su-x arrays, Vector-based IR models: Term weighting similarity measures, evaluation metrics, test collections and issues. Query expansion, thesaurus creation, clustering algorithms, SVD/LSI, Relevance Feedback and Probabilistic IR models: user modeling, automatic feedback acquisition, Passage Retrieval and Stemming algorithms.
**Relation of IR to indexing and cataloging:**
Index Structures, Index merging algorithms, Efficient indexing techniques, Alternate Index Structures & Compression. Collection Based indexes, LSI, PIRCS, network structures.
Document routing/filtering/topic-classification; Spam detection:
Types of document, Terms used to represent documents in an IR system, Selection of terms, Procedures used to weight terms, Representation of a document, Relationships between terms. Information extraction and text understanding, Named entity recognition and tagging, sense tagging, co-reference resolution. MUC template filling, Text summarization, event detection and tracking. Information visualization – Dotplot, Texttiling, graphical queries, Document Clustering.
**Query analysis:**
Types of queries, representation of queries ed in IR systems. Kinds of support for query formulation, Query expansion.
**Matching techniques**
Similarity between documents and queries, Mathematical model underling the matching process.

**Evaluation:**
Assessment of the performance of IR systems. Criteria for evaluation, measuring 'goodness', tests of IR systems. Presentation of search results, display of search results, manipulation of search results.
**Relevance feedback:**
Relevance judgments. Additional term selections to the system.. Dynamic respond ally to judgments and selections.
**Hypertext IR & Distributed IR:**
Relationships between documents. Identify appropriate networked collections. Multiple distributed collections simultaneously.
**Multimedia IR:**
Techniques to represent audio and visual document. Query databases of multimedia documents. Display the results of multimedia searches.
**IR on the World Wide Web:**
New technologies and protocols, Web robots, spiders, crawlers,ants, HTTP, robot exclusion. Harvest, collection fusion, Metacrawler, Collaborative filtering. Web agents – webshopper, bargainfinder, Economic, ethical, legal and Political issues.

## RECOMMENDED BOOKS

### Main Reading
1. D. Grossman and O. Frieder. Information Retrieval: Algorithms and Heuristics,  Kluwer
2. Ricardo Baeza-Yates and  Berthier Ribeiro-Neto: Modern Information Retrieval
3. Korfhage, Robert R. Information Storage and Retrieval, 191-218. New York: Wiley, 1997
4. INFORMATION RETRIEVAL A book by C. J. van RIJSBERGEN B.Sc., Information Retrieval Group, University of Glasgow  (www.dcs.gla.ac.uk)


## EL 0018 INTERNET TECHNOLOGIES

**Introduction**
Internet Architecture : Client-Server Architecture, How Domain Name Service works. How routers work.
**Internet Protocols**
Layered Protocol Architecture, TCP/IP, ICMP, SMTP, FTP, HTTP.
**Internetworking with TCP/IP**
Internet addressing, DHCP and static IP addressing, Address classes, IP subnets, IP supernets, Classless IP addressing, Routing Protocols : RIP, OSPF, IGRP. ARP and RARP protocols. Mobile IP.
**IP Network QOS and Multimedia Applications**
RTP, RTCP, RSVP, MPLS, VOIP, MGCP
**IP Multicasting**
Reverse path forwarding, Multicast addressing, Internet Group Management Protocol,   Multicast Source discovery Protocol. DVMRP, CBT.
**Internet Management and Security**
SNMP, Proxy servers, Firewalls, VPN, How cookies Passports and Web tracking works. Cryptography, privacy and Digital certificates, Parental controls on internet.
**Internet Multimedia Technologies**
Multimedia: Definition, requirements, Inherited constraint of Internet Audio and Video on internet, Standardized data format for multimedia, multimedia compression JPEG, MPEG, Streamed data transfer, Multicast IP and Mbone,

## RECOMMENDED BOOKS

### Main Reading
1. Behrouz Forouzan, "TCP/IP Protocol Suite", 2nd edition, Tata MCGraw-Hill.
2. Douglas E Comaer, "Computer Networks and Internet", 2nd edition, Pearson Education Pvt. Ltd.
3. Request For Comments (RFC) Documents ( Web Site : http://www.rfc-editor.org/rfc.html )

### EL 0019  IMAGE PROCESSING AND COMPUTER VISION

**Introduction**
Image formation model, representation, spatial and Gray Level resolution, Colour models-RGB, CMY and HIS models

**Image Enhancement In Spatial Domain**
Piecewise linear transformation, Histogram equalization, Histogram specification, image averaging, spatial filters – smoothing and sharpening, Laplacian filter, sobel operator, Canny edge detector.

