# SACRED HEART COLLEGE (AUTONOMOUS), CHALAKUDY

# DEGREE OF
# MASTER OF SCIENCE (M.Sc.)
# IN
# COMPUTER SCIENCE

# AS PER

## CHOICE BASED CREDIT AND SEMESTER SYSTEM - CBCSS (PG)

**OBE BASED PROGRAMME CURRICULUM**
(EFFECTIVE FROM 2024 ADMISSION ONWARDS)

**BOARD OF STUDIES IN COMPUTER SCIENCE AND APPLICATIONS (PG)**

# CONTENTS

# REGULATIONS FOR THE DEGREE OF MASTER OF SCIENCE (COMPUTER SCIENCE)

# CBCSS – PG

### EFFECTIVE FROM 2024 ADMISSION ONWARDS

## 1. PROGRAMME OBJECTIVES

The course of the MSc (Computer Science) Programme is designed with the following objectives:

1. To equip students to take up challenging research-oriented responsibilities and courses for their higher studies/profession.
2. To train and equip the students to meet the requirements of the Software industry in the country and outside.
3. To motivate and support the students to prepare and qualify challenging competitive examinations such as JRF/NET/JAM/GATE etc.

## 2. PROGRAMME OUTCOME (PO)

After the successful completion of the Post Graduate Programme, M.Sc Computer Science at University of Calicut, a student would have :

| | |
|---|---|
| **PO1**: | Attained in depth knowledge of foundations of computing. |
| **PO2**: | Development of soft skills and practicing professional ethics. |
| **PO3:** | An ability to understand, analyze and design efficient algorithms. |
| **PO4:** | Apply computer science theory and software development concepts to construct computing-based solutions. |
| **PO5:** | To make them employable according to the current demand of the IT Industry and responsible citizens. |
| **PO6:** | An ability to understand and solve emerging research problems. |
| **PO7:** | Develop programming skills to implement research projects. |

## 3. PROGRAMME SPECIFIC OUTCOME (PSO)

| | |
|---|---|
| **PSO1**: | Evaluate complex real-world problems by applying principles of theoretical computing, engineering and Mathematical models. |
| **PSO2:** | Modern Tool usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations. |
| **PSO3:** | Understand all dimensions of the concepts of software application development and projects. |
| **PSO4:** | Aware the students to publish their work in reputed journals. |
| **PSO5:** | Conceive Project Management capabilities to solve real world problems in accordance to the needs of the industry, in a specific time frame. |
| **PSO6:** | Design and develop computer programs/computer-based systems in the field of Computer Sciences viz. Computational Intelligence, Machine learning, Web technology, Information Retrieval Systems, Data Analytics, Communication and networking. |
| **PSO7:** | To prepare the students to address the challenging requirements coming from the enterprise applications. |

## 4. ADMISSION

1. The admission to all M.Sc Computer Science programmes shall be as per the rules and regulations of the University.
2. The eligibility criteria for admission shall be as announced by the University from time to time.
3. Separate rank lists shall be drawn up for reserved seats as per the existing rules.
4. The college shall make available to all the admitted students the information regarding all the courses including electives offered with syllabus and credit for the entire course.
5. There shall be a uniform calendar prepared by the University for the Conduct of the programmes.
6. There shall be provision for inter collegiate and inter University transfer in the 2nd and 3rd semester within a period of two weeks from the date of commencement of the semesters.
7. There shall be provision for credit transfer subject to the conditions specified by the Board of Studies concerned.
8. There shall be a uniform calendar prepared by the University for the registration, conduct/schedule of the courses, examinations and publication of results.

## 5. READMISSION

1. There shall be provision for readmission of students.
2. For readmission, the vacancy should be within the sanctioned strength in the parent college. If there is no vacancy in the junior batch of the parent college, readmission can be taken in another college with the junior batch, if there is vacancy within the sanctioned strength in the concerned college.
3. This readmission is not to be treated as college transfer.
4. There should be a gap of at least one semester for readmission.
5. The candidate seeking readmission to a particular semester should have registered for the previous semester examination.
6. Readmission shall be taken within two weeks from the date of commencement of the semester concerned.
7. The Principal can grant readmission to the student, subject to the above conditions, and inform the matter of readmission to the Controller of Examinations within one month of such readmission.
8. If change in scheme occurs while readmission, provision for credit transfer will be subjectto the common guidelines prepared by the Board of Studies/ Faculty concerned.

## 6. DURATION OF THE PROGRAMME

1. The minimum duration for completion of a four semester PG Programme is two years. The maximum period for completion is 4 years.
2. The duration of each semester shall be 90 working days, inclusive of examinations, spread over five months.
3. Odd semesters shall be held from June to October and even semesters from November to March subject the academic calendar of the University.

## 7. PROGRAMME STRUCTURE

1. The Programme includes three types of courses, viz., Core courses (Code C), Elective Courses (Code E) and Audit Courses (Code A).
2. Every student of the MSc Computer Science Programme shall have to work on a project/dissertation of not less than 8 credits under the supervision of a faculty member as per the curriculum. Project/dissertation shall be treated as Core Courses. Project Work is mandatory for all regular Programmes and Comprehensive Viva-voce is optional and these shall be done in the end semester. The combined Credit for the Project Work and Comprehensive Viva-voce shall not be more than 8 (eight) credits subject to a minimum of 4 (four) credit for Project Work. All students have to submit a Project Report/Dissertation in the prescribed structure and format as a part of the Project Work undertaken.

3. Total credit for the Programme shall be 80 (eighty), this describes the weightage of the course concerned and the pattern of distribution is as detailed below
   i) Total Credit for Core Courses shall not be less than 60 (sixty) and not more than 68 (sixty-eight).
   ii) Total Credit for Elective Course shall not be less than 12 (twelve) and not more than 20 (Twenty).
   iii) Total Credits for Comprehensive Viva-voce and Project Work combined together shall be 8 (eight) subject