

Curriculum of COMPUTER SCIENCE & ENGINEERING DIPLOMA PROGRAM

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GUIDELINES FOR MPECS

1.0 INTRODUCTION :

The National Policy on Education 1986, recommends (Art 6.6) that “..... Technological and Management Education Programs including education in Polytechnic, will also be on a flexible, modular pattern based on credits with provision for multi-point entry. A strong guidance and counseling service will be provided.” Multi-Point Entry & Credit System (MPECS) is the mode for introducing the desired flexibility in the curriculum of diploma program. Under the World Bank assisted Tech Ed. Project I & II, TTTIs have facilitated successful introduction of MPECS in the diploma programs offered by various States in the country, including the State of Assam in the Eastern region.

The State of Mizoram has initiated a World Bank assisted project (Tech.Ed.III) for capacity expansion, improvement of quality and efficiency of the technician education system of the State. One of the essential criteria of the project is offering diploma programs in MPEC system.

TTTI, Calcutta has drafted a guide document for incorporating MPEC system in the revised curriculum of the Diploma program in Mechanical Engineering, being offered by the State.

2.0 PHILOSOPHY OF MPECS :

It has been observed that students demonstrate better performance in Teaching-Learning process when they are made responsible for their own learning. The MPECS allows the student himself/herself to select content, learning strategies and to decide the pace in which he/she desires to learn, which results in increased motivation among the students. The influences of individual differences is also taken into consideration in order to provide flexibility to the learners.

2.1 Objectives :

The scheme for introduction of MPECS has been designed with the following objectives :

- To allow students, possessing different academic qualifications, entry to the polytechnics at different levels appropriate to their qualifications.
- To provide opportunity to the students to pursue program of studies at flexible pace according to their capability.
- To provide option to students to select courses of study according to their needs and interest.
- To provide scope for working personnel to upgrade their knowledge and skills.

2.2 Advantages of MPECS :

The following advantages and benefits are expected to be obtained by offering the Diploma program in MPEC mode.

- Students can select their individual courses according to their needs, interests, aptitudes, abilities and their entry qualifications.
- Students will have a higher degree of motivation and psychological satisfaction as they will be involved in the decision making progress in the course selection.
- Students can complete the program at their own pace.
- The inbuilt flexibility permits of easily catering to the changing and diversified manpower needs. The programs provide for multiple option catering to a spectrum of occupations within and across the discipline.
- The concept of pass/fail is replaced by accumulation of credits by individual student depending on their capability and thus promoting competition and reducing frustration.
- Students possessing entry qualifications higher than the minimum stipulated will get the opportunity to complete the program earlier.
- Fast learners have the opportunity to route his/her program such as to attain the desired credit in less time.
- Low achievers, unable to attain credit in particular course(s) can re-route his/her program to complete in longer time and thus reduce frustration.
- Extra credits can be earned by students as & when necessary to obtain upto date knowledge.
- New specialized and advanced courses, to keep abreast with the developments in the industry and emerging technologies, can be easily introduced without affecting the total structure.
- Efficiency of the system will be increased by reducing the wastage of time.

2.2..1 Benefits o MPECS

To Students-

- No Stigma of pass/fail
- Possibility of completing program in less/more time, according to choice
- Choice of courses according to need.
- Scope of taking interdisciplinary course for value addition

To Teachers-

- Task of teaching less strenuous and enjoyable with motivated students in class
- Enhancement of GUIDANCE & COUNSELLING skill.

To industry-

- Higher probability of getting technical manpower with proper mix of knowledge and skill
- Possibility of utilization of the system for continuing education of its personnel leading to career development.

3.0 SALENT FEATURES:-

The salient features of the proposed system are as below :

3.1 Eligibility for admission to Diploma program;

3.1.1 To be eligible for admission into the Diploma program in Mechanical Engineering, a student will have to possess the minimum qualifications of

- (i) Pass in High School Leaving Certificate (HSLC) Examination (10+) conducted by the Board of Secondary Education, Mizoram or any other examination recognized by the State Council for Technical Education as equivalent, and
- (ii) Be selected through the appropriate screening/selection process conducted by the State Directorate of Technical Education or any appropriate authority.

3.1.2 State Council for Technical Education will decide the equivalence of other examinations notify from time to time.

3.2 Multi-Point Entry:

This provides entry of students, with different qualifications, to the Diploma program at different points on the CREDIT SCALE and not on TIME scale with the provision of appropriate credit exemption depending on entry qualification. Fig-1 below illustrates the system-

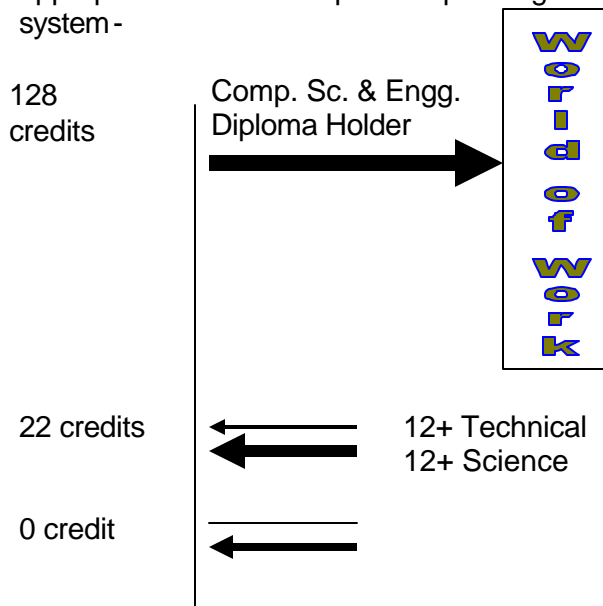


Fig - 1

3.3 Credit:

The weightage to any course is provided in terms of CREDIT based on contact hours. The contact hour is the sum of Lecture, Tutorial and Practical classes allotted per week for teaching the course.

According to the AICTE Norms

1 Credit = 1 Lecture hour per week
OR 2 Tutorial/Practical hours per week.

Depending upon the course structure, each course will have a credit designated to it. As for example, a course having a teaching scheme of Lecture (L)-Tutorial (T)-Practical (P) as 3-0-0 will carry 3 credits, L-T-P as 3-2-0 will carry 4 credits, L-T-P as 3-2-2 will carry 5 credits, L-T-P as 0-0-6 will carry 3 credits.

The credits are rounded off to the nearest higher round number. For example, a course with a L-T-P of 3-0-3 will have 4.5 credits to be rounded off to 5.

3.3.1 *Minimum Credits:* Minimum credits to be earned by a student for award of Mechanical Engineering Diploma is 120 credits. The allocation of minimum credits to be acquired by a student under each category of courses is appended.

3.3.2 Students admitted to the Diploma program with qualifications higher than the minimum specified entry qualification would get suitable exemption from attending the courses of the Diploma programme already studied by him.

3.3.2.1 Students admitted after passing Higher Secondary School Leaving Certificate (HSSLC) Examination conducted by the Board of Higher Secondary Education, Mizoram or any other equivalent examination with Physics, Chemistry and Mathematics will be exempted from attending the foundation courses and will be granted **22 credits** for the exempted courses.

3.3.2.2 The State Council for Technical Education will decide the courses for exemption and grant of credit for the same for students entering with other higher qualifications like 10+ ITI, 12+ Technical etc.

3.4 Course Categories:

The courses (*i.e subjects under conventional system*) of study under the Diploma program will include theory, practical, tutorial, project work etc. These courses are categorized in six (6) groups as indicated below:

- (1) FOUNDATION COURSES: These are courses essential for further study of technology related courses including courses like Communication in English, Applied Mathematics and Engineering Science.
- (2) HARD CORE COURSES: The institute core of technical courses belonging to all disciplines including courses like Engineering Drawing, Workshop Practice, Engineering Mechanics and Introducing to Information Technology.
- (3) SOFT CORE COURSES: These are courses providing basic concepts of supervision/management/environment and technology courses related to allied

disciplines. A student has the option of taking only TWO (2) courses from the list according to his need and interest.

- (4) **BASIC TECHNOLOGY COURSES:** These are basic courses required for Mechanical Engineering as bridge between the Applied Science and Applied Technology.
- (5) **APPLIED TECHNOLOGY COURSES:** These are professional courses through which the desired knowledge and skills are developed among the students to perform their job functions as Mechanical Engineering Diploma holders. These courses provide for intensive hand on practice to the students through laboratory and project work.
- (6) **ELECTIVE COURSES:** The training through previous courses listed in (1) to (5) would provide a broad base to the students for performing their job functions in the world of work. The elective courses provide an opportunity to the students of acquiring specialized knowledge in areas of interest to them.

3.5 Academic Session:

Each Academic year will be divided into two terms, each of six months duration. "ODD TERM" will span from July to December and "EVEN TERM" will span from January to June. Each term will have a minimum contact period of 35 hours per week for 15 weeks. The preparatory study leave to the students, term-end examination, publication of results, term-end break etc. will be covered by the balance duration of the terms.

3.6 Time required for obtaining Diploma:

A student can obtain the Diploma within **a minimum duration of 2 years and a maximum duration of 6 years**

3.7 Scheme of Studies and Evaluation

The Scheme of studies and evaluation for Mechanical Engineering Diploma program including the list of courses, pre-requisites for each course, the requisite minimum number of credits to be acquired by the students in different categories of course, mode of contact, contact hours and the evaluation scheme are appended.

4.0 REGISTRATION:

Nomenclature: The different terms used in connection with the MPEC system are explained below:

- **Registration for a course:** It entitles a student to regularly attend classes for the course to satisfy the prescribed provision for earning the credit for the course.

Earning Credit for a registered course: Appearing in end term theory/practical examination for the course, having end-term examination, and securing minimum specified percentage of marks in Theory/ Practical examination, separately for each course.

Securing minimum specified percentage of marks in Internal Assessment for the course not having end-term examination.

- **Keeping the Term:** Students who have satisfied the eligibility for appearing in end term examination for a course and either have not appeared in end-term examination or

appeared in the end-term examination but could not obtain the credit for the respective course are said to have "kept the term" for the respective course.

Such students have the option of either '*registering a fresh*' for the course or '*re-registering*' for the course. In the event of fresh registration, the credits for attendance and I.A. will not be accumulated.

- **Eligibility for appearing in the end-term examination:** Attending the classes regularly to attain minimum prescribed percentage of attendance and securing minimum percentage of marks in Internal Assessment (I.A) of respective course would make a student eligible for appearing in the end-term examination for the respective course.

- **Re-registration for a course:** The students who have '*kept the term*' for a course can re-register for the respective course. Such students will have to appear only in the end-term examination of the respective course and the credits earned for attendance and Internal Assessment will be accumulated for transfer to the student. Such courses will be called "**Backlog Courses**"

However, the accumulated credit for attendance and internal assessment will not be transferred if the student **registers afresh** for the respective course.

4.1 A student will have to register, at the polytechnic, for the courses he/she would like to study in a term, at the beginning of each term, till he/she becomes eligible for the award of diploma. The Guidance & Counselling Unit of the Institute will advise the student in deciding about the courses of his/her choice and the pace of learning.

4.1.1 A student must complete the study of the pre-requisite course (i.e., at least have "kept the term") specified for a course before selecting the respective course for registration.

4.1.2 A 10+ student would be allowed to register for Applied Technology and Elective courses only after he/she has completed the study (at least have "kept the term") of Foundation and Hard Core courses.

4.1.3 A 12+ student would be allowed to register for Applied Technology and Elective courses only after he/she has completed the study (at least have "kept the term") of Hard Core courses.

4.1.4 The Institute authorities would provide the list of courses to be offered in the odd and even terms of an academic year, at the commencement of each academic year.

4.1.5 The Guidance & Counselling Unit would advise the students about the options available to each individual student, taking into consideration the courses in which credit had been earned by the student (through study/exemption), pre-requisites for the courses, backlog courses and limits for registration of courses.

4.1.6 The Institute would not arrange special classes in courses not scheduled to be offered in the term.

4.1.7 Selection of courses would be done satisfying the condition of maximum and minimum number of courses.

4.2 Limit of courses for registration:

4.2.1 A student can register in any term for a maximum seven (7) number of courses out of which, the courses having end-term examination shall not be more than six.

A student not having any course for re-registration would have to register in any term, except the last term for minimum three [3] courses having end-term examination.

4.2.2 However, High Achiever students would be permitted to register for additional courses in any term, in excess of stipulation of 4.2.1, as below:

4.2.2.1 10+ High Achiever students would be permitted to register for up to eight (8) courses in any term after completion of odd and even terms of first year.

4.2.2.2 12+ High Achiever students would be permitted to register for up to nine (9) courses in any term after completion of odd term of first year.

[Note:

(a) 10+ High Achiever- Those 10+ students who have registered for minimum seven (7) courses in each of the odd term and even term of first year and have earned credits for all the registered courses in first attempt would be designated as 10+ High Achiever.

(b) 12+ High Achiever- Those 12+ students who have registered for minimum seven (7) courses in the odd term of first year and have earned credits for all the registered courses in first attempt would be designated as 12+ High Achiever.

(c) Those high achiever students will have to continue earning credits for all the subsequently registered courses in the first attempt to be eligible to continue as high achievers.]

4.2.3 Maximum number of courses having end-term examination registered and re-registered by a student in any term shall not exceed ten (10).

4.2.3.1 Examples explaining the above rule are given below:

A 10+ student has registered in a term for 6 courses, all having end-term examination (4.2.1) and has earned credit for only 1 course but has "kept the term" for other 5 courses.

Option I: The student decides to re-register for all the 5 backlog courses. Maximum number of courses, with end-term examination, for registration/re-registration = 10 (4.2.3)

Allowable number of courses, with end-term examination,

for registration = $10 - 5 = 5 < 6$ (OK, 4.2.1)

Hence, allowable number of fresh courses, mid end-term examination, for registration = 5

Total allowable number of fresh courses, with & without end-term examination, for registration = $5 + 7 = 6$.

Option II: The student decides to re-register for 2 backlog courses and to register afresh for other 3 courses.

Maximum number of courses, with end-term examination, for registration/re-registration = 10 (4.2.3)

Allowable number of courses, with end-term examination,

for registration = $10 - 2 = 8 > 6$ (Not OK, 4.2.1)

Hence, allowable number of courses, with end-term examination, for registration = 6 (4.2.1)

Hence, allowable number of fresh courses, with end-term examination, for registration = $6 - 3 = 3$

Total allowable number of fresh courses, with & without end-term examination, for registration = $3 + 1 = 4$

5.0 EXAMINATION RULES:

The State Council for Technical Education (SCTE) would conduct the examinations according to the prevailing system.

5.1 Two end-term examinations (odd and even) would be held in each academic.

5.2 Each term examinations in any term would be conducted for all courses, registered and unregistered for examination, in the respective term.

5.3 Registration for examination: Students eligible for appearing in the end-term examination for a course will have to register/re-register for examination of the respective courses in which he/she desires to appear in a term. Registration/re-registration processes have to be completed within the stipulated period specified by SCTE

5.4 Eligibility for appearing in end-term examination of a course: A student shall regularly attend the classes prescribed for the course to attain minimum 75% of attendance (theoretical and practical classes separately) and secure minimum 50% marks in the Internal Assessment for the course to be eligible to register for examination of the respective course.

5.5 A student would not be allowed to re-register for examination of a course in she has already earned credit.

5.6 A student has to pay the examination fees, as prescribed by the SCTE from time to time, at the time of registration/re-registration for examination in the course by the prescribed form.

5.7 SCTE shall ensure publication of results of end-term examinations in any term within the term itself.

5.8 Eligibility for earning credit for a course:

The following criteria are to be satisfied by a student to earn the credit for a course-

5.8.1 For courses having end-term examination-

(i) a student must first satisfy the eligibility condition in 5.4 for appearing in the examination and

(ii) Secure 40% marks in Theory end-term examination and 50% marks in Practical end-term examination of the course, as specified in the scheme of evaluation.

5.8.2 For courses not having end-term examination- a student must secure 50% marks in the Internal Assessment for the course, as specified in the scheme of evaluation.

5.9 Performance of a Student:

The performance of a student would be expressed in terms of 'Credit Point Average' (CPA), which would be computed as below:

CPA(%) of a student for diploma program

$$\frac{\sum (\% \text{ of marks obtained in a course} \times \text{No. of credits for the course})}{\sum \text{ of Credits in all courses studied}}$$

5.10 Award of Diploma:

A student who has successfully completed the study of a minimum number of courses and has earned the stipulated minimum number of credits for each category of courses (i.e.. Foundation, Hard Core, Soft Core, Basic Technology, Applied Technology and Elective courses) as per specified evaluation scheme of Diploma program will be awarded Diploma in Mechanical Engineering by the State Council of Technical Education.

5.10.1 The students would be awarded classes on the basis of CPA of a student, computed for the whole diploma program, as below:

| <u>CPA</u> | <u>Class</u> |
|---------------------------------|------------------------------|
| 75% and above | First Class with Distinction |
| 60% and above and less than 75% | First Class |
| 50% and above and less than 60% | Second Class |

5.11 A student may be allowed to discontinue his/ her studies after attending at least 2 terms and he/she must rejoin within 2 years from the date of discontinuation to be entitled for transfer of all credits accumulated by him/her. A student may avail of this flexibility of discontinuing the study maximum twice.

5.12 A student, with or without temporary discontinuation, would have to complete the diploma program within 6 years from the date of first registration.

6.0 Guidance and Counseling unit

An effective guidance and counseling unit in the polytechnic is an essential requirement for successful implementation of MPECS, which has also been recognized by the National policy of education. This unit would be responsible for guiding and counseling of students and also for planning, implementation and operation of MPECS.

6.1 Structure:

The unit will have as its member senior teachers from all departments of the institute offering diploma program. One of them will be designated as Coordinator of the unit, who will be responsible for effective operation of the unit. The designated teachers must be effectively trained in MPECS and Guidance & Counselling of students.

The work of existing students section and examination section will come under the purview of this unit. The secretarial assistance and support staff for this unit can be provided by redeployment of the concerned administrative staff. The supporting staff should also be trained in MPECS.

The unit must be provided with adequate computer facility and trained staff for efficient functioning of the unit.

6.2 Functions: The guidance & counseling unit of the institute will have the following major functions:

- Making the students aware about the structure and operation of MPECS.
- Providing guidance to the students during registration and re-registration.
- Counselling the students in selection of courses.
- Maintaining record of progress of individual student.
- Providing & collecting data to / from the SCTE.
- Continuously conducting study on entry category/ choice of courses/ performance in various courses.
- Developing & maintaining data base on entry level/characteristics/program duration/pass rate/ employment etc.

DISTRIBUTION OF COURSES FOR THE DIPLOMA PROGRAMME IN COMPUTER SC. & ENGINEERING FOR THE STATE OF MIZORAM (MULTI POINT ENTRY AND CREDIT SYSTEM [MPECS])

| Category of Courses | Course Code | | Credits to be acquired | No. of Courses |
|---------------------------|-------------|----------|------------------------|----------------|
| | Subject | Category | | |
| Foundation Course | - | 1 | 22 | 06 |
| Hard Core Course | - | 2 | 18 | 06 |
| Soft Core Course | - | 3 | 06 | 02 |
| Basic Technology Course | CS | 4 | 33 | 09 |
| Applied Technology Course | CS | 5 | 43 | 12 |
| Elective Course | CS | 6 | 06 | 02 |
| TOTAL: | | | 128 | 37 |

Scheme of Studies and Evaluations (MPECS)

Diploma in Computer Sc. & Engineering

1. FOUNDATION COURSE :

| Sl. No. | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | Total Mark | Credit |
|--------------|------|-------------------------------|---------------|-------------------|----------|----------|-------------------|---------------------|------------|-----------|---------------------|------|------------|-----------|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | Practical | | | | |
| | | | | L | T | P | End Exam | Internal Assessment | | End Exam | Internal Assessment | | | |
| | | | | | | | | Class Test | Assignment | | Sessional | Viva | | |
| 1 | 101 | Communication in English - I | | 2 | 1 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 2 | 102 | Communication in English - II | 101 | 2 | 1 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 3 | 103 | Applied Mathematics-I | | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 4 | 104 | Applied Mathematics-II | | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 5 | 105 | Engineering Science - I | | 3 | 0 | 4 | 70 | 15 | 15 | 25 | 25 | 0 | 150 | 5 |
| 6 | 106 | Engineering Science - II | 105 | 3 | 0 | 4 | 70 | 15 | 15 | 25 | 25 | 0 | 150 | 5 |
| TOTAL | | | | 16 | 2 | 8 | 420 | 90 | 90 | 50 | 50 | | 700 | 22 |

2. HARD CORE COURSE :

| Sl. No. | Code | Course | Study Scheme | | | Evaluation Scheme | | | | | | | Total Mark | Credit | |
|--------------|------|-----------------------------------------------------|---------------|-------------------|----------|-------------------|------------|---------------------|------------|------------|---------------------|-----------|------------|-----------|--|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | | Practical | | | | |
| | | | | L | T | P | End Exam | Internal Assessment | | End Exam | Internal Assessment | | | | |
| | | | | | | | | Class Test | Assignment | | Sessional | Viva | | | |
| 7 | 201 | Engineering Drawing –I | | 0 | 0 | 6 | 0 | 0 | 0 | 50 | 50 | 0 | 100 | 3 | |
| 8 | 202 | Engineering Drawing –II | 201 | 0 | 0 | 6 | 0 | 0 | 0 | 50 | 50 | 0 | 100 | 3 | |
| 9 | 203 | Workshop Practice - I | | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 25 | 25 | 50 | 2 | |
| 10 | 204 | Workshop Practice – II | 203 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 25 | 25 | 50 | 2 | |
| 11 | 205 | Engineering Mechanics | | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 | |
| 12 | 206 | Introduction to Computer Programming & C Prog. Lab. | | 3 | 0 | 4 | 70 | 15 | 15 | 50 | 25 | 25 | 200 | 5 | |
| TOTAL | | | | 6 | 0 | 23 | 140 | 30 | 30 | 150 | 175 | 75 | 600 | 18 | |

3. **SOFT CORE COURSE : (Any two to be taken)**

| Sl. No. | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | Total Mark | Credit |
|--------------|------|--------------------------------------------------|---------------|-------------------|----------|----------|-------------------|---------------------|------------|-----------|---------------------|----------|------------|----------|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | Practical | | | | |
| | | | | L | T | P | End Exam | Internal Assessment | | End Exam | Internal Assessment | | | |
| | | | | | | | | Class Test | Assignment | | Sessional | Viva | | |
| 13 | 301 | Engineering Economics & Accountancy | | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 14 | 302 | Element of Management and Industrial Legislation | | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 15 | 303 | Entrepreneurship Development | | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 16 | 304 | Element of Electronics | 105,106 | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 17 | 305 | Materials Science | 105,106 | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 18 | 306 | Environmental Education | | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| TOTAL | | | | 6 | 0 | 0 | 140 | 30 | 30 | 0 | 0 | 0 | 200 | 6 |

4. BASIC TECHNOLOGY COURSES FOR COMPUTER SC. & ENGINEERING:

| Sl. No. | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | Total Mark | Credit |
|--------------|-------|--------------------------------------------|-----------------------|-------------------|----------|-----------|-------------------|---------------------|------------|------------|---------------------|------|-------------|-----------|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | Practical | | | | |
| | | | | L | T | P | End Exam | Internal Assessment | | End Exam | Internal Assessment | | | |
| | | | | | | | | Class Test | Assignment | | Sessio nal | Viva | | |
| 19 | CS401 | Computer Architechture & Organizations | - | 3 | | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 150 | 3 |
| 20 | CS402 | System Programming | CS401, CS408 | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 21 | CS403 | Gigital Circuits & Lab | - | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 15 | 10 | 150 | 4 |
| 22 | CS404 | Operating System & Lab. | CS408 | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 15 | 10 | 150 | 4 |
| 23 | CS405 | Microprocessor & Interfacing & Lab. | 206 CS401 CS403 | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 15 | 10 | 200 | 4 |
| 24 | CS406 | Communication Theory & Lab. | - | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 15 | 10 | 100 | 4 |
| 25 | CS407 | Computer Communication & Networking & Lab. | CS401 CS406 | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 15 | 10 | 150 | 4 |
| 26 | CS408 | Data Structure & Algorithm & Lab. | 206 | 3 | 0 | 2 | 70 | 15 | 15 | 25 | 15 | 10 | 100 | 4 |
| 27 | CS409 | Theory of Computing | CS408 | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| TOTAL | | | | 27 | 0 | 12 | 630 | 135 | 135 | 150 | 90 | | 1200 | 33 |

5. APPLIED TECHNOLOGY COURSES:

| Sl. No. | Code | Course | Study Scheme | | | | Evaluation Scheme | | | | | | Total Mark | Credit |
|--------------|-------|-----------------------------------------|--------------------------|-------------------|----------|-----------|-------------------|---------------------|------------|------------|---------------------|------------|-------------|-----------|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | Practical | | | | |
| | | | | L | T | P | End Exam | Internal Assessment | | End Exam | Internal Assessment | | | |
| | | | | | | | | Class Test | Assignment | | Sessio nal | Viva | | |
| 28 | CS501 | Business Data Processing & Lab. | CS408 | 3 | 0 | 4 | 70 | 15 | 15 | 50 | 25 | 25 | 200 | 5 |
| 29 | CS502 | Computer Graphic & Multimedia & Lab. | CS401 CS408 | 3 | 0 | 4 | 70 | 15 | 15 | 50 | 25 | 25 | 200 | 5 |
| 30 | CS503 | Internet & Web Technology & Lab. | CS407 | 3 | 0 | 4 | 70 | 15 | 15 | 50 | 25 | 25 | 200 | 5 |
| 31 | CS504 | Parallel & Distributed Computing | CS401, CS404 CS407 | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 32 | CS505 | VLSI & Embedded System | CS405 CS408 | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 33 | CS506 | PC Utilities Lab | - | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 25 | 25 | 50 | 2 |
| 34 | CS507 | Database Management System (DBMS) & Lab | CS501 | 3 | 0 | 4 | 70 | 15 | 15 | 50 | 25 | 25 | 200 | 5 |
| 35 | CS508 | Object Oriented Methodology & Lab. | 206 | 3 | 0 | 4 | 70 | 15 | 15 | 50 | 25 | 25 | 200 | 5 |
| 36 | CS509 | Software Engineering | CS501 CS507 | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 37 | CS510 | Graphic Theory & Combinatoric | 104,104 CS 408 | 3 | 0 | 0 | 70 | 15 | 15 | 0 | 0 | 0 | 100 | 3 |
| 38 | CS511 | Seminar | - | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 25 | 25 | 50 | 2 |
| 39 | CS512 | Projects | - | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 25 | 25 | 50 | 2 |
| TOTAL | | | | 27 | 0 | 32 | 630 | 135 | 135 | 250 | 200 | 200 | 1550 | 43 |

6. ELECTIVE COURSES (Any two to be taken)

| Sl. No. | Code | Course | Study Scheme | | | Evaluation Scheme | | | | | | Total Mark | Credit | |
|-----------------------------|-------|---------------------------|------------------|-------------------|----------|-------------------|------------|---------------------|------------|-----------|---------------------|------------|------------|----------|
| | | | Pre-requisite | Contact Hour/Week | | | Theory | | | Practical | | | | |
| | | | | L | T | P | End Exam | Internal Assessment | | End Exam | Internal Assessment | | | |
| | | | | | | | | Class Test | Assignment | | Sessional | | | Viva |
| 40 | CS601 | Pattern Recognition | CS502 CS409 | 3 | 0 | 0 | 70 | 15 | 15 | | | | 100 | 3 |
| 41 | CS602 | Soft Computing | CS409 | 3 | 0 | 0 | 70 | 15 | 15 | | | | 100 | 3 |
| 42 | CS603 | Optimization Technique | 103,104 CS408 | 3 | 0 | 0 | 70 | 15 | 15 | | | | 100 | 3 |
| 43 | CS604 | Digital Signal Processing | CS403 CS407 | 3 | 0 | 0 | 70 | 15 | 15 | | | | 100 | 3 |
| Total of Two Courses | | | | 6 | 0 | 0 | 140 | 30 | 30 | | | | 200 | 6 |

Computer Architecture & Organisation

L T P
3 0 0

Curri. Ref. No.: CS401

Total Contact hrs : 45

Total marks: 100

Theory: 100

Theory: 45

End Term Exam: 70

Practical:

I.A: 30

Pre requisite: NA

Practical:

Credit: 3

End Term Exam:

I.A :

Theory

Total Periods : 45

Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

**TOTAL
HRS.**

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1. Evolution of Computers : | 5 |
| Brief history of development; Babbage's machines, Von Neumann Concept, Difference between calculators and computers. Generations of Computer -SSI, LSI, VLSI, Classification - micro, mini, main frames and supercomputers. PC's and portable systems. | |
| 2. Number Representation: | 5 |
| Signed numbers, Signed - magnitude 1's complement, 2's complement and excess notations, numbers, Fixed and floating point numbers and operations, Booth's Algorithm, Common errors in arithmetic truncation errors, round of errors. Codes : weighted and non-weighted, BCD, ASCII, EBCDIC | |
| 3. Central Processing Unit: | 8 |
| Components of Arithmetic Logic Unit (in block diagram only). Different types of instructions. Instruction format, addressing modes, different CPU registers – Accumulator, Hag, Program Counter, Instruction Register and General Purpose registers. Hardware control unit - its different functions | |
| 4. Microprocessor: | 7 |
| Intel 8085 architecture and simple assembly language programming concept. Brief introduction to Intel 8086/8088 and Pentium processor (relative study), Brief introduction to RISC processor | |
| 5. Memory: | 6 |
| Concept of bits, bytes and words; Storage of numbers and characters, RAM, ROM, EPROM; Concept of cache memory - its role in performance improvement, memory hierarchy | |
| 6. I/O Devices: | 10 |
| Printers - Dot Matrix, Ink Jet, Line, Laser; Visual display unit — alphanumeric and graphic, Keyboard, Graphics devices - mouse, joy-stick, Scanners and digitizers, Auxiliary storage devices – floppy and Hard Disk : Sector,Tracks and Cylinders, accessing mechanisms(brief idea) Magnetic tapes-description and accessing mechanisms, CD ROM | |
| 7. PC Architecture | |

REFERENCE BOOKS:

1. Computing Organizatioin & Architecture – by Stallings PHI
2. Computing Organizatioin- by V.C Hamacher, Z.G.Vranesic & S.G Zaki, MGH
3. Computing Architecture & Organizatioin-by J.P Hayes, MGH
4. Computing Organizatioin & Design – by Pal Chaudhury, PHI
5. Computing System Architecure – by Mano PHI

SYSTEM PROGRAMMING

L T P
3 0 0

Curri. Ref. No.: CS402

Total Contact hrs : 45 Total marks: 100
 Theory: 45
 Practical:
 Pre requisite: CS401, CS408
 Credit: 3

Theory: 100
 End Term Exam: 70
 I.A.: 30
 Practical:
 End Term Exam:
 I.A :

Theory
 Total Periods : 45
 Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

| | TOTAL HRS. |
|------------------------------------------------------------------------------|-----------------------|
| 1. Assembly Language | 6 |
| 1.1 Introduction to assembly language | |
| 1.2 Description of functional characteristics, addressing modes, | |
| 1.3 Data types and instruction structure | |
| 1.4 Registers | |
| 1.5 Indexing | |
| 1.6 Instruction set description | |
| 2. Macros | 4 |
| 2.1 Recursive macros | |
| 2.2 Sub-routines | |
| 2.3 Stacks, procedures, exception handling. | |
| 3. Assemblers | 8 |
| 3.1 Overview of assembly process | |
| 3.2 Processing of imperative, declarative and assembler directive statements | |
| 3.3 Relocation, linking and loading concepts | |
| 3.4 One and two pass assembler | |
| 3.5 Symbol table organization, program sections, output forms | |
| 4.0 Macro-assembler | 7 |
| 4.1 Macro definitions and parameters | |
| 4.2 Macro call expansion | |
| 4.3 Macro definition and macro call within a macro | |
| 4.4 Conditional assembly macro-processor | |
| 5. Loaders | 6 |
| 5.1 Review of loading, linking and relocation | |
| 5.2 Absolute, dynamic and direct loading schemes | |
| 5.3 Program linking schemes and resolution of external references | |
| 5.4 Optional features in loaders and linkage editors | |
| 5.5 Overlay structures and dynamic loading | |
| 6. Compiler Construction | 14 |
| 6.1 Introduction to compiler | |
| 6.2 Phases & passes, Bootstrapping | |
| 6.3 Lexical Analysis | |
| 6.4 Syntax Analysis | |
| 6.5 Boot-up and Top-down parsers | |
| 6.6 Translation | |
| 6.7 Code Optimization | |
| 6.8 Code Generation | |

REFERENCE BOOKS :

1. System Programming – by John Donovan TMH
2. System Programming – by Dhamdhare

Digital Circuits & Lab

Curri. Ref. No.: CS403

L T P
 3 0 2
 Total Contact hrs : 75
 Theory: 45
 Practical:30
 Pre requisite: NA
 Credit: 4

Total marks: 100

Theory: 100
 End Term Exam: 70
 I.A.: 30
 Practical:50
 End Term Exam:25
 I.A : 25

Theory
 Total Periods : 45
 Periods : 3 P/W

| UNIT TOPIC/SUB-TOPIC | TOTAL HRS. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1. Number System: Number Systems and Codes : Decimal, Binary, Octal, Hexadecimal number system and conversion from one number system to another, Arithmetic operations using these number systems, Representation of egative number in the different number systems. Complements and complement subtraction, Different codes (H421, Kx~3, 2421, dray, Alphanumeric, BCD, Seven segment codes etc) and code conversions. | 6 |
| 2.0 Boolean Algebra and Logic Gates: Postulates and different theorems. SOP and POS forms of expression and their conversion. Simplification : using Boolean theorems and k-map (up to 4 variables) Basic logic gates - their symbols, truth table and logic ' expression for the output simple circuit reali7ation using tlie logic gates. Realization of any expression either using all NAND or NOR gates | 6 |
| 3.0 Combinational Logic Circuits : Arithmetic circuit (Adder/ Subtractor), Multiplexers and their uses, Decoder/demultiplexers and their uses, code converter, Kncodcr, parity generator/checkers. | 8 |
| 4.0 Families of Logic Circuit: TTL and CMOS family, open collector and tri-state logic gates. | 3 |
| 5.0 Storage Devices & Sequential Circuits : Latches and Flip-flops, Timing diagrams of latches and flip flops, conversion of one flipflop to smother. Counters - Binary ripple counters, Asynchronous module counters, UP/Down counter. Synchronous counters (binary, different modulo and UP/Down), Timing diagram of all types of counters. Brief introduction to a few commercially available counter ICs (asynchronous and synchronous). | 06+04+02 =12 |
| 5.1 Shift-registcrs-Different types of shift registers and their functional details, A few applications of shift-registers. | |
| 5.2 Memory -Memory types and terminology. Memory organisation, Semiconductor memory, reading and writing, RAM, ROM, PROM cells and circuits, EPROM (Programming and erasing), Dynamic RAM, Memory expansion, PLA. | |
| 6.0 Data Converters : Digital-to-Analog Conversion - Weighted resistor, R-2R ladder, DAG performance `and their characteristics. Analog-to-Digital Conversion - Counter type ADC, dual slope type, successive approximation type, tracking type and flash type, ADC performance and their characteristics. | 6 |
| 7.0 Display and Display Drives : | 4 |

Introduction to LEU, LCD, 7-segment displays, liar graph display and Dot matrix displays. Decoder drivers for 7-segment display, liar graph display and I.C.D. Multiplexing of display.

TOTAL 45

Practical

Total Periods : 30

Periods : 2 P/W

1. Verification of truth tables of different basic logic gates.
2. Realisation of logic expressions using different basic logic gates.
3. Realisation of logic expressions using either all NAND or all NOR gates.
4. Adder circuits (Half, Full-adder) design.
5. Design of a multiplexer using logic gates (4 to 1 Multiplexer)
6. Use of commercially available multiplexer ICs to realise two logic functions.
7. Design of a decoder using logic gates (2 to 4 decoder)
8. Use of commercially available decoder ICs to realise two logic functions.
9. Design of RS, JK, D latches using logic gates.
10. Design of master/slave JK flip-flop.
11. To study the functional behaviour of some commercially available flip-flop ICs (JK and D)
12. Counter design (modulo 6 and 10 asynchronous and synchronous counters) using flip-flop and to display the counts on 7-segment display units.
13. To study the performance of some commercially available counter ICs (asynchronous and synchronous), cascading of counter ICs, Different modulo (MOD-6 and MOD-10) counter design using counter ICs.
14. To design a shift register using flip-flops and to study its behaviour.
15. To study the different functional features of shift register ICs.

REFERENCE BOOKS :

1. Digital Systems — by Ronald . J. Tocci, PHI
2. Digital Design - by Mano, PHI
3. Digital Logic & Comp. Design - by Mano, PI 11
4. Digital Circuits — by D. Ray Chowdhury

Operating System & Lab

L T P
3 0 2
Total Contact hrs : 75
Theory: 45
Practical: 30
Pre requisite: CS408
Credit: 4

Total marks: 150

Curri. Ref. No.: CS404

Theory: 100
End Term Exam: 70
I.A.: 30
Practical: 50
End Term Exam: 25
I.A : 25

Theory
Total Period : 45
Periods :3 P/W

UNIT TOPIC/SUB-TOPIC

**TOTAL
HRS.**

1. Introduction

2

| | | |
|------|------------------------------------------------------------------------------------------|---|
| 1.1 | Definition of O.S | |
| 1.2 | History of O.S | |
| 1.3 | Concepts | |
| 1.4 | Structure | |
| 2. | Processes | 4 |
| 2.1 | Definition of process & thread | |
| 2.2 | Interprocess communication | |
| 2.3 | Classical LP.C. problems | |
| 2.4 | Process Scheduling | |
| 3. | Process Scheduling Algorithm | 5 |
| 3.1 | Resident Monitor(Single user) | |
| 3.2 | Multi user system | |
| 3.3 | Time sharing system | |
| 3.4 | PIPS | |
| 3.5 | Round Robin Fashion/Time quantum. Concept. | |
| 3.6 | Multiple queues | |
| 3.7 | Priority queues | |
| 3.8 | Shortest job first | |
| 4. | Memory Management | 7 |
| 4.1 | Resident Monitor | |
| 4.2 | Multiple Partition | |
| 4.3 | Garbage collection and compaction | |
| 4.4 | Paged memory management | |
| 4.5 | Page Replacement Algorithms | |
| 4.6 | Swapping | |
| 4.7 | Segmentation | |
| 4.8 | Segmented paged memory management | |
| 4.9 | Demand paged memory management | |
| 4.10 | Virtual Memory | |
| 5. | File Systems | 5 |
| 5.1 | Concept of Piles & Directories | |
| 5.2 | Pile System Implementation | |
| 5.3 | Security Issues in l'iles | |
| 5.4 | Protection Mechanisms | |
| 5.5 | Case studies of Unix file system | |
| 6. | Input/Output | 4 |
| 6.1 | Principles of I/O Hardware | |
| 6.2 | Principles of I/O Software | |
| 6.3 | Disk | |
| 6.4 | Clocks | |
| 6.5 | Serial and Parallel port access | |
| 6.6 | Terminal Access | |
| 7. | Device Management | 3 |
| 7.1 | Techniques for Device Management — Dedicated, sliared, virtual | |
| 7.2 | Device allocation considerations 1/0 traffic control & I/O Schedule, I/O Device handlers | |
| 7.3 | SPOOLing | |
| 8. | Dead Locks | 5 |
| 8.1 | Concept of deadlock | |
| 8.2 | Resources | |
| 8.3 | Dead lock Prevention : Blanker Algorithm & Safety Algorithm | |
| 8.4 | The Ostrich Algorithm | |
| 8.5 | Deadlock Detection and Recovery | |

| | | |
|-----|------------------------------------|----|
| 9. | 8.6 Deadlock Prevention | |
| | Distributed O.S. | 5 |
| | 9.1 Definition | |
| | 9.2 Types of Distributed O.S | |
| | 9.3 Workstation server model | |
| | 9.4 The processor pool model | |
| | 9.5 The hybrid model | |
| | 9.6 Case study SUN NFS File Server | |
| 10. | Case Studies | 5 |
| | 10.1 UNIX O.S | |
| | 10.2 MS-DOS | |
| | 10.3 WINDOWS-NT | |
| | | |
| | TOTAL | 45 |

Practical

Total Period : 30

Periods : 2 P/W

UNIX

1. Overview of UNIX
UNIX as an Operating system, Kernel, Shell and User, UNIX File System, Files and Directories, Access permission, File system hierarchy
2. Basic UNIX Commands
Listing of files and directories, Copying, Deletion, Renaming and Comparing files, Creation, Navigation and Removing directories. Access permission of files and directories. Editors in UNIX, Status of users, terminals, date and time. Displaying blown- up message. Paging and printing of files. Background jobs
3. Advance Features of UNIX
I-nodes, Trees, Pipes and Filters, Cutting, Pasting and Sorting of files. Searching for a pattern in a string
4. Programming with the Shell
System variables and shell variables. Interactive shell scripts, shell termination, Conditional statements. Looping statements. Special parameters in shell Computation and string handling

REFERENCE BOOKS:

1. Operating System — Madnick and Donovan - MGI I
2. Operating System Concepts - A. Stiberschatz and P. Calvin ADP
3. The UNIX Programming Environment - by Kernighan & Pike - Pill
4. UNIX — Concepts & Application -- by Sumitabha Das

Microprocessor & Interfacing & Lab

L T P
3 0 2

Cum. Ref. No.: CS405

Total Contact hrs : 75

Total marks: 150

Theory: 45

Theory: 100
End Term Exam: 70

Practical: 30

I. A.: 30

Pre requisite: 206, CS401,
CS403
Credit: 4

Practical: 50
End Term Exam: 25
I.A : 25

Theory

Total Periods : 45

Periods :3P/W

UNIT TOPIC/SUB-TOPIC

| | TOTAL HRS. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1. Brief history of microprocessor and Application. Introductions of 8085 microprocessor CPU and register organisation of 8085 Instruction Sets addressing modes assembly language concept, Preparation of small programmes using 8085, Data bus, Address bus control bus Interrupt times, multiplanning of bus | 10 |
| 2. Introduction to 8085 & 8086 microprocessor, command set programming and machine code | 8 |
| 3. a) Study of Interfacing chips - 8255A, 8279 b) Study of Universal timer | |
| 4. Programming with I/O chips - 8255, 8259 | 5 |
| 5. A) Study of ADC and DAC modules: use of done delay sub routine. B) Counter (Clocked) using universal timer chips C) Traffic light control systems D) Stepper motor control E) Programming Techniques for a achieving time delay F) Programming Techniques for constructing counters G) Keyboard Interfacing | 7 |
| 6. Pentium family of processors: block diagram, addressing mode, data types, register organization, memory management, pipelining, branch prediction & superscaler structure | 10 |

Practical

Total Periods : 30

Periods : 2 P/W

1. Brief history of microprocessor and Application. Introductions of 8085 microprocessor CPU and register organisation of 8085 Instruction Sets addressing modes assembly language concept, Preparation of small programmes using 8085, Data bus, Address bus control bus Interrupt times, multiplanning of bus
2. Introduction to 8085 & 8086 microprocessor, command set programming and machine code
3. a) Study of Interfacing chips - 8255A, 8279
b) Study of Universal timer
4. Programming with I/O chips - 8255, 8259
5. A) Study of ADC and DAC modules : use of time delay sub routine.
H) Counter (Clocked) using universal timer chips
I) Traffic light control systems
J) Stepper motor control
K) Programming Techniques for a achieving time delay
L) Programming Techniques for constructing counters
M) Keyboard Interfacing
7. Pentium family of processors: block diagram, addressing mode, data types, register organisation, memory management, pipelining, branch prediction & superscaler structure

REFERENCE BOOKS:

1. Microprocessor & Microcomputer by Malvino
2. Introduction to Microprocessor - by A.P. Mathur, TMH
3. Microprocessor - by Ramesh S. Gaonkar, PHI
4. Microprocessor by Rafiquazzaman
5. Microprocessor - by D.Hall, MGH
6. IBM PC & Clones - by GovindarajaUie, TMH
7. Computer Organization & Architecture - by William Stalings, PHI

Communication Theory & Lab

L T P
3 0 2

Cum. Ref. No.: CS406

Total Contact hrs : 75

Total marks: 150

Theory: 45

Theory: 100

End Term Exam: 70

Practical: 30

I. A.: 30

Pre requisite:

Practical: 50

Credit: 4

End Term Exam: 25

I.A : 25

Theory

Total Periods : 45

Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

**TOTAL
HRS.**

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1. Analog Communication: | 5 |
| Amplitude Modulation : Need to modulate definition, Carrier, Sidebands, Modulation factor and percentage Modulation, Power in carrier and sidebands. Modulated wave form, generation of Double side band (DSB) and single side and (SSB) Brief Description with block diagram of an AM transmitter. | |
| 2. AM Radio Receiver: | 4 |
| Demodulator : Square law detector. Concept of heterodyning, Block Schematic diagram and operational description of an AM receiver, sensitivity, selectivity and Fidelity of a receiver. Qualitative idea about IF freq. Local OSC, IF stage and output audio stages | |
| 3. Frequency Modulation principles: | 4 |
| Definition, Modulated wave, Frequency Deviation % Modulation, Bandwidth, & Spectrum of FM wave. Armstrong method of Generation of FM wave. Brief description about FM transmitter | |
| 4. FM Receivers: | 3 |
| Detection of FM wave, the Discriminator, Qualitative Description of different stages of an FM receiver. Comparison of AM and FM systems | |
| 5. Telegraphy: | 5 |
| Nodes — Morse, cable, 5 unit & 7 unit code and their uses, speed of working band, Manual Telegraphic System, Principles of Carter Telegraphy Telegraph Instruments : Mouse key (single current), double current key, PBO secunder polarised and non-polarised telegraph relays Teleprinter : Principles of working, Construction of Teleprinter, transmitter receiver, automatic Telex system (Principle of working) Line Testing : Murray & Verley looptests. Principles of carrier telegraphy | |
| 6. Telephone: | 5 |
| Telephone Instruments : Subscriber Telephone apparatus and accessories, Receiver, Transmitter, magnetic generator, Hay's transmission bridge, working principles of manual exchange High grade Communication Receivers (Modular block diagram & working principles Study of frequency synthesiser, phase locked | |

| | | |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| | loop, VCD digital read out, different types of filters and detectors Noises in receivers and their reduction Principles of VHP receivers, Digital discriminator, selective calling circuit. Automatic Telephones : Principles of multi exchange, Intercensing, Telex & RTTU | |
| 7. | Digital Modulation Techniques: Principle of Sampling, Quantization, pulse code modulation (PCM). Frequency shift Keying (FSK) and phase shift keyin (SK) | 4 |
| 8. | Digital Communication: Data forms, VRF System : (Simplex, half duplex, duplex communication) Transmission Mode between stations. Networks : Point to point, star. Ring, Bus. Data Communication systems Block schematic Description Brief Introduction to Time Division Multiplexing and freq. Division Multiplex principle under hygin synchronom and Asynchronom transmission. Moderns Low speed modems. Medium speed modems and High speed Modems concept and need for protocols. | 10 |
| 9. | A brief Introduction to Fiber optic communication system and satellite communication system. An introductory description of , Mobile communication. | 3 |
| 10. | Antenna — Basic principles | 2 |
| | TOTAL | 45 |

Practical

Total Periods : 30

Periods : 2 P/W

List of Experiments on Analog Communication

1. Measurement of voltage standing wave ratio.
 2. Measurement of frequency and Wavelength.
 3. Measurement of Microwave power.
 4. Measurement of Impedance of a transmitting line.
 5. Study of wave-guide attenuators.
 6. Determination of Kystran characteristics.
 7. Study of microwave tuners.
 8. Study of Directional couplers.
 9. Study of Series Tee and shunt Tee.
 10. Study of Microwave Detectors and Mixers.
 11. Determination of Reflection Laws within a wave-guide.
 12. Study of characteristics of i-f Amplifier and AFC Circuit.
 13. Determination of Microwave Receiver sensivity and system performance.
 14. Study of Modulation and Demodulation circuit - (a) Amplitude Modulation (b) Frequency Modulation.
 15. Determination of Percentage Modulation.
 16. Study of Microwave and different types of Antennas.
 17. Study of Installation Procedure of Microwave Antenna.
 18. Study of a Radar System.
- List of Experiments on digital Communication
19. Signal Sampling and Re-construction.
 20. Effect of Different sampling frequency.
 21. Effect of varying the sampling frequency duty cycle.
 22. Study of Second order and Fourth order low pass filter.
 23. Study of Time Division Multiplexed Amplitude Modulation and Demodulation.
 24. Study of Sampling and Multiplexing Technique and the Re-construction .
 25. Study of A/D and D/A converter.
 26. Study of Pseudo random sequence.
 27. Study of Error Control Coding Techniques.

28. Uses of spectrum analyzer for harmonic analysis.

REFERENCE BOOKS:

1. Electronic Communication Modulation & Transmission - Robert & Schoen Beck, PHI
2. Electronic Communication Systems - G. Kennedy

Computer Communication & Networking & Lab

L T P
3 0 2

Cum. Ref. No.: CS407

Total Contact hrs : 75 Total marks: 150

Theory: 45

Practical: 30

Pre requisite: CS401, CS406

Credit: 4

Theory: 100

End Term Exam: 70

I. A.: 30

Practical: 50

End Term Exam: 25

I.A : 25

Theory

Total Period : 45

Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

**TOTAL
HRS.**

| | |
|-----------------------------------------------------------------|---|
| 1. Introduction | 6 |
| 1.1 The uses of Computer Network | |
| 1.1.1 Network Goals | |
| 1.1.2 Application of Network | |
| 1.2 Network Structures | |
| 1.3 Network Architecture | |
| 1.3.1 Protocol Hierarchies | |
| 1.3.2 Design Issues for the Layers | |
| 1.4 The O.S.I Reference Model | |
| 1.5 Services | |
| 1.5.1 OSI Terminology | |
| 1.5.2 Connection-oriented and Connectionless services | |
| 1.5.3 Service primitives | |
| 1.5.4 The Relationship of services to protocols | |
| 1.6 Example Network | |
| 1.6.1 Public Networks | |
| 1.6.2 ARPANET | |
| 1.6.3. Novell Netware | |
| 2. The Physical Layer | 6 |
| 2.1 Transmission Median | |
| 2.2 Wireless Transmission | |
| 2.3 Telephone System | |
| 2.4 ISDM | |
| 2.5 Transmission and switching | |
| 3. The Medium Access Sub layer | 5 |
| 3.1 ALOHA | |
| 3.2 CSMA | |
| 3.3 Collision Free protocols | |
| 3.4 IEEE Standard 802 for LAN Ethernet, Token Bus,Token ring | |
| 3.5 Bridges | |
| 4. The Data Link Layer | 4 |

| | | |
|-------|-----------------------------------------------------------------|----|
| 4.1 | Data Link Layer Design Issue | |
| 4.2 | Error Detection and Correction | |
| 4.3 | Elementary Data Link Protocols | |
| 4.4 | Sliding windows protocols | |
| 5. | The Network Layer | 4 |
| 5.1 | Network Layer Design Issues | |
| 5.2 | Routing Algorithms | |
| 5.3 | Congestion Control Algorithms | |
| 6. | The Transport Layer | 4 |
| 6.1 | The Transport Services | |
| 6.2 | Elements of Transport Protocols | |
| 6.3 | A simple Transport Protocols | |
| 7. | The session Layer | 4 |
| 7.1 | Design Issues | |
| 7.1.1 | Concept of Data exchange dialog management, activity management | |
| 7.2 | Remote Procedure Call | |
| 7.2.1 | Client-server model | |
| 7.2.2 | Semantics of R.P.C | |
| 8. | The Presentation Layer | 4 |
| 8.1 | Design Issue | |
| 8.2 | Data Compression Techniques | |
| 8.3 | Elementary idea of cryptography | |
| 9. | The Application Layer | 3 |
| 9.1 | Design Issue | |
| 9.2 | File Services | |
| 9.3 | E Mail | |
| 10. | Concepts of internet and www, Html, TCP/IP | 5 |
| | TOTAL | 45 |

Practical

Total Periods : 30

Periods : 2 P/W

1. Study and describe the differences between centralised distributed and collaborative computing. (Students may be told to identify from given specification of system).
2. Case studies of LAN, MAN, WAN
3. Study and describe client, server, peers (identify from given specification)
4. Study network services - remote login, telnet, ftp (Either from internet or a network being made available)
5. Determine how a specific network service is affected given a network architecture (centralised and distributed).
6. Demonstrate different transmission media Twisted pair. Co-axial cables. Wireless, Identify advantages and disadvantages
7. Identify, describe - Network connectivity devices like Media connector. Interface boards, Modems, Repeaters, Hubs, Switch, Bridges, Multiplexer, Routers
8. Study main protocols through Windows 95/98/NT (any two in details) (TCP/IP, SLIP, PPP, FDDI, X.25, ISDN, ATM)
9. Laboratory setting-up of ethernet, installation of ethernet card and testing
10. Design LAN
11. Configure Network Server Windows NT, Server installation, network printing, network application, client server
12. Configure Network Clients
13. Preventing Problems in a Network Physical, electrical, virus, worm security

14. Troubleshooting Isolating a problem, recovery from disaster, study of Took, terminators, cable protocol analysers
15. Network Administration

REFERENCE BOOKS :

1. Computer Network — A. S. Tanenbaum, PHI
2. Data Communication & Computer Networks — W. Stallings, PHI

Data Structure & Algorithm & Lab

| | | | |
|------------------------|------------------|---|----------------------|
| L | T | P | Cum. Ref. No.: CS408 |
| 3 | 0 | 2 | |
| Total Contact hrs : 75 | Total marks: 150 | | Theory: 100 |
| Theory: 45 | | | End Term Exam: 70 |
| Practical: 30 | | | I. A.: 30 |
| Pre requisite: 206 | | | Practical: 50 |
| Credit: 4 | | | End Term Exam: 25 |
| | | | I.A : 25 |

Theory

Total Periods : 45
 Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

| | TOTAL HRS. |
|--------------------------------------------------|---------------|
| 1. Introduction and Overview | 2 |
| 1.1 Introduction | |
| 1.2 Basic Terminology | |
| 1.3 Elementary Data Organization | |
| 1.4 Data Structures | |
| 1.5 Data Structure Operation | |
| 1.6 Algorithms; Complexity; Time- space Tradeoff | |
| 2. Preliminaries | 3 |
| 2.1 Introduction | |
| 2.2 Mathematical notation and Functions | |
| 2.3 Algorithmic Notation | |
| 2.4 Control Structures | |
| 2.5 Complexity of Algorithms | |
| 2.6 Sub algorithms | |
| 2.7 Variables | |
| 2.8 Data Types | |
| 3. String Processing | 5 |
| 1.1 Introduction | |
| 1.2 Basic Terminology | |
| 1.3 Storing Strings | |
| 1.4 Character Data Type | |
| 1.5 String Operation | |
| 1.6 Work Processing | |
| 1.7 Pattern matching Algorithms | |
| 4. Arrays, Records and Pointers | 8 |
| 1.1 Introduction | |
| 1.2 linear Arrays | |

| | | |
|------|--------------------------------------------------------------------|---|
| 1.3 | Representation of Linear Arrays in Memory | |
| 1.4 | Traversing Linear Arrays | |
| 1.5 | Inserting and Deleting | |
| 1.6 | Sorting; Bubble Sort | |
| 1.7 | Search; Linear Search | |
| 1.8 | Binary Search | |
| 1.9 | Multidimensional Arrays | |
| 1.10 | Pointers; Pointer Arrays | |
| 1.11 | Records; Record Structures | |
| 1.12 | Representation of Records in Memory; parallel Arrays | |
| 1.13 | Matrices | |
| 1.14 | Spares Matrices | |
| 5. | Linked Lists | 5 |
| 5.1 | Introduction | |
| 5.2 | Linked Lists | |
| 5.3 | Representation of Linked Lists in Memory | |
| 5.4 | Traversing a Linked List | |
| 5.5 | Searching a Linked List | |
| 5.6 | Memory Allocation Garbage Collection | |
| 5.7 | Insertion into a linked list | |
| 5.8 | Deletion from a Linked List | |
| 5.9 | Header Linked Lists | |
| 5.10 | Two -Ways Lists | |
| 6. | Stacks, Queues, Recursion | 6 |
| 7.1 | Introduction | |
| 7.2 | Stacks | |
| 7.3 | Array Representation of Stacks | |
| 7.4 | Arithmetic Expression; Polish Notation | |
| 7.5 | Quicksort, an Application Stakes | |
| 7.6 | Recursion | |
| 7.7 | Towers of Hanoi | |
| 7.8 | Implementation of Recursive Procedures by Stacks, | |
| 7.9 | Queues | |
| 7.10 | Defuse | |
| 7.11 | Priority Queues | |
| 7. | Trees | 5 |
| 7.1 | Introduction | |
| 7.2 | Binary Trees | |
| 7.3 | Representing Binary Trees in Memory | |
| 7.4 | Traveling Binary Trees | |
| 7.5 | Traversal Algorithms using Stacks | |
| 7.6 | Header Nodes; Threads | |
| 7.7 | Binary Search Trees, | |
| 7.8 | Trees, Searching and Inserting in a Binary Search Tree | |
| 7.9 | Deleting in a Binary Search Tree | |
| 7.10 | Heap, Heapsort | |
| 7.11 | Path Lengths; Huffman's Algorithm | |
| 7.12 | General Trees | |
| 8. | Graphs and Their Application | 4 |
| 8.1 | Introduction | |
| 8.2 | Graph Th. Terminology | |
| 8.3 | Sequential Representation of Graphs; Adjacency matrix, path matrix | |
| 8.4 | Warshall's Algorithm, Shortest Paths | |
| 8.5 | Linked Representation of a Graph | |

| | | |
|------|-----------------------------------------------------------|---|
| 8.6 | Operations on Graphs | |
| 8.7 | Traversing a Graph | |
| 9. | Sorting and Searching | 5 |
| 9.1 | Introduction | |
| 9.2 | Sorting | |
| 9.3 | Inserting Sort | |
| 9.4 | Selection Sort | |
| 9.5 | Merging | |
| 9.6 | Merge-sort | |
| 9.7 | Radix Sort | |
| 9.8 | Linear searching | |
| 9.9 | Binary searching | |
| 9.10 | Interpolation searching | |
| 9.11 | Hashing | |
| 10. | Introduction to File Organization | 2 |
| | Sequential, Index-Sequential and Direct file Organization | |

Practical

Total Periods : 30
Classes : 2 P/W

Program Related to

1. Creation of singly & doubly linked list
2. Insertion, deletion and updation of (1) above
3. Creation of stack, queue and incertion/deletion operation on Stack/Queue
4. Conversion amongst infix, prefix & postfix expressions
5. Creation of tree and insertion/deletion of a node
6. Tree traversal problem
7. Graph search algorithms
8. Searching & Sorting Algorithm

REFERENCE BOOKS:

1. Data Structures : Seymolur Lipschutz (Schaum Series)
2. Fundamentals of Computer Algorithms — by Horowitz,E & Sahani, S- Galgotia
3. Data Structures Theory Applications : Trembly & Sorenson, TMH

Theory of Computing

L T P
3 0 0

Cum. Ref. No.: CS409

Total Contact hrs : 75

Total marks: 150

Theory: 45

Theory: 100
End Term Exam: 70

Practical: 30

I. A.: 30

Pre requisite: CS408

Credit: 3

Practical:

End Term Exam:

I.A :

Theory

Total Period : 45

Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

TOTAL
HRS.

1. Theory of Automata
 - 1.1 Strings over an Alphabet and their properties

8

| | | |
|----|------------------------------------------------------|---|
| | 1.2 Finite Automation | |
| | 1.3 Transition Diagram and Transition Matrix | |
| | 1.4 Acceptability of a String by a Finite Automation | |
| | 1.5 Nondeterministic Finite Automation | |
| | 1.6 Equivalence of DFA and NFA | |
| | 1.7 Mealy and Moore Models | |
| | 1.8 Minimization of Finite Automata | |
| 2. | Formal Languages | 4 |
| | 2.1 Basic Definitions | |
| | 2.2 Operations of Languages | |
| | 2.3 Grammar and the Language generated by a Grammar | |
| | 2.4 Chomsky Classification of Languages | |
| 3. | Regular Sets and Regular Grammars | 7 |
| | 3.1 Regular Expressions and Regular Sets | |
| | 3.2 Finite Automata and Regular Expressions | |
| | 3.3 Pumping Lemma for Regular Sets | |
| | 3.4 Closure Properties of Regular Sets | |
| | 3.5 Regular Sets and Regular Grammars | |
| 4. | Context-Free Languages | 8 |
| | 4.1 Context-Free Languages | |
| | 4.2 Derivation Trees | |
| | 4.3 Ambiguity in Context-Free Grammars | |
| | 4.4 Closure Properties of Context-Free Languages | |
| | 4.5 Chomsky and Greibach Normal Forms | |
| | 4.6 Pumping Lemma for Context-Free Languages | |
| 5. | Pushdown Automata | |
| | 5.1 Basic Definitions | |
| | 5.2 Acceptance by Pushdown Automata | |
| | 5.3 Pushdown Automata and Context-Free Languages | |
| 6. | Turing Machine | 8 |
| | 6.1 Definition of Turing Machine | |
| | 6.2 Representation of Turing Machine | |
| | 6.3 Acceptability by Turing Machine | |
| | 6.4 Design of Turing Machine | |
| | 6.5 Universal Turing Machine | |
| | 6.6 Halting Problem | |
| 7. | Computability | 6 |
| | 7.1 Primitive Recursive Functions | |
| | 7.2 Recursive Functions | |
| | 7.3 Partial Recursive Functions and Turing Machine | |

REFERENCE BOOKS:

1. Introduction to Language and the Theory of Computation — by J. C. Martin — Tata McGraw Hill
2. Theory of Computer Science - by K.L.P. Mishra & N. Chandansekaran - Prentice Hall of India
3. Introduction to Automata Theory, Languages and Computation — by J. Hopcroft & J. Ullman — Narosa Publishing House

APPLIED TECHNOLOGY COURSES

Business Data Processing & Lab

L T P
 3 0 4
 Total Contact hrs : 105
 Theory: 45
 Practical: 60
 Pre requisite: CS408
 Credit: 5

Cum. Ref. No.: CS501

Theory: 100
 End Term Exam: 70
 I. A.: 30
 Practical: 100
 End Term Exam: 50
 I.A : 50

Theory
 Total Periods : 45
 Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

| | TOTAL HRS. |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 1. Introduction: Introduction to Information - Time, Relevant, Precision | 1 |
| 2. Information Systems and Business Context: Organisation, Technology, Management | 2 |
| 3. Information Systems in Management: Types of information systems - Transaction processing system, Management information system, Decision support system, Executive . information system. Office information system/knowledge work system | 10 |
| 4. Categories of Information Systems on the Basis of Processing : Batch, On-line, Real-time | 2 |
| 5. Data and File Concepts: File structures and data access - Sequential access. Direct access, Indexed sequential access | 3 |
| 6. Data Management: The requirement - Data redundancy, Maintaining consistency within the data collection, Program-data interdependence, Flexibility in use of data and sharing data, Data management trends | 5 |
| 7. Applications of IS: Inventory management. Sales management. Personnel management | 12 |
| 8. Management Information System: MIS services - Routine performance reports, Exception reports, On-demand reports, Predictive reports Implementing an MIS | 5 |
| 9. Installing an MIS: Crash or direct installation. Parallel installation, Pilot installation, Phased installation | 3 |
| 10. Limitation of Information Systems : Unsuitability for certain tasks. Unrealistic expectations. Information not tailored to user needs | 2 |
| Total | 45 |

Practical

Total Periods : 60
 Periods : 4 P/W

FOXPRO - 30 hrs.

(Instead of FOXPRO, other equivalent package may be used)

Introduction to FOXPRO

Introduction, Special features of FoxPro, Starting FoxPro, Terminologies used in FoxProFile/Table-Record-Fields, Conventions used for naming fiends. Data types

Understanding Databases

Introduction, Opening a Table/Database, Adding records in a table. Close a file

Retrieving and Editing the Data

Introduction, List, Display, Record pointer, Moving the record pointer - Goto -Skip, Modifying data-Edit-Browse

Removing the Data

Introduction, Delete record. Recall, Pack, Zap, Replace

Managing Databases

Introduction, Sorting, Indexing, Searching for record within the database -Locate-Find-Seek

Working with Reports

Introduction, Creating a report format, Generating a report. Previewing the Report-Grouping of data-Subtotals-Grand total

Working with Multiple Files

Introduction, Work area, Linking up related database, Updating a database(s) using key field(s), Memory variables -Working with memory variables -Set commands

Functions

Introduction, In-built function-Character functions-Data functions, General functions. Some special functions in FoxPro

Arrays

Introduction, Arrays, Storing and retrieving a record-Scatter-Gather, Array functions – Copy From/ To array - Copy to - Append from

Programming Techniques

Introduction, Pseudocode - Preliminaries for pseudocode, Algorithms - Algorithm definition, Data dictionary - General facilities available in data dictionary - Organisation and management of data dictionary, Program specifications - Input specifications - Processing specifications - Output specification. System development - System development life cycle - Structured analysis - Structured design

Getting Started with Programming

Introduction, Commands for writing programs - Say - Get-Read - Valid - Range, Picture, Input Accept - Cancel, Branching concepts - If-endif- Do case Otherwise

Programming Structures

Introduction, Looping commands - Do while - Por-Endfor Scan-End Scan

Working with Functions and Procedures

Introduction, Function, Procedure

Menu Builder

Introduction - Define Menu - Define Pad - Clear Menu Popup - Define popup - Define Bar, Working with Menus - Read Menu - Prompt-Menu To Sample program Function for use with GUI tools - Working with Windows - Define Windows – Activate Window- Deactivate Window - Clear Window Release Window - Hide Window - Show Window -Show Window All

Screen Builder

Introduction, Screen based commands Create screen - Modi screen - Set format to

File Heading Commands

Introduction, Basic file handling commands Fopeno - Fopeno - Fereateo - Freado – Fwriteo Fgetso - Fputs - Fseeko - Fflusho - Fcloseo

Working with Queries

Introduction, Working with queries, Catalog manager - Creating a Catalog manager
COBOL - 30 hrs.

Programming in COBOL

COBOL language concepts — Character set. Reserve words, Divisions and sections
 Data Movement and Control Statements - Data input/output, USAGE clause, PERFORM
 statement, IF...ELSE statement Arithmetic Computations - ADD, SUBTRACT, MULTIPLY
 and DIVIDE statements, Arithmetic expressions, COMPUTE statement Table
 Manipulation — Arrays and subscripts, OCCURS clause, SET statement Sorting and
 Searching Facilities - SORT statement, RELEASE statement, RETURN statement,
 MERGE statement, SEARCH statement File Handling in COBOL — Sequential file
 organisation, Line sequential file organisation, Indexed sequential file organisation

REFERENCE BOOKS:

1. Management Information System — by Sadagopan — PHI
2. COBOL Programming - Ray & Ghosh Dastidar - TMH
3. Manual for FOXPRO

Computer Graphics & Multimedia & Lab

L T P
 3 0 4

Cum. Ref. No.: CS501

Total Contact hrs : 105 Total marks: 200
 Theory: 45
 Practical: 60
 Pre requisite: CS408
 Credit: 5

Theory: 100
 End Term Exam: 70
 I. A.: 30
 Practical:100
 End Term Exam:50
 I.A :50

Theory
 Total Periods : 45
 Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

**TOTAL
 HRS.**

| | | |
|----|---------------------------------------------------|---|
| 1. | Introduction to Computer Graphics | 5 |
| | 1.1 Introduction | |
| | 1.2 Image Processing and Picture analysis | |
| | 1.3 Conceptual framework for interactive graphics | |
| | 1.4 Classification | |
| 2. | Hardware | 4 |
| | 2.1 Various display devices | |
| | 2.2 Video controller | |
| | 2.3 Random - scan display processor | |
| | 2.4 Image scanners | |
| | 2.5 Interaction hardware | |
| 3. | Raster Graphics Techniques | 8 |
| | 3.1 Interaction handling | |
| | 3.2 Raster graphics features | |
| | 3.3 Line drawing algorithms | |
| | 3.4 Circle drawing algorithms | |
| | 3.5 Scan conversion | |
| | 3.6 Polygon filling | |
| | 3.7 Pattern filling | |
| | 3.8 Halftoning | |
| | 3.9 Clipping techniques | |

| | | |
|----|-------------------------------------------------------------------------|-----------|
| 4. | Geometric Transformation and Viewing: | 3 |
| | 4.1 2D and 3D transformation | |
| | 4.2 Representation and composition | |
| | 4.3 3D viewing | |
| 5. | User Interfacing | 5 |
| | 5.1 Interaction handling models | |
| | 5.2 Window management | |
| | 5.3 Input/Output handling | |
| | 5.4 Tool kits | |
| 6. | Curves & Surfaces and Solid Modeling | 7 |
| | 6.1 Polygon meshes | |
| | 6.2 Parametric cubic curves | |
| | 6.3 Quadric surfaces, Bezier and B-spline curves | |
| | 6.4 Representing solids : sweep representation, boundary representation | |
| | 6.5 Spatial partitioning | |
| 7. | Visibility | 5 |
| | 7.1 Hidden line and Hidden surfaces | |
| | 7.2 Floating horizon algorithm | |
| | 7.3 Roberts algorithm, Z-buffer | |
| | 7.4 List priority algorithms | |
| 8. | Rendering | 4 |
| | 8.1 Illumination models | |
| | 8.2 Shadows | |
| | 8.3 Shading | |
| | 8.4 Transparency | |
| 9. | Animation | 4 |
| | 9.1 Conversion & Computer Aided animation | |
| | 9.2 Rules & Technology | |
| | TOTAL | 45 |

Practical

Total Periods : 60

Periods : 4P/W

1. **Sound Forge**

Sound recording and editing through sound forge XP

- 1.1 The main screen
- 1.2 The data window
- 1.3 Opening an existing file - playing a sound file
- 1.4 Playing a section of a file
- 1.5 Copying data to a new file
- 1.6 Saving a file
- 1.7 Simple editing
- 1.8 Advanced editing
- 1.9 Editing sound formats
- 1.10 Applying sound processing functions
- 1.11 Recording sound using sound forge.

2. **Adobe Premiere**

- 2.1 Creating desktop video with Adobe Premiere
- 2.2 Creating on Adobe Premiere movie
- 2.3 Starting a new project importing clips, assembling the clipping construction window, previewing the movie, changing duration of a cell, creating a transition, adding other clips and transitions.
- 2.4 Applying filters to a clip

- 2.5 Changing the time unit in the construction window
- 2.6 Using preview command to preview die transition and filter effects
- 2.7 Adding sound to movie
- 2.8 Connecting and capturing source video through broadband cord
- 2.9 Editing and compressing die video
- 3. Adobe Photoshop**
 - 3.1 Scanning image
 - 3.2 Creating new images
 - 3.3 Changing foreground and background colours
 - 3.4 Creating and using paths
 - 3.5 Editing and retouching
 - 3.6 Duplicating images
 - 3.7 Layers - linking with layers
 - 3.8 Grouping a images
 - 3.9 Rubber stamp and pattern stamp tool
 - 3.10 Painting - paintbrush tool, air-brush tool, pencil tool, eraser tool, gradient tools
 - 3.11 Photoshop filters
- 4. Authorware 5 Attain**
 - 4.1 Introduction - system requirements, installing, general features
 - 4.2 Knowledge objects - introduction to knowledge objects, choosing a knowledge object, adding a knowledge object file, authorware knowledge objects
 - 4.3 Authoring basics - icon based authoring what each icon does die toolbar, working with icons on the flow line, authoring - step by step, distribution requirements, packaging an AW piece, packaging an AW piece for the web
 - 4.4 Creating interactions - components of an interaction. Plow an interaction works, tracing the flow through an interaction, setting up an interaction step by step
 - 4.5 Directing the flow - Decision structure, frameworks, navigation structures - step by step
 - 4.6 Transitions, Positioning and motion - using transition for special effects, positioning objects using the motion icon, making objects move step by step.
- 5. Director - 7**
 - 5.1 Introduction - system requirement, installing director
 - 5.2 Basic - Overview, work area, adding interactivity with lingo, using the score, using markers, selecting and editing frames in the scores using xtras
 - 5.3 Sprites - creating, selecting and layering sprites positioning, splitting and joining sprites
 - 5.3 Working with cast members and casts - using the cast window, creating cast members
 - 5.4 Behaviours - attaching behaviour, creating and modifying behaviour
 - 5.5 Colour, Tempo and transitions - animation, navigation and user interaction, movies in a window, sound, video and synchronization, distributing movies.
- 6. ToolBook II Instructor**
 - 6.1 Introduction - system requirement, installing instructor
 - 6.2 Understanding Instructor concepts - planning die project, building an application, using open script
 - 6.3 Exploring the Instructor interface - about die Instructor, Visual interface using tools in Instructor
 - 6.4 Using die book specialist - working with books and pages, working with Toolbook II catalogues, working with objects, setting object properties, adding buttons, working with text & hotwords, working with list boxes and combo boxes, adding graphics, using multimedia, hiding, showing and animating objects, creating a quiz using question objects.

REFERENCE BOOKS :

1. Multimedia Communication – by Keno et al – PH
2. Fundamentals of Computer Graphics & Multimedia – by Mukherjee-PHI
3. Multimedia- An Introduction – by John Villamil & Louis Molina-Prentice Hall
4. Multimedia-Production Planning & Delivery– by John Villamil & Louis Molina-Prentice Hall
5. Multimedia- Sound & Video – by Jose Lozano – Prentice Hall
6. Multimedia Graphics- by John Villamil & Leony Fernandez, Elias-Prentice Hall
7. Manuals of Sound Forge, Adobe Premiere, Adobe Photoshop, Authorware 5 Attain Director – 7, Toolbook II Instructor

Internet & Web Technology & Lab

| | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <p>L T P 3 0 4</p> <p>Total Contact hrs : 105 Theory: 45 Practical: 60 Pre requisite: CS407 Credit: 5</p> <p>Theory Total Periods : 45 Periods : 3 P/W</p> | <p>Cum. Ref. No.: CS503</p> <p>Theory: 100 End Term Exam: 70 I. A.: 30 Practical:100 End Term Exam:50 I.A :50</p> | <p>Total marks: 200</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|

| UNIT TOPIC/SUB-TOPIC | TOTAL HRS. |
|---------------------------------------------------------------------|------------|
| 1. Internet Fundamentals | 3 |
| 1.1 Motivation for internetworking | |
| 1.2 History and scope of internet | |
| 1.3 Internet protocol and standardization | |
| 1.4 Role of ISP & Factors for choosing an ISP | |
| 1.5 Internet service providers in India | |
| 1.6 Types of connectivity such as Dial Up, Leased, VSAT etc. | |
| 1.7 Internet server and client modules on various operating systems | |
| 2. TCP/IP | 12 |
| 2.1 TCP/IP internet layering model | |
| 2.2 Reliable stream transport service (TCP) | |
| 2.2.1 Need for stream delivery | |
| 2.2.2 Properties of reliable delivery sendee | |
| 2.2.3 Providing reliability | |
| 2.2.4 Idea behind slide windows | |
| 2.2.5 Ports connections and end points | |
| 2.2.6 Segment, stream, sequence number | |
| 2.2.7 TCP segment format | |
| 2.2.8 TCP header | |
| 2.2.9 TCP Checksum computation | |
| 2.2.10 Acknowledgement and retransmission | |
| 2.2.11 Time out and retransmission | |
| 2.2.12 Response to congestion | |
| 2.2.13 Establishment of a TCP connection | |

- 2.2.14 Source and destination address
- 2.2.15 Protocol number
- 2.2.16 Checksum
- 2.2.17 Closing TCP connection
- 2.2.18 TCP connection reset
- 2.3 Connection less data gram delivery (Internet Protocol)
 - 2.3.1 Concept of unreliable delivery
 - 2.3.2 Connection less delivery system
 - 2.3.3 Purpose of internet protocol
 - 2.3.4 IP header
 - 2.3.5 Source and destination address
 - 2.3.6 Protocol number
 - 2.3.7 Checksum
 - 2.3.8 Routing in an internet
 - 2.3.9 Direct and indirect delivery
 - 2.3.10 Table driver IP routing
 - 2.3.11 Default roots
 - 2.3.12 Post specific roots
 - 2.3.13 Rooting with IP address
 - 2.3.14 Obtaining a subnet mask
 - 2.3.15 Benefits of TCP/IP
- 2.4 Subnet Address Extension
 - 2.4.1 Introduction to subnet address extension
 - 2.4.2 Minimizing network numbers
 - 2.4.3 Transparent routers
 - 2.4.4 Subnet Addressing
 - 2.4.5 Flexibility in subnet address assignment
 - 2.4.6 Implementation of subnet with mask
 - 2.4.7 Subnet mask representation
 - 2.4.8 Routing in the presence of subnet
- 2.5 User Data gram Protocol
 - 2.5.1 Introduction to UDP
 - 2.5.2 Identifying the ultimate destination
 - 2.5.3 Format of UDP message
- 2.6 Domain Name System
 - 2.6.1 Internet addressing
 - 2.6.2 IP address/domain name address; why both
 - 2.6.3 Mapping of domain name to address
 - 2.6.4 Domain name resolution
 - 2.6.5 Efficient translation
 - 2.6.6 Abbreviation of domain name
 - 2.6.7 Obtaining authority for a sub domain
- 3. Internet Applications and Services
 - 3.1 Email
 - 3.1.1 Email networks
 - 3.1.2 Email protocols
 - 3.1.3 Format of an email message
 - 3.1.4 Email routing
 - 3.1.5 Email clients, POP3, IMAP
 - 3.2 FTP
 - 3.2.1 Public domain software
 - 3.2.2 Types of FTP servers
 - 3.2.3 FTP clients
 - 3.3 Telnet

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|-------|-------------------------------------------------------|----|
| 3.3.1 | Telnet protocol | |
| 3.3.2 | Server domain | |
| 3.3.3 | Telnet clients | |
| 3.3.4 | Terminal emulation | |
| 3.4 | Internet Relay Chat | |
| 3.4.1 | IRC network and servers | |
| 3.4.2 | Channels | |
| 4. | Internet Security | 3 |
| 4.1 | Overview of Internet Security threats & Vulnerability | |
| 4.2 | The need for computer security | |
| 4.3 | Firewalls: introductory concepts & its necessity | |
| 4.4 | Specific intruder approach | |
| 4.5 | Security strategies | |
| 4.6 | Security tools | |
| 4.7 | Encryption | |
| 4.8 | Enterprise networking & access to Internet | |
| 4.9 | Antivirus programs | |
| 5. | E-Commerce | 10 |
| 5.1 | Electronic Commerce Environment & Opportunities | |
| 5.1.1 | Background | |
| 5.1.2 | Electronic commerce environment | |
| 5.1.3 | Electronics market place technologies | |
| 5.1.4 | Modes of electronic commerce | |
| 5.2 | Overview | |
| 5.2.1 | Electronics data interchange | |
| 5.2.2 | Migration to OPEN EDI | |
| 5.2.3 | Electronic commerce with www/Internet | |
| 5.3 | Electronics Payment System | |
| 5.3.1 | Types of electronics payment system | |
| 5.3.2 | Digital token based electronics payment system | |
| 5.3.3 | Smart cards & electronics payment system | |
| 5.3.4 | Credit card based electronics payment system | |
| 5.3.5 | Risk and electronics payment system | |
| 5.3.6 | Designing electronics payment system | |
| 5.4 | Electronic Cash & Electronics Payment Scheme | |
| 5.4.1 | Internet monetary payment & security requirements | |
| 5.4.2 | Payment & purchase order process | |
| 5.4.3 | On-line Electronic cash | |
| 5.5 | Master Card / Visa secure Electronics Transaction | |
| 5.5.1 | Business requirements | |
| 5.5.2 | Concepts | |
| 5.5.3 | Payment processing. | |
| 6. | HTML & Interactive tools | 5 |
| 6.1 | Document overview | |
| 6.2 | Header elements | |
| 6.3 | Section headings | |
| 6.4 | Block oriented elements | |
| 6.5 | Lists | |
| 6.6 | Inline elements | |
| 6.7 | Visual markup | |
| 6.8 | Hypertext links | |
| 6.9 | Uniform Resource Locator | |

| | | |
|------|----------------------------------------------|----|
| 6.10 | Imagers | |
| 6.11 | Tables | |
| 6.12 | Special characters | |
| 6.13 | CGI (Common Gateway Interface) | |
| 6.14 | ActiveX | |
| 6.15 | VB Script | |
| 6.16 | Java Script and Java. | |
| 6.17 | PERL | |
| 7. | Introduction to ASP | 5 |
| 7.1 | Concepts of ASP | |
| 7.2 | Benefits of using ASP | |
| 7.3 | Creating ASP pages | |
| 7.4 | Generating web pages dynamically with ASP | |
| 8. | Search Engines | 3 |
| 8.1 | Technology overview | |
| 8.2 | Popular search engines | |
| 8.3 | Registration of web site in a search engines | |
| | TOTAL | 45 |

Practical

Total Periods : 60

Periods : 4 P/W

1. Installation of network components under NT or 95/98/ LINUX
2. Installation of TCP/IP
3. Installation of Intranet
4. Configuration of one web server
5. Deployment of HTML files in Intranet servers
6. Creation of simple HTML pages, using the following tags.

```
<Hn> ..... </Hn>
<P> ..... </P>
<Br>
<AHREF> ..... </A>
<Img>
<FONT>
```
7. Creation of tables and lists using HTML
8. Creation of simple forms incorporating GUI components (command button, text box, radio button, check box, combo box) in HTML pages
9. Practical on different Internet services (WWW, Mail, FTP, Chat)
10. Simple application using conditional statements
11. Develop application using loop constraints
12. Creation of classes, interfaces and packages
13. Simple application using threads and runnable interface
14. Simple application using thread synchronization methodology
15. Creating application to create user defined exception
16. Simple application to handle inbuilt exceptions
17. Write application to incorporate simple I/O classes
18. Creating application for text file handling
19. Creating application for random file handling
20. Writing applet and embedding it into HTML file
21. Create applet to display different graphical shapes (line, circle, ellipse, arcs, rectangle) and incorporate colour in those shapes
22. Create applet to incorporate GUI components (command button, text box, text area, list box, combo box, check box, frame, check box group)
23. Create applet-using layout manager
24. Write applet to incorporate events

25. Create multi threaded applet
26. Elementary problems on CGI
27. Elementary problems on Active X
28. Elementary problems on VBscript
29. Elementary problems on Java Script
30. Elementary problems on PERL

REFERENCE BOOKS:

1. Internet working with TCP/IP Vol — I: principles, protocols and architecture — by Douglas E. Comer - PHI
2. Internet working with TCP/IP Vol — II : design, implementation and internals — by Douglas E. Comer & David L. Stevens - PHI
3. Internet working with TCP/IP Vol — III : client server programming and applications — by Douglas E. Comer & David L. Stevens — PHI
4. HTML : the definitive guide — lby Chuck Musciano & But Kennedy
5. E-MAIL security : how to keep your electronic messages private — by Bruce Schneier — John Wiley
6. Dynamic HTML : the definitive reference — by Danny Goodman
7. Dynamic HTML in Action — by Schurman & Pardi — PHI/Microsoft Press

Parallel & Distributed Computing

| | | | | |
|----------------------------------|---|------------------|--|----------------------|
| L | T | P | | Cum. Ref. No.: CS504 |
| 3 | 0 | 0 | | |
| Total Contact hrs : 105 | | Total marks: 200 | | Theory: 100 |
| Theory: 45 | | | | End Term Exam: 70 |
| Practical: | | | | I. A.: 30 |
| Pre requisite: CS401,CS404,CS407 | | | | Practical: |
| Credit: 5 | | | | End Term Exam: |
| | | | | I.A : |

Theory
 Total Periods : 45
 Periods : 3 P/W

| UNIT TOPIC/SUB-TOPIC | TOTAL HRS. |
|----------------------------------------------------------|-------------------|
| 1. Introduction to Parallel & Distributed Systems. | 4 |
| 1.1 Distributed System and Real-Time System | |
| 1.2 Parallel Systems and Flynn's classification | |
| 1.3 Design Issues for different types of models | |
| 1.3 Sample Distributed Application. | |
| 2. Memory Management for Distributed Systems | 5 |
| 2.1 Review of Centralized Memory Management. | |
| 2.2 Simple Memory Model and Shared Memory Model | |
| 2.3 Distributed Shared Memory. | |
| 2.4 Memory Migration. | |
| 3. Inter-process Communication | 6 |
| 3.1 Selection Factors | |
| 3.2 Message Passing, Shared Memory, Pipes, Sockets. | |
| 3.3 Remote Procedure Calls | |
| 3.4 Static and Dynamic Interconnection Networks | |
| 4. Concurrency Control, and Distributed Synchronization. | 8 |
| 4.1 Mutual Exclusion and Critical Regions | |
| 4.2 Semaphores, Monitors and Locks | |
| 4.3 Token-Passing and Mutual Exclusion | |

| | | |
|-----|-------------------------------------------------|----|
| 4.5 | Introduction to Global Time and Physical Clocks | |
| 4.6 | Network Time Protocol (NTP), Logical Clocks | |
| 5. | Distributed File Systems. | 4 |
| 5.1 | Distributed Name Service | |
| 5.2 | Distributed File Service | |
| 5.3 | Distributed Directory Service. NFS. X.500. | |
| 6. | Scalar and Vector Processing | 3 |
| 6.1 | Definitions | |
| 6.2 | Linear and non-linear pipeline processors | |
| 6.3 | Super-pipelining | |
| 6.4 | Vector processing principle | |
| 7. | Parallel Algorithms | 10 |
| 7.1 | PRAM model of computation | |
| 7.2 | Broadcast and Prefix sums | |
| 7.3 | Permutation algorithms | |
| 7.4 | Parallel sorting | |
| 8. | Distributed Security | 5 |
| 8.1 | Cryptography and Digital Signatures | |
| 8.2 | Authentication | |
| 8.3 | Access Control (Firewalls) | |
| | TOTAL | 45 |

REFERENCE BOOKS

1. Computer Architecture & Organization – by Hayes – Mc Graw Hill
2. Computer Architecture & Parallel Processing – by Hwang & Briggs Mc Graw Hill
3. Design Efficient Algorithms for Parallel Computers – by Quinn Mc Graw Hill

VLSI & Embedded System

| | | | | |
|-----------------------------|---|------------------|--|----------------------|
| L | T | P | | Cum. Ref. No.: CS505 |
| 3 | 0 | 0 | | |
| Total Contact hrs : 45 | | Total marks: 100 | | Theory: 100 |
| Theory: 45 | | | | End Term Exam: 70 |
| Practical: | | | | I. A.: 30 |
| Pre requisite: CS405, CS408 | | | | Practical: |
| Credit: 3 | | | | End Term Exam: |
| | | | | I.A : |
| Theory | | | | |
| Total Periods : 45 | | | | |
| Periods : 3 P/W | | | | |

| UNIT TOPIC/SUB-TOPIC | TOTAL HRS. |
|--------------------------------------------------------------------------------------------|------------|
| 1. VLSI Design | |
| 1.1 Introduction to VLSI design, design styles and parameters, popular technologies | 3 |
| 1.2 Logic implementation with nMOS, CMOS & PLAs | 4 |
| 1.3 Pass vs. transistor logic, transit time, clocking, scaling, PLA minimization & folding | 4 |
| 1.4 Testing & testability issues | 3 |

| | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1.5 Physical design Algorithms : partitioning, floor planning & placement, routing, compaction, gate arrays, FPGAs | 4 |
| 1.6 Data structures for layout design magic | 3 |
| 1.7 Design rule checking, symbolic layout, complexity of layout algorithms | 5 |
| 2. Embedded Systems | |
| 2.1 Introduction to embedded systems, architecture of embedded systems, specifications of embedded systems, design methodologies | 4 |
| 2.2 Real time issues - modeling, specification, communication, scheduling, protocols etc. | 5 |
| 2.3 Hardware software partitioning, approaches to software and code generation, operating issues, memory and low power issues, validation approaches, distributed embedded systems | 10 |
| TOTAL | 45 |

REFERENCE BOOKS :

1. Introduction to VLSI Systems - by C. Mead & L. Conway — Addison Wesley
2. Introduction to VLSI Design — by Fabricus — Prentice Hall
3. Layout Design & Verification — by T. Ohtsuld — North Holland
4. Algorithms for VLSI Physical Design Automation — by N. Sherwani
5. An Introduction to VLSI Physical Design - by M. Sarafzadeh & C. K. Wong - MHI
6. Hardware Software Co-design of Embedded Systems — by Falf Niemann — Kluwer Academic
7. Design Principles of Distributed Embedded Applications — by Hermann Kopetz — Kluwer Academic
8. Real Time System Design — by Levi & Agrawal - MH

PC Utilities Lab

L T P
0 0 4

Cum. Ref. No.: CS506

Total Contact hrs : 60

Total marks: 50

Theory: 0

Theory:

Practical: 60

End Term Exam:

Pre requisite: Nil

I. A.:

Credit: 2

Practical:50

End Term Exam25

I.A :50

Theory

Total Periods : 60

Periods :4 P/W

1. **Introduction to MS Office**
Basic features of Ms Office, Overview of Different Office Tools
2. **Introduction to MS Word**
Creating and Editing document, Formatting Documents, Working with Tables, Spell checking. Mail Merging, Importing Graphics into word Document
3. **Introduction to MS Excel**
Creating a New Work Book, Entering Labels, Values and Formulas, Formatting the layout. Working with Functions, Creating the Chart from data. Writing macros
4. **Introduction to Power Point**
Creating a Presentation, Adding/Editing Text, Working with objects. Formatting the Presentation, Placing the chart in slide, Slide Show and Printing
5. **Introduction to MS Access**
Creation of database

Creation of tables - Field Declaration, Data type Declaration, Constraint Declaration. Working with records. Querying die database, Joining Tables, Designing the Form, Creating the report

REFERENCE BOOKS :

1. Manual for MS Office
2. Self Learning Study Material on MSWORD developed by TTTI, Calcutta
3. Self Learning Study Material on MS POWER POINT developed by TTTI, Calcutta
4. Self Learning Study Material on MS EXCEL developed by TTTI, TTTI, Calcutta

Database Management System (DBMS) & Lab

| | | | | |
|-------------------------|---|------------------|-------------------|-------|
| L | T | P | Cum. Ref. No.: | CS507 |
| 3 | 0 | 4 | | |
| Total Contact hrs : 105 | | Total marks: 200 | Theory: 100 | |
| Theory: 45 | | | End Term Exam: 70 | |
| Practical: 60 | | | I. A.: 30 | |
| Pre requisite: CS501 | | | Practical:100 | |
| Credit: 5 | | | End Term Exam:50 | |
| | | | I.A :50 | |
| Theory | | | | |
| Total Periods : 45 | | | | |
| Periods : 3 P/W | | | | |

| UNIT TOPIC/SUB-TOPIC | TOTAL HRS. |
|----------------------------------------------------------------------|-------------------|
| 1. Introduction to Database Management System | 5 |
| 1.1 Database System environment | |
| 1.2 File oriented Approach | |
| 1.3 Database Approach | |
| 1.4 Users of DBMS | |
| 1.5 Intended use of DBMS | |
| 1.6 Benefit of using database approach | |
| 1.7 Concepts of Client Server Architecture and distributed system | |
| 2. Database System Concept and Application | 5 |
| 2.1 Date Models, Schemes and instances | |
| 2.2 DBMS architecture and Independence | |
| 2.3 Database Languages and Interfaces | |
| 2.4 The database system environment | |
| 2.5 Classification of DBMS | |
| 3. E-R diagram | 2 |
| 3.1 Defining relations. Entity Set | |
| 3.2 E-R Model concept with examples | |
| 4. SQL | 12 |
| 4.1 Data definition in SQL | |
| 4.2 Queries in SQL | |
| 4.3 Create, Update, Insert statements in SQL | |
| 4.4 Views in SQL | |
| 4.5 Specifying additional constraints as assertions | |
| 4.6 Specifying indexes | |
| 5. Functional Dependencies and Normalization for Relational Database | 4 |
| 5.1 Functional dependencies | |
| 5.2 Normal forms based on primary keys | |

| | | |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 5.3 | General definitions of second and third normal forms | |
| 5.4 | Boye Codd normal form | |
| 6. | Transaction Processing Concepts | 3 |
| 6.1 | Introduction to transaction processing | |
| 6.2 | Transaction and System concept | |
| 6.3 | Desirable properties of transactions | |
| 6.4 | Schedules and recover ability | |
| 7. | Concurrency Control Techniques | 3 |
| 7.1 | Basic Concepts; Concepts of Locks : live lock, dead lock; erializability | |
| 8. | Security and Integrity | 5 |
| 8.1 | Security and integrity viola don | |
| 8.2 | Authorization | |
| 8.3 | Authorization and Views | |
| 8.4 | Granting of Privileges | |
| 8.5 | Security specification in SQL | |
| 8.6 | Encryption | |
| 9. | Distributed Databases | 6 |
| | Principles of distributed database; data fragmentations, transparency, integrity, allocation of fragments, translation of global query to fragment query; concurrency control — elementary ideas. | |
| | TOTAL | 45 |

Practical

Total Periods : 60

Classes : 4 P/W

1. Oracle
 - 1.1 Introduction to Oracle
 - 1.2 Datatypes and attributes constraints, primary key, unique, foreign key, check, not null
2. Introduction to Structured Query Language (SQL)
 - 2.1 Data definition language (DDL) - Create, alter, drop table
 - 2.2 Data manipulation language (DML) - Select, insert, update, delete
 - 2.3 Data control language - Grant, revoke
 - 2.4 Creating and deleting views, index
3. Introduction to PL/SQL
 - 3.1 Block structure, variable and types, looping constructs, expression and operators, functions
 - 3.2 Cursors variable, cursor fetch, loops
 - 3.3 procedure, functions, triggers
 - 3.4 Error handling and exceptions
 - 3.5 Composite datatypes
4. Developer 2000
 - 4.1 Oracle forms - Form modules, blocks, items, windows, canvas views, triggers, master detail forms, menu, alert, LOV
 - 4.2 Oracle reports - report generation with parameters
5. DBA Function
 - 5.1 Installation of Oracle & D2K
 - 5.2 Creation of Database
 - 5.3 Routine Maintenance of Database
 - 5.4 Back up & Recovery of Database
 - 5.5 Concept of inet.ora

REFERENCE BOOKS

1. Fundamental of Database System - by Elmasri and Navathe
2. Database Management – by CJ Date

3. Principles of Database System – by John E. hopcroft & Jeffrey D. Ullman
4. Developing Personal Oracle 7 Application – by David Lockman
5. Oracle 8 DBA Handbook – by Kevin Loney

Object Oriented Methodology & Lab

L T P
3 0 4

Cum. Ref. No.: CS508

Total Contact hrs : 105

Total marks: 200

Theory: 45

Theory: 100
End Term Exam: 70

Practical: 60

I. A.: 30

Pre requisite: 206

Practical:100

Credit: 5

End Term Exam:50

I.A :50

Theory

Total Periods : 45

Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

TOTAL HRS.

1. Overview
 - Introduction to object oriented approach
 - Need of object oriented programming
 - Identifying objects
 - Characteristics of object oriented language
 - Defining objects
2. Introduction to Object Oriented Methodology
 - Object oriented development
 - Object oriented theme
 - Comparison of object oriented language and procedure oriented language
 - Basic concepts of OOPs objects, classes, data encapsulation, inheritance
 - Polymorphism and overloading
3. Object Oriented Analysis & Design
 - Introduction to software engineering paradigms
 - Requirement analysis and problem statement — Identifying objects, specifying attributes, defining operation & inter object communication
 - Object oriented analysis & prototyping
 - Object oriented design concepts
 - Object oriented design methods
 - Object & class definition
4. Object Oriented Language C++ Features Common statement
 - Basic data types Operators Arithmetic, relational, logical operators
 - Manipulators, assignment and conditional operators
 - New and delete operators Control structure, FOR loop, WHILE loop
 - If-else statement, Switch statement, Break and continue statement
5. Arrays and Pointers
 - Defining an array and accessing it's elements , Array as class member data
 - Array of objects , Addresses and pointers , Pointers and functions
6. Structure and Functions
 - Specifying the structure, Defining a structure variable, Accessing the members of a structure, Enumerated data types, Function definition and declaration
7. Objects and Classes
 - Definition and declaration, Private, public, protected, Constructor, destructor

- 8. Access specifier, Structures and classes
Operator Overloading
Basic concepts of overloading, Overloading unary operators, Overloading binary operators, Advantages of operator overloading
- 9. Inheritance
Definition of inheritance, Basic concepts of 'Base class' and 'derived class'
Derived class constructor, Class hierarchies, Public and private inheritance
Multiple & multilevel inheritance
- 10. Virtual Functions
Definition of virtual function, Friend function and friend classes, Use of 'this' pointer
- 11. Templates
Introduction to templates, Class templates, Member function template

Practical

Total Periods : 60

Periods : 4 P/W

Problems on :-

Objects and classes
Declaring and creating objects
Constructors
Modifiers
Passing objects to methods
Instance variables and class variables
Instance method & class method
Scope of variables interface and packages
Introductory Problems on Class Inheritance Super classes and sub class
Calling super class constructors
Calling super class methods
Object class
Number class
Processing date and time
Class Templates and Exceptional handling

REFERENCE BOOKS:

1. Object Oriented Programming — by E. Balaguruswamy, TMH
2. Object Oriented Programming in Microsoft C++ - by Robert Lafore
3. Software Engineering — by Roger S. Pressman, PHI
4. Object Oriented Modeling & Design - by James Rumbaugh, Michael Blaha, William Premerlani, Frederick Eddy, William Lorensen
5. Teach Yourself C++ - by Al Stevens

Software Engineering

L T P
3 0 0

Total Contact hrs : 45

Total marks: 100

Theory: 45

Practical:

Pre requisite: CS501, CS507

Credit: 3

Cum. Ref. No.: CS509

Theory: 100

End Term Exam: 70

I. A.: 30

Practical:

End Term Exam:

I.A :

Theory
 Total Periods : 45
 Periods : 3 P/W

| UNIT TOPIC/SUB-TOPIC | TOTAL HRS. |
|--------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 1.0 Introduction to Software Engineering | 4 |
| 1.1 The evolving role of software | |
| 1.2 Software crisis-problems and causes | |
| 1.3 Software engineering paradigms | |
| 1.4 Classic life cycle | |
| 1.5 Prototyping | |
| 1.6 Spiral Model | |
| 1.7 Generic view of software engineering | |
| 2.0 Software Requirement Analysis | 6 |
| 2.1 Requirement analysis fundamentals | |
| 2.2 Structured analysis : Basic notation and its extension, object oriented analysis and data modeling, process modeling | |
| 3.0 Software Design | 5 |
| 3.1 Evolution of software design | |
| 3.2 Design fundamentals; Abstraction, refinement, modularity, software architecture | |
| 3.3 Flow oriented design and object-oriented design | |
| 4.0 Quality Assurance | 4 |
| 4.1 Software quality factor | |
| 4.2 Software quality Assurance (SQA) | |
| 4.3 SQA activities | |
| 4.4 Software reliability, errors and faults | |
| 4.5 Software reliability models | |
| 5.0 Verification and Validation | 3 |
| 5.1 Software testing strategies & techniques | |
| 5.2 Elementary ideas of black box & white box testing | |
| 6.0 Software Evaluation | 2 |
| 7.0 Software Documentation | 3 |
| 8.0 Software Project Management | 18 |
| 8.1 Basic concepts of software project management process objectives, scope, estimation, COCOMO model | |
| 8.2 Project planning | |
| 8.3 Project scheduling, Gantt chart, pert chart | |
| 8.4 Managing people, project staffing, group working, working environment | |
| 8.5 Project monitoring, milestone, methods of project monitoring | |
| 8.6 Risk analysis, tracking and control, version management | |

REFERENCE BOOKS:

1. Software Engineering Beginners Approach — by Pressman — TMH
2. Software Engineering — by Pankaj Jalote
3. Fundamentals of Software Engg- Carlo Ghezzi, MehdiJazayeri, & Dino Mandrioli-PHI.
4. Software E ngineering — by Sommerville

Graph Theory & Combinatorics

L T P

Cum. Ref. No.: CS510

3 0 0
 Total Contact hrs : 45 Total marks: 100
 Theory: 45
 Practical:
 Pre requisite: 103, 104, CS408
 Credit: 3

Theory: 100
 End Term Exam: 70
 I. A.: 30
 Practical:
 End Term Exam:
 I.A :

Theory
 Total Periods : 45
 Periods : 3 P/W

| UNIT TOPIC/SUB-TOPIC | TOTAL HRS. |
|------------------------------------------------------------------------------|------------|
| 1. Basic Concepts | 4 |
| 1.1 Graphs and Subgraphs | |
| 1.2 Isomorphism and Degrees | |
| 1.3 Walks and Connected Graphs | |
| 1.4 Cycles in Graphs | |
| 1.5 Cut-vertices and Cut-edges | |
| 1.6 Matrix Representations of Graphs | |
| 2. Eulerian and Hamiltonian Graphs | 4 |
| 2.1 Eulerian Graphs | |
| 2.2 Hamiltonian Graphs | |
| 2.3 Weighted Graphs | |
| 3. Bipartite Graphs | 3 |
| 3.1 Bipartite Graphs | |
| 3.2 Perfect Matchings — The Marriage Problem | |
| 3.3 Trees | |
| 3.4 Spanning Trees | |
| 4. Planar Graphs | 5 |
| 4.1 Definitions | |
| 4.2 Euler Formula | |
| 4.3 Characterization of Planar Graphs - Kuratowski's Theorem (without proof) | |
| 4.4 Colourings of Planar Graphs (vertex colouring only) | |
| 5. Directed Graphs | 6 |
| 5.1 Definitions and Representation | |
| 5.2 Connectivity in Digraphs | |
| 5.3 Strong Orientation of Graphs | |
| 5.4 Eulerian Digraphs | |
| 5.5 Tournaments | |
| 6. Graph Algorithms | 6 |
| 6.1 Depth-First and Breadth-First Algorithms | |
| 6.2 Shortest Path Algorithms | |
| 6.3 Minimal Spanning Trees | |
| 7. Combinatorics | 6 |
| 7.1 Counting Principles | |
| 7.1.1 Sum and Product Rules | |
| 7.1.2 Counting Functions | |
| 7.1.3 Binomial and Multinomial Theorems | |
| 7.1.4 Inclusion and Exclusion Principle | |
| 7.1.5 Marriage Problem Revisited / | |
| 7.2 Ramsey Theory | 4 |
| 7.2.1 The Pigeonhole Principle | |

| | |
|---------------------------------------------------|----|
| 7.2.2 Ramsey's Theorem (without proof) | |
| 7.2.3 Examples of Ramsey's Theorem | |
| 7.3 Difference Equation | 5 |
| 7.3.1 Difference Operator | |
| 7.3.2 Linear Difference Equations | |
| 7.3.3 First-Order Linear Equations | |
| 7.3.4 Linear Equations with constant coefficients | |
| 7.3.5 Systems of Difference Equations | |
| 7.4 Block Design and Error-correcting codes | 2 |
| Total | 45 |

REFERENCE BOOKS :

1. Graph Theory and Applications - by N Deo - Prentice Hall
2. Graph Theory — by F.Harary - Narosa Publishing House
3. Introduction Combinatorial Mathematics — by C.L.Liu
4. Discrete Mathematics for Computer Scientists - by J.K-Truss - Addison-Wesley

ELECTIVE COURSES

Pattern Recognition

| | | | | |
|-----------------------------|---|------------------|--|----------------------|
| L | T | P | | Cum. Ref. No.: CS601 |
| 3 | 0 | 0 | | |
| Total Contact hrs : 45 | | Total marks: 100 | | Theory: 100 |
| Theory: 45 | | | | End Term Exam: 70 |
| Practical: | | | | I. A.: 30 |
| Pre requisite: CS502, CS409 | | | | Practical: |
| Credit: 3 | | | | End Term Exam: |
| | | | | I.A : |
| Theory | | | | |
| Total Periods : 45 | | | | |
| Periods : 3 P/W | | | | |

| UNIT TOPIC/SUB-TOPIC | TOTAL HRS. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1. Introduction to Pattern Recognition, applications of Pattern Recognition | 5 |
| 2. Hyperplane properties and design functions, minimum distance pattern classification with simple and multiple prototypes | 10 |
| 3. Clustering — K means and isodata algorithm, Pattern classification by likelihood functions, Bayes classifier, Learning and estimation of mean Vector and Covariance Matrix | 10 |
| 4. Trainable pattern classifier — Gradient technique, Robbins - Monre algorithm, potential functions and least mean square errors | 10 |
| 5. Feature selection by entropy minimization, Karhuner Lucke expansion and divergence maximization | 10 |
| TOTAL | 45 |

REFERENCE BOOKS:

1. Pattern Recognition Principles — By Tou & Conzalez — Addison Wesley
2. Pattern Classification & Scene Analysis — by Duda & Hord — Addison Wesley

Soft Computing

L T P
3 0 0
Total Contact hrs : 45
Theory: 45
Practical:
Pre requisite: CS409
Credit: 3

Total marks: 100

Cum. Ref. No.: CS602

Theory: 100
End Term Exam: 70
I. A.: 30
Practical:
End Term Exam:
I.A :

Theory
Total Periods : 45
Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

| | TOTAL HRS |
|--------------------------------------------------|----------------------|
| 1. Introduction and overview | 5 |
| 1.1 Introduction | |
| 1.2 Intelligent Systems | |
| 1.2.1 Artificial Neural Network | |
| 1.2.2 Fuzzy Theory | |
| 1.2.3 Genetic Algorithms | |
| 1.2.4 Rough Sets | |
| 1.2.5 Chaotic Systems | |
| 1.2.6 Multisets | |
| 2. Fuzzy Systems | 10 |
| 2.1 Fuzzy sets and operation on Fuzzy sets | |
| 2.2 Fuzzy Relations and its Operation . | |
| 2.2.1 Fuzzy Relational Equations | |
| 2.2.2 Fuzzy Rule-base | |
| 2.3 Fuzzy Measures | |
| 2.3.1 Belief Measures | |
| 2.3.2 Probability Measures | |
| 2.3.3 Possibility Measures | |
| 2.3.4 Measures of Fuzziness | |
| 2.3.5 Fuzzy Arithmaric | |
| 2.4 Fuzzy Logic and Approximate Reasoning | |
| 2.4.1 Truth values in Fuzzy logic | |
| 2.4.2 Approximate Reasoning | |
| 2.4.3 Fuzzy Expert Systems | |
| 2.5 Application of Fuzzy Theory | |
| 2.5.1 Fuzzy Pattern Recognition | |
| 2.5.2 Fuzzy Clustering | |
| 2.5.3 Fuzzy Relational Database | |
| 2.5.4 Human Machine interaction | |
| 3. Artificial Neural Network | 10 |
| 3.1 Introduction | |
| 3.2 Supervised Learning and Feedforward networks | |
| 3.2.1 Perceptron learning rules | |
| 3.2.2 Adaline | |
| 3.2.3 Back propagation | |

| | | |
|-------|-------------------------------------------------------------------------------------------------------------------|-----------|
| 3.3 | Feedback Networks | |
| 3.3.1 | Hop field Networks | |
| 3.3.2 | Associative Memory | |
| 3.3.3 | Boltzman Machine | |
| 3.4 | Unsupervised Learning | |
| 3.4.1 | Signal Hebbian learning rule / | |
| 3.4.2 | Competitive learning rules | |
| 3.4.3 | Self organizing Feature Maps | |
| 3.5 | Recurrent Neural Network | |
| 3.5.1 | Real-time Recurrent learning | |
| 3.5.2 | Reinforcement learning | |
| 4. | Genetic Algorithms | 5 |
| 4.1 | Basics of GA | |
| 4.2 | Applications | |
| 4.2.1 | Parameter learning | |
| 4.2.2 | Path Planning | |
| 4.2.3 | Systems Identification & Control | |
| 5. | Belief Networks | 4 |
| 5.1 | Dempster-Shafer Theory | |
| 5.2 | Pearl's Belief Revision Algorithm | |
| 6. | Synergism of Soft Computing Tools | 6 |
| 6.1 | Neuro-Belief, Neuro -GA, Fuzzy-Belief and Neuro-Fuzzy-GA synergisms | |
| 7. | Engineering Applications in Reasoning, Pattern Recognition, Image Understanding, Control and Signal Processing | 5 |
| | TOTAL | 45 |

REFERENCE BOOKS:

1. Artificial Intelligence and Soft Computing: Behavioral and Cognitive Modeling of the Human Brain - by Amit Konar - CRC Press
2. Neural Networks: Algorithms, Applications and Programming Techniques - by James A Freeman and David M. Skapura - Addison Wesley Publishing Company
3. Fuzzy Logic and Expert systems Applications - by Cornelius T. Leondes
4. Practical Applications of Computational Intelligence Techniques - by LakhmiJain and Philippe De Wilde Kluwer - Academic Publishers
5. Genetic Algorithms — by David Goldberg - Addison Wesley

Optimisation Technique

L T P
3 0 0

Cum. Ref. No.: CS603

Total Contact hrs : 45 Total marks: 100

Theory: 45

Theory: 100

End Term Exam: 70

Practical:

I. A.: 30

Pre requisite: 103,104, CS408

Practical:

Credit: 3

End Term Exam:

I.A :

Theory

Total Periods : 45

Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

**TOTAL
HRS.**

1. Introduction to Operation Research

2

| | | |
|-----|--------------------------------------------------|---|
| 1.1 | Mathematical Operations Research Model | |
| 1.2 | Operation Research Techniques | |
| 1.3 | Problem Modelling | |
| | 1.3.1 Definition of the Problem | |
| | 1.3.2 Construction of Model | |
| | 1.3.3 Solution of Model | |
| | 1.3.4 Validation of Model | |
| | 1.3.5 Implementation of Model | |
| 2. | Linear Programming | 7 |
| | 2.1 Construction of the LP Model | |
| | 2.2 Graphical Solution of an LP Problem | |
| | 2.2.1 Solution of a Maximization Model | |
| | 2.2.2 Solution of a Minimization Model | |
| | 2.2.3 Slack, Surplus and Unrestricted variables | |
| 3. | The Simplex Method | 6 |
| | 3.1 The Simplex Algorithm | |
| | 3.2 Artificial Starting Solution | |
| | 3.3 Simplex iteration for optimum solution | |
| 4. | Transportation and Assignment Model | 7 |
| | 4.1 Defining Transportation Model | |
| | 4.2 The Transportation Algorithm | |
| | 4.2.1 North — West Corner Initial Solution | |
| | 4.2.2 Vogel's Approximation Method | |
| | 4.3 The Assignment Problem (Hungarian Model) | |
| 5. | Decision Analysis | 5 |
| | 5.1 Decision — Making under Risk | |
| | 5.1.1 Expected Value Criterion | |
| | 5.1.2 Variable of the Expected Value Criterion | |
| | 5.2 Decision under Uncertainty | |
| | 5.2.1 Optimistic (Maximax / Minimin principle) | |
| | 5.2.2 Pessimistic (Minimax / Maximin principle) | |
| | 5.2.3 Minimum regret (Savage principle) | |
| | 5.2.4 Hurwicz principle | |
| 6. | Project Management | 7 |
| | 6.1 Linear Programming Formulation / | |
| | 6.2 Critical Path Method (CPM) | |
| | 6.3 Program Evaluation & Review Technique (PERT) | |
| 7. | Inventory Control | 6 |
| | 7.1 Static EOQ Models | |
| | 7.1.1 Classic EOQ Model | |
| | 7.1.2 EOQ with Price Break | |
| | 7.1.3 Multi-item EOQ with Storage Limitation | |
| | 7.2 Probabilistic Models | |
| | 7.2.1 Continuous Review Models | |
| | 7.2.2 Single Period Models | |
| | 7.2.3 Multi Period Models | |
| 8. | Queueing Theory | 5 |
| | 8.1 Elements of Queueing Model | |
| | 8.2 Role of Exponential Distribution | |
| | 8.3 Pure Birth & Death Models | |
| | 8.4 Specialised Position Queues | |
| | 8.4.1 Steady State Measure & Performance | |
| | 8.4.2 Single Server Model | |
| | 8.4.3 Multiple Server Model | |

8.4.4 Machine Servicing Model

TOTAL 45

REFERENCE BOOKS :

1. Operation Research - An Introduction by Hamdy A. Taha Sixth Edition PHI
2. Operation Research by C.S. Mustafi

Digital Signal Processing

L T P
3 0 0

Cum. Ref. No.: CS604

Total Contact hrs : 45

Total marks: 100

Theory: 100

Theory: 45

End Term Exam: 70

Practical:

I. A.: 30

Pre requisite: CS403, CS407

Practical:

Credit: 3

End Term Exam:

I.A :

Theory

Total Periods : 45

Periods : 3 P/W

UNIT TOPIC/SUB-TOPIC

TOTAL
HRS.

- | | | |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1. | Concept of Signal Analysis Discrete signals, operations on discrete signals, decimation and interpolation, discrete — time harmonics & sinusoids, aliasing and sampling theorem, random signals | 3 |
| 2. | Discrete — Time Systems, discrete time operators, system classifications, digital filters, described by difference equations, impulse response of digital filters, stability of discrete — time LTI systems | 3 |
| 3. | Fourier Analysis Fourier Series, simplifications through signal symmetry, Parseval's . relation and the power in periodic signals, the spectrum of periodic signals, properties of fourier series, signal reconstruction and the Gibbs effect, system response to periodic inputs, the Dirichlet kernel and the Gibbs effect, the fourier series, orthogonality, and least squares, existence, convergence and uniqueness | 5 |
| 4. | Fourier Transform Fourier transform pairs and properties, system analysis using the fourier transform, frequency response of filters, energy and power Spectral density, time band-width measures | 3 |
| 5. | Laplace Transform Properties of the Laplace Transform, Poles and Zeros of the Transfer Function and inverse Laplace Transform & system analysis, connections. Application of Laplace Transform | 4 |
| 6. | Sampling & Quantization Ideal sampling, sampling, interpolation and signal recovery, quantization, digital processing of analog signals, compact disc digital audio, dynamic range processors | 3 |
| 7. | The Discrete - Time Fourier Transform (DTFT) : DTFT and fourier transforms, properties of the DTFT, transfer functions, system analysis using the DTFT, connections, ideal filters, frequency response of discrete algorithms, or sampling and sampling rate conversion | 4 |
| 8. | The DFT & FFT | 5 |

| | | |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| | Properties of the DFT, connections, approximating the DTFT by the DFT, the DFT of periodic signals, the DFT of nonperiodic signals, spectral smoothing by time windows, applications in signal processing, spectrum estimation, matrix formulation of the DFT & IDFT, the FFT | |
| 9. | z-Transform | 6 |
| | Two sided z-transform, properties of the ztransform, poles, zeros and the Z-plane, transfer functions, inverse Ztransform, one sided Z-transform, Z-transform & system analysis, frequency response, conversions, transfer functions realization, interconnected systems, minimum-phase systems, frequency response, allpass filters | |
| 10. | IIR Digital Filters | 4 |
| | Design, response matching, matched Z-transform for factored forms, mapping from discrete algorithms, bilinear transformation, spectral transformation for IIR filters | |
| 11. | FIR Digital Filters | 5 |
| | Symmetric sequences and linear phase, window based design, half-band FIR filters, FIR filter design by frequency sampling, optimal linear-phase FIR filters, maximally flat FIR filters, FIR differentiators and Hilbert transformers. Least squares and Adaptive signal processing. | |
| | | TOTAL |
| | | 45 |

REFERENCE BOOKS:

1. Digital Signal Processing - by A. V. Oppenheim & R. W. Schaffer - PH
2. Analog & Digital Signal Processing — by Ashok Ambardar — Books/Cole Publishing Co.
3. Theory & Applications of Digital Signal Processing - by R. Rabins & B. Gold (PH)

LIST OF EQUIPMENT FOR THE STATE OF MIZORAM

- | | |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------|
| | Hardware |
| 1. | Digital Power 1C supply |
| 2. | Electronic Digital Multi meter |
| 3. | CRO dual trace |
| 4. | Pulse Generator |
| 5. | Logic Probes (TTL & CMOS) |
| 6. | Digital 1C Trainers (TrL) |
| 7. | Digital logic Trainers (TTL) |
| 8. | Logic Trainer Boards |
| 9. | Microprocessor |
| 10. | Logic Analyser |
| 11. | 8255 Study Card |
| 12. | 8251 Study Card |
| 13. | (Servers & Clients) Pentium III/IV, 866 MHz or higher, 128/256 MB RAM, 20 GB or higher HDD, CD drive, FDD (1.44 MB), SVGA Color monitor. Mouse |
| 14. | Networking including accessories (hub, switch, bridges, router, cable etc.) |
| 15. | CD writer. |
| 16. | Plotter |
| 17. | Printers |
| 18. | Scanner |
| 19. | Digital Camera |
| 20. | Video Capture Card |
| 21. | Multimedia Kit |
| 22. | VSAT for Internet or equivalent as available. |

Software

1. Office 2000
2. Visual Studio
3. Norton Andvirus
4. SPSS
5. Flash
6. AutoCAD
7. Tool Book
8. Author ware
9. Corel Draw
10. Frontpage
11. 3DMAX
12. JAVA
13. Oracle & D2K
14. Oracle Designer
15. Language compilers
(C, C++, Pascal, COBOL, LISP, Prolog, &etc.)
16. Premiere
17. Photoshop
18. Director
19. PageMaker
20. UNIX
21. Windows - NT/2000/98/millennium

LIST OF RESOURCE PERSONS

| Sl. No. | Name | Organisation |
|---------|------------------------|------------------------------------------------------------------------------------------------|
| 1. | Prof. M. K. Ray | Jadavpur University, Calcutta |
| 2. | Prof.(Ms.)J.Sil | Calcutta University, Calcutta |
| 3. | Sri N. Chaki | Naval Post Graduate School, California, USA & On-lien from Calcutta University, Calcutta |
| 4. | Sri H. Rahman | Indian Instt. Of Information Tech., Calcutta |
| 5. | Prof. S. Bandyopadhyay | Calcutta University, Calcutta |
| 6. | Prof. S. Bhattacharya | Indian Instt. Of Information Tech., Calcutta |
| 7. | Dr. P. N. Basu | CMC Ltd., Calcutta |
| 8. | Dr. R. P. Dutta | CMC Ltd., Calcutta |
| 9. | Sri S. Chowdhury | Calcutta University, Calcutta |
| 10. | Prof. D. Raychowdhury | Calcutta University, Calcutta |
| 11. | Prof. C. Majumder | Jadavpur University, Calcutta |
| 12. | Dr. S. K. Chakraborty | TTTI, Calcutta |
| 13. | Prof. D. Ray | TTTI, Calcutta |
| 14. | Sn N. De | TTTI, Calcutta |
| 15. | Dr. Siddhartha Ray | TTTI, Calcutta |
| 16. | Dr. S. Majumder | CPSC, Manila, On-lien from TTTI, Calcutta |
| 17. | Sri R. Chatterjee | TTTI, Calcutta |
| 18. | Dr. R. Dasgupta | TTTI, Calcutta |

Document Preparation

1. Sri Mainak Mandal, TTTI, Calcutta
2. Sri Subrata Mitra, TTTI, Calcutta
3. Sri Utpal Chakraborty, TITI, Calcutta