**Image Enhancement In Frequency Domain**
2D Discrete Fourier transform and its inverse, filtering in frequency domain, Ideal and Gaussian Low pass filters, high pass filtering, separability property 0f 2D Fourier transform, Fast Fourier Transform.

**Image Segmentation**
 Line detection, Edge detection, Edge linking and boundary detection, Hough Transform, Thresholding, Region based segmentation

**Morphological Image Processing**
 Logic operations involving binary images, Dilation and Erosion, Opening and closing, Applications to Boundary extraction, region filling, connected component extraction.

**Image Compression**
Coding redundancy- Huffman coding, LZW coding, run length coding, Lossy compression – Lossy predictive coding, transform coding- DCT, bit allocation, Compression standards – JPEG, video Compression.

**Image Representation**
Boundary description, Shape numbers, Fourier descriptors, Texture, principal Components based description.

**3D Vision**
Projective geometry, single perspective camera, stereopsis, the fundamental matrix – its estimation from image point correspondences, applications of epipolar geometry in vision, correlation based and feature based stereo correspondence, shape from motion, optical flow.

**RECOMMENDED BOOKS**

**MAIN READING**
1.   Gonzalez and Woods, "Digital Image Processing"' 2002, Pearson education, Asia.
2.   Sonka, Hlavac and Boyle Brooks/Cole, "Image Processing, Analysis, and Machine Vision", 1999, Thomson Asia Pte Ltd Singapore.

**SUPPLEMENTARY READING**

1.   Jain and Rangachar, "Machine Vision", 1999, McGraw Hill International Edition.
2.   Schalkoff, John Wiley and Sons, "Digital Image Processing & Computer
     Vision", 1989, John Wiley and Sons.

### EL 0020  ADVANCED UNIX PROGRAMMING

**Introduction**
Organization of UNIX interface, Programmer interfaces. System call API , Error handling. UNIX standardization. UNIX implementations. Relationship of standards and implementation.

**File I/O and Directories**
File descriptor and basic file I/O calls. Duplicating file descriptors. File Types, File access permissions, Set-user-id and set-group-id bits. Setting file permissions. Changing file ownership. Soft and hard links. Reading directories. Synchronising file contents. Standard I/O library.

**Process**

Environment of UNIX process. Command Line arguments. Environment variables. Memory allocation. Process relationship, Process groups, sessions, Controlling Terminal, Process related system calls. Foreground, Background Processes and Job control. Orphaned process groups.

**Signals**

Signal concept, Reliable and unreliable signals, Signal sets, Signal related system calls. Non local jumps. Job control using signals.

**Terminal I/O**

Special Input Characters. Canonical and Non canonical modes. Terminal Option flags. Getting and setting terminal attributes. Pseudo terminals. Opening and using pseudo Terminals.

**Advanced I/O**

Nonbloking I/O, Record locking. Stream, I/O multiplexing, Memory mapped I/O, Asynchronous I/O.

**Inter-process communication**

Pipes, Message queues, Semaphores and shared memory.

**RECOMMENDED BOOKS**

**Main Reading**
1.   Steven W R, " Advanced Programming in UNIX Environment" Addison Wesley.

**Supplementary Reading**
1.   UNIX **man** pages and standard C library (libc) **info** documentation.

**EL 0021  WINDOWS PROGRAMMING USING VC++**

**C and C++ foundations**

Data controls, C++ classes, writing and using functions, Arrays, pointers, I/O, Structures, unions and miscellany, Advanced C and C++ programming techniques, Working in Object-oriented environment.

**Generic concepts and tools for windows**

 Procedure oriented development Win 32 API, Object oriented development, Foundation class library. Windows 95 and Windows NT programming techniques. Debugging techniques.

**RECOMMENDED BOOKS**

**Main Reading**
1.   Murray, et al, "The Visual C++ Handbook", 2nd edition, Osborne McGraw Hill, New York, 1996.

**EL 0022  GEOGRAPHICAL INFORMATION SYSTEMS**

**Objective:** This course will provide introduction to Geographical Information Systems from the point of view of software developers. The underlying technology and how to apply GIS in decision making will be discussed. At the end of the course, the Learner should be able to understand the spatial terminology and build applications using open source GIS tools.

**Syllabus:**
1.   Introduction to GIS:      GIS definition, key components, functions of GIS, benefits, relationship with other disciplines, issues, application areas.
2.   Spatial Data Structures: spatial data models- Raster and vector data models, Quad-tree, R-tree-searching, insertions, deletion algorithms. Topology and topological models- 9 Intersection model.
3.   Spatial data base fundamentals: Extended ER diagram for spatial entities. Spatial data model, object relational mode, ex. Oracle spatial data model
4.   spatial data models: ISO 19101 data model, geometry classes, basic element types, SDO-GEOMETRY structure and operations
5.   Spatial indexing: principles, benefits, index types, implementation in Oracle.

6. Spatial SQL: (operators and functions) terminology, principles, set based operations, topological operations. Spatial joins. Spatial functions.
7. Network modelling: motivation, general network concepts, Network data model and metadata, spatial indexes on NM, shortest path and other functions. Directed and undirected networks, Traveling salesperson problem, reachability analysis, spanning tree
8. spatial data infrastructure and OpenGIS: introduction, components of SDI. Standards.

## RECOMMENDED BOOKS

1. Geographic Information Systems and Science, Longley, Goodchild, Rhind, Wiley & Sons
2. The Design and Analysis of Spatial Data Structures by Hanan Samet, Addison Wesley
3. Spatial Databases- A Tour by Shekhar Chawla, Upper Saddle River, NJ, USA, Prentice Hall.
4. Pro Oracle Spatial, R. Kothuri & Beinat, E, APRESS, USA.

## EL 0023 COMPONENT TECHNOLOGY:

**Motivation for components:**
introduction covering experience from software development - market vs. technology standards.
**Foundation:-**
definition of a component, important issues: components, interface and re-entrance; polymorphism, objects vs. class composition; Scale and granularity of components- architecture (patterns and frameworks) ;
**Component Technologies:**
wiring standards (how to connect components); Approaches: OMG CORBA, Microsoft .NET, Sun: Javabeans, J2EE & EJBs, ;
**Service Oriented Architecture and web services.**
Component architecture, component frameworks, component development ,component distribution and acquisition , component assembly

## RECOMMENDED BOOKS

**Main Reading**
1. Component Software (Beyond Object-Oriented Programming): Clemens Szyperski, ACM Press Addison Wesley, 2nd Edition, 2002

## EL 0024  MANAGERIAL ECONOMICS

Nature and scope of managerial economics. Objectives of the firm, Managerial and behavioral theories of the firm.
Concepts of opportunity cost, incremental, time perspective Principles of discounting and equimargins, Demand analysis - purpose and concepts. Elasticity of demand, Methods of demand forecasting.
Product and cost analysis, short run and long run, average cost curve.
Law of supply, Economics and diseconomies of scale, Law of variable proportions.
Production function - single output isoquants.
Pricing Prescriptive approach, Price determination under perfect competition, Monopoly, oligopoly and monopolistic competition. Full cost pricing, product line pricing, Pricing strategies.
Profits : Nature and measurement, policy, Break-even analysis, Case study.

## RECOMMENDED BOOKS

**Main Reading**
1. Dean, J, "Managerial Economics", Prentice Hall of India, New Delhi,1982.
2. Mote V.L. et.al, " Managerial Economics", Concepts and cases" Tata McGraw Hill, New Delhi, 1980.

## EL 0025 CORPORATE PLANNING

Significance of Planning, Types, Need Requites, Corporate planning, system approach, Role of the planner, Corporate planning and budgeting.

Social responsibility, Scope, contents, corporation and society, consumers, corporation and democracy, community and government, Social responsibility versus profitability and productivity, growth Professionalism as a means of social behavior.

Mission and purpose, Business definitions - objectives and goals, Environment appraisal, Concepts, components - Scanning and appraising the environment.

Organization appraisal, Dynamics, capability factors, Considerations, Methods and techniques, Structuring, Planning gaps analysis Manager Audit, significance of gaps.

### RECOMMENDED BOOKS

**Main Reading**
1. Kazni A., " Business Policy", Tata McGraw Hill, New Delhi, 1992.
2. Johnson G. et al. 3rd edition, " Exploring corporate Strategy", Prentice Hall of India, New Delhi, 1994.


## EL 0026  INVESTMENT TECHNOLOGY

Source of investment information

Valuation of debt securities. Debt prices and interest rate risk. Default risk and purchasing power risk. Market interest rates and term structure of interest rates. Valuation of warrants and convertibles. Options pricing models.

Valuation of equity a ; Dividends and valuation. MMS arguments, fundamentals analysis, Earning multipliers. Timing of purchase and sale of equity shares, estimating earnings and risk.

Portfolio theory. Efficient investments and diversification. Markowit graphical portfolio analysis. Capital market theory. Portfolio performances evaluation - Sharpe, Treynor, Jenson, Measures. Mutual funds – kinds and valuation. Behavior of share prices - technical analysis. The efficient markets Hypothesis-random walk and martingale methods.

### RECOMMENDED BOOKS

**Main Reading**
1. Clark J.J. et al, " Financial Management A capital Market Approach ", Helbrook, 1976.
2. Sharpe W.F, " Investments", Prentice Hall of India, new Delhi, 1996.


## EL 0027  BUSINESS FINANCE

Financial and economic development, Intermediation, role and Patterns, Functions of money and capital market, Interest rates Determination, term structure.

Primary capital market, new issues, growth and trends, Financial Intermediaries, merchant bankers, managers, brokers, underwriters Secondary market - organization and functioning. Trading and Settlement. Problems relating to membership, commission, margins, arbitration and off-floor trading. Reforming the markets SEBI.

Market for government securities - the discount and finance house. Operation and managerial problems of commercial banks, Inter-bank call money market. Non-banking financial institutions, leading policies, schemes, composition and quantum of assistance of IDBI, IFCI, ICICI, UTI, LIC, GIC and state level financial corporations.

Credit rating information, Parameters, Role Agencies, CRISIL, Regulatory framework for financial markets and institutions, regulations versus deregulation, Role of RBI, Bank rate, open market operation policies.

**RECOMMENDED BOOKS**

**Main Reading**
1. Copeland T.E. et al, " Financial theory and Corporate Policy", Addison Wesley, Reading MA, 1988.
2. Uppal J.S, " Public Financial Institution s in India", Mac Milan, New York, 1984.

## EL 0028 MANAGEMENT INFORMATION SYSTEMS

The course will discuss a variety of framework for identifying information technology applications. The scope of IT applications would cover Management Information System, Decision Support System, Executive Information System and Expert System.

Provide a broad understanding of the types of benefits information technology applications can provide in an organization through transaction processing management and operational control, decision support system, office automation, organizational communication and group work support.

Socio-economic environment and information technology theoretical in social analysis of computing role of information systems in organization and the impact of information system on organizations markets, frameworks for information system planning information systems and competitive advantages, the new strategic role of information system, methodologies for evaluating investments in IT, framework and methodologies should be discussed and illustrated with case studies.

Design reporting system including of discussion of principles in indicator design, managing information support activity in organization, concept of the business process reengineering (BPR) an how IY can enable BPR.

Critical success factor in implementing IT applications including the need for managing the process of change illustrated through case students of successful/failed IT projects. Critical role of security in implementing IT applications should be discussed.

## EL 0029 ELECTRONIC COMMERCE

Introduction to electronic commerce, Internet as a network infrastructure for electronic commerce, Business and advertising on the Internet.

Network security and firewalls, Electronic payment, Business to business (B2B) transaction and EDI, Value added networks, Consumer oriented business transactions (B2C)

E-Commerce applications: On-line education, digital library etc. Technology underneath E-Commerce: Multimedia and digital video, Broadband telecommunications, Mobile and wireless computing, Software agents.

**RECOMMENDED BOOKS**

**Main Reading**
1. Ravi Kalakota and Andrew Whinston, " Frontiers of Electronic Commerce" . Addison-Wesley, 1999.
2. Kamlesh Agarwala et.al, " Business on the net" An Introduction to the What and How of E-Commerce" .

## EL 0030 SOFTWARE PROJECT MANAGEMENT

Managerial Issues in Software Projects: Introduction to software markets, Planning of software projects, Size and Cost Estimations, Project Scheduling, Measurement of software quality and productivity, ISO and Capability, Maturity, Models for organizational growth, Project Management and Practice.

Managing the systems life cycle, requirements determination, logical design, physical design, testing implementation, system and database Integration issues, metrics for project management and systems performance evaluation, managing expectations, superiors users, team members and other related to the project: determining skill requirements and staffing the project, cost effectiveness analysis: reporting and presentation techniques and effective management of both behavioral and technical aspects of the project.

## RECOMMENDED BOOKS

### Main Reading
1. Gilb T, " Principles of Software Engineering Management", Addison Wesley, Reading MA, 1988.
2. Putnam L.H., Myers W, " Industrial Strength Software - effective Management using measurement", IEEE C.S. Press, 1997.
3. Thayer R.H., " Software Engineering Project Management", IEEE C.S. Press, 1997.


## EL 0031 SOFTWARE TESTING

**Objective :**
To provide a detailed study of testing software and automated tools.
**Testing fundamentals:**
Software testing – Levels of software testing – Test activities – Testing Life Cycle – Test Organization – White Box testing – Basis Path Testing – Control Structure testing – Black Box Testing.
**Functional testing:**
Equivalence Class Partitioning - Boundary Value Analysis – Cause-effect Graphing - Special cases. Performance Testing – Stress testing – Configuration Testing – Security Testing – Recovery Testing – Integration Testing – Regression Testing – Acceptance Testing.
**Object oriented testing methods**:
Testing Methods at Class level – Interclass test case design- Testing for Specific Environment, architecture, and application - Testing patterns.
**Testing process:**
Comparison of different techniques- Test Plan – Test case Design Procedure Specification – Test Case Execution and Analysis - Test Documentation - Reporting test results - Final test reporting, Test Driven Development & Refactoring
**Testing Web Application:**
Testing concepts for web apps – Content Testing – User Interface Testing – Component Level Testing – Navigation Testing – Configuration Testing – Security Testing – Performance Testing.
**Testing Tools:**
Need for automated testing tools - Selection of testing tool – Tools used at various phases.

## RECOMMENDED BOOKS

### Main Reading
1. Srinivasan Desikan, Gopalswamy Ramesh , "Software Testing : Principles and Practices", Pearson Education, 2006
2. Software Testing in the Real World, by E. Kit (1995)
3. The Web Testing Handbook, by S. Splaine and S. Jaskiel
4. Testing Applications on the Web, by H. Nguyen, R. Johnson, and M. Hackett
5. Software Testing and Continuous Quality Improvement, by W. Lewis, et al
6. How to Break Software Security, by J. Whittaker, et al
7. Web resources: http://www.softwareqatest.com

## EL 0032  ORGANIZATIONAL BEHAVIOR

**Introduction to Organizations and Individuals:**
What is an organization, components of organization, nature and variety of organization (in terms of objectives, structure etc.) models of analyzing organization, phenomena, organizational and business variables, organizations in the Indian context, institutions and structures, basic roles in an organization etc. perception, attitudes, motives, (achievement, power and affiliation), commitment, values creativity and other personality factors, profile of a manager and an entrepreneur.

**Interpersonal and Group Processes:**
Interpersonal trust, understanding the other person from his/her point of view, interpersonal communication, listening, feedback, counselling, transactional analysis, self-fulfilling, prophecy, etc. leadership, motivation, people, working as a member of a team, team functioning, team decision-making, team conflict resolution, team problem solving.

**Organizational Structure and Integrating Interpersonal and Group Dynamics:**
Elements of structure, functions of structure, determinants of structures, dys-functionality's of structures, structure technology- environment-people relationships, principles underlying design of organizations, organizational culture, organizational politics, issues of power and authority, organizational communications, organizational change, integrating cases(s).

Case method and lectures should be supplemented with a variety of other methodologies such as feedback on questionnaires and tests, role plays, and behaviour simulation exercise.

## RECOMMENDED BOOKS

**Main Reading**
1. Arnold, John, Robertson, Ivan T. and Cooper, Cary L., " Work Psychology : Understanding Human Behavior in the Workplace", Macmillan India Ltd., Delhi, 1996.
2. Dwivedi, R.S. " Human Relations and Organizational Behavior, " A Global Perspective", Macmillan India Ltd., Delhi, 1995.
3. French and Bell (4th ed.), " organizational Development : Behavioral Science Interventions for Organization Improvement", Prentice Hall of India Pvt. Ltd., New Delhi, 1994.
4. Hellriegel, Slocum and Woodman, "Organizational Behavior" West Publishing Co.USA,1986.
5. Hersey and Blanchard (6th ed.), " Management of Organizational Behavior Utilizing Human Resources", Prentice Hall of India Pvt. Ltd., New Delhi, 1996.
6. Prasad Kesho, " Organizational Development of Excellence", Macmillan India Ltd. New Delhi, 1996.
7. Robbins (4th ed.), " Essentials of Organizational Behavior", Prentice Hall of India Pvt. Ltd., New Delhi, 1995.
8. Scehrmerhorn, Hunt and Osborn, "Managing Organization Behavior", John Willey & Sons, USA 1982.
9. Weston Mergers, "Restructuring and Corporate Control", Prentice Hall of India Pvt. Ltd., New Delhi, 1995.

## EL 0033 PARALLEL PROGRAMMING

Processes and processors Shared memory, fork join constructs, Basic parallel programming techniques, loop splitting, spin locks, contention barrier and row conditions.
Variations in splitting self and indirect scheduling. Data dependency, forward and backward block scheduling.
Linear recurrence relations, backward dependency, Performance tuning overhead with number of processes, effective use of cache.
Parallel programming examples, Average, mean squared deviation, curve fitting, numerical integration, travelling salesman problem, gaussian elimination, Discrete event time simulation.
Parallel Programming constructs in HPF, FORTRAN 95, Parallel programming under UNIX.

**RECOMMENDED BOOKS**

**Main Reading**
1.   Brawer S, " Introduction to parallel programming", Academic Press, New York, 1989.

## EL 0034 JAVA PROGRAMMING

**An overview of object oriented programming and Terminology :**
Abstraction variable and methods, encapsulation interfaces, messages : object communicating with objects, modularity, classification, inheritance.
**Overview of JAVA Language, Java development environment, Language fundamental:**
how Java differs from C: Programs structure and environment, name space: Packages, classes and members, commands, no pre-processor, Unicode and character escape, primitive data types, reference data types objects, array, strings, operators, statement, exceptions and exception handling.
**Classes and Objects in Java :**
Introduction to Class and Objects, object creation, class variables class methods, object destruction, subclass and inheritance overriding methods, data hiding and encapsulation, abstract class and interface.
**String and Arrays** : Strings arrays and Utility classes.

**Input/Output** : Streams standard system streams. IO streams, filtered stream.
**Abstract windowing toolkit** : AWT overview, graphics, fonts, colors, images, java controls, layout components, new AWT features.
**Applets Introduction to Applets**,
Applet designing basics, drawing graphics, handling events, reading applet parameters, images and sounds, JAR files, applet security restriction, signed applet-weaving Applet into web pages.
**Threads :**
using thread in applets, creating threaded objects, threaded attributes, thread priority, multithreaded programs.
**Events** : Java 1.0 Event model, Java 1.1 Event model.
Object serialization, Java beans, Internalization, reflection.

**RECOMMENDED BOOKS**

**Main Reading**
1.   " A complete reference for Java " Herbert Schmidt.
2.   " java in Nutshell" David Flanagan, - O'Reilly
3.   " Java programming" Balaguruswami.

## EL 0035 SYSTEMS ANALYSIS AND SIMULATION

Rule of Modelling in Systems Analysis, Computer Simulation of Stochastic System. Generation of Pseudo-Random Numbers and Stochastic Variants using the computer.
Simulation of Queuing Systems. Using special purpose languages for simulation of queuing systems. GPSS and / or SLAM system Dynamics.
Simulation of System with feedback : using DYNAMO in System Dynamics. Cases on Simulation in Production, Finance, Marketing and Corporate Planning, Project work.

**RECOMMENDED BOOKS**

**Main Reading**
1.   Banks J. Carson S. Nelson B.L, " Discrete-Event System Simulation", (2nd Edition), Prentice Hall of India, New Delhi, 1996.
2.   Deo N., " System Simulation with Digital Computers", Prentice hall of India,1979.

3. Law A.M. and Kelton W.D, "simulation Modeling and Analysis", (2nd edition), McGraw Hill N.Y., 1991.

## EL 0036 FOUNDATION OF DECISION PROCESSES

Role of decision making in management, Framework, Criteria under conditions of certainty, risk and uncertain, Bays theorem, Sequential decision making, decision tree analysis.

Theory of utility. Utility function curve, Competitive game theory, Queuing models, Single channel, single phase waiting line with Poisson. Distributed arrival rates and exponentially distributed service times. Markov models.

Simulation : Monte Carlo Application to queuing and inventory Models. Application in functional areas of marketing, production, Finance, Behavioural aspects in decision making, open and closed models of decisions.

Systematic problem analysis and decision making. Decision making in functional areas-case studies.

## RECOMMENDED BOOKS

**Main Reading**
1. Gregory G., " Decision analysis", Pitman London, 1988.
2. Johnson R.D. et al, "Quantitative Techniques for Business Decisions", Prentice Hall, N.J., 1977.

## EL 0037 TAXATION PRACTICES

Assessments of undivided families, Meaning Basic condition, taxable Income, Partitions, Tax planning, Assessment of firms and Associations, Scheme of taxation types, treatment of losses, Tax Planning.

Assessment of companies Types profits, depreciation, tax Planning, Section 80, Bonus issues, divided policy, Return of income and assessment procedure Types of assessment, Time limits, Reassessment Cooperatives.

Collection and recovery of tax Deduction at source, rates advance payment, Modes of recovery, Refund Appeals and revision Penalties.

Wealth Tax Chargeability, valuation, return, appeals, revisions, payment and recovery, gift tax chargeability, rebate, assessment, appeals, revision, payment and recovery.

Central sales tax, Concept of sale and purchase, Inter-state trade, Inter-state export and import trade, State sale tax: Assessing authority, Single, Multiple point tax, Procedure for registration and cancellation, Returns payment appeals and revisions.

## RECOMMENDED BOOKS

**Main Reading**
1. Central and State tax acts.
2. Singhania V.K, " Taxman Direct Taxes", Taxman, New Delhi, 1996.

## EL0038 MULTIMEDIA TECHNOLOGIES

**Fundamentals of Multimedia:** What is multimedia? Components of multimedia, Overview of multimedia applications and multimedia authoring tools

**Graphics and Image Representation:** Fundamentals of image formation and data representations, Sampling and quantization, Contrast & brightness, Histogram methods, Simple image processing operations: Point processing, **Spatial filtering, Edge detection, Popular file formats:** BMP, GIF, JPG, PNG etc.

**Color Science and Color Models:** Human vision, Camera systems, Gamma correction, Color matching, CIE Chromaticity, different Color models –
RGB, CYMK, YUV, YIQ, Transformations among color model
**Fundamental of Video:** Different types of video signals – component, composite and S-video, Analog TV transmission systems - NTSC, PAL, Chroma sub-sampling, Display technology fundamentals – interlacing & progressing scanning, Digital video - HDTV
**Fundamentals of Audio:** Digitization of sound, Psychoacostics – frequency & temporal masking, Unit of sound measurement - Signal-to-Noise Ratio (SNR), Linear and non-linear quantization, Audio filtering and transmission,
Coding of audio – PCM, DPCM, ADPCM, Audio quality versus data rate, Synthetic sounds, Popular file formats – MIDI system, WAV, MPEG etc.
**Multimedia Data Compression:** General data compression scheme – lossy v/s lossless, Modeling v/s encoding, Basics of information theory, Lossless compression algorithms – Run-Length Encoding (RLE), Variable-Length Coding (VLC) – Huffman Coding, Dictionary-based coding – LZW, Arithmetic Coding, Differential coding of images, Lossless JPEG, Lossy compression algorithms
– Distortion Measure, Transform coding, Discrete Cosine Transform (DCT), Video compression, Image and video compression standards.
**Multimedia Information Management** – Multimedia database design, Content based information retrieval: image retrieval, video retrieval etc.

## <u>RECOMMENDED BOOKS</u>

**Main Reading**
  1. Fundamentals of Multimedia by Ze-Nian Li & Mark S Drew published by
Pearson Education International Edition

**Supplementary Reading**
1. R. Steinmetz and K. Nahrstedt, "Multimedia: Computing, Communications & Applications", by Pearson Education International Edition
2.  Sayood Khalid "Title: Introduction To Data Compression" 3rd Edition,
Publisher: Morgan Kaufmann Publishers Inc

**Instructions to Fill in the Application Form**

1.  Please read the application form carefully before filling. Fill in the form legibly and return it to the office of the Department of Computer Science & Technology, Goa University on or before Friday 3$^{rd}$ June, 2011(4.00 pm). Please note that no application will be received after this date and the department will not be held responsible for any postal delays
    In case the application is being sent by post, send the application to :

    The Admission Coordinator, 2011 - 2012
    Department of Computer Science & Technology,
    Goa University, Taleigao Plateau,
    Goa 403 206.
    Phone: (0832) – 6519272/ 6519072 / 6519087
    E-mail: dcst@unigoa.ac.in / vvkamat@unigoa.ac.in

2.  Do not attach original certificates or mark sheets etc., only attested true copies or attested Xerox copies should be enclosed. Original certificates and mark sheets must be brought at the time of admission failing which no admission will be given.

3.  Following documents must accompany the application form.

    1.  XIIth Std. marksheet
    2.  Graduation year one, year two mark sheets
    3.  Graduation final year mark sheet, if result is declared
    4.  Proof of having secured a score of at least 50 percentile in GA paper in the CST E-level or I-level test. The CST score entered in the application form must be identical to the score in the candidate's CST score card.
    5.  SC/ST/OBC/PH/FF certificate wherever applicable. (Only for candidates passing out from Goa University)

**\* GRADUATED FROM** G ☐ O ☐ F ☐

**GOA UNIVERSITY**
**Department of Computer Science & Technology**
**MASTERS OF COMPUTER APPLICATIONS**
**Application Form (2011 - 2012)**

**Paste your
Passport size
Photograph**
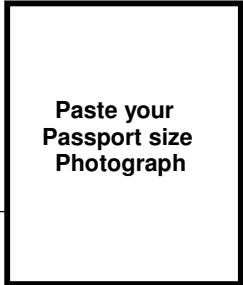
1. **NAME** _____

_____

**(BLOCK LETTERS)   (SURNAME)   (FIRST NAME)   (MIDDLE NAME)**

2. **DATE OF BIRTH:** _____/_____/_____

3. **PLACE OF BIRTH:** _____

4. **ADDRESS FOR CORRESPONDENCE:**
_____

_____

_____

5. **PHONE WITH STD/ISD CODE**_____**EMAIL**
_____

6. **CATEGORY   GENERAL** ☐   **SC** ☐   **ST** ☐   **OBC** ☐   **PH** ☐   **FF** ☐
   **(In case of SC/ST/OBC/PH/FF attach certificate)**

7. **WHETHER CANDIDATE HAS APPEARED/PASSED   APPEARED   ☐   DEGREE:** _____
   **IN FINAL YEAR OF DEGREE PROGRAM   PASSED   ☐   YEAR:** _____

8. **NAME AND ADDRESS OF THE COLLEGE FROM WHICH THE BACHELOR'S DEGREE IS OBTAINED**
_____

_____

9. **EDUCATIONAL QUALIFICATION (Beginning with S.S.C. Examination or Equivalent)**

| Certificate/Degree | Board/University | Month & Year of Passing | Percentage Obtained | Class awarded |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

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**10. CST SCORE DETAILS**

ROLL NUMBER _____ DATE OF CST EXAMINATION
_____/_____/_____

| Paper | Raw Score | Score | Percentile | Candidates |
|---|---|---|---|---|
| Part A : General aptitude | | | | |

**\* CATEGORY        G -  If graduated from Goa University        O - If graduated from other Indian Universities**
**            F  - Foreign Student**

**11. DEMAND DRAFT DETAILS :**

| Name of Bank | Branch from where D.D. Drawn | D.D. Number | Date when drawn | Amount |
|---|---|---|---|---|
| | | | | |

**DECLARATION BY THE APPLICANT**

I hereby declare that the particulars furnished by me in this application are correct to the best of my knowledge. If any information is found to be false/incorrect at any time or if I am unable to furnish documentary proof of my qualifying degree and percentage of marks at the time of admission, I am liable to be disqualified.

DATE :      ____/____/_____

PLACE :      _____

**Signature of the Applicant**

**Important: Last date for the receipt of duly filled in Application Form at Department of Computer Science & Technology, Goa University: 3rd June, 2011 (4.00 p.m)**

_____

## ACKNOWLEDGEMENT SLIP

Received from Shri/Smt ……………………………………………………………………. ………..

Application for admission to the First Year of the M.C.A Course at DCST, Goa University for Academic

Year 2011-2012 on …………………………

By  Post/Hand delivery.


Date:                                                    Admission Coordinator 2011-2012
                                                              DCST, Goa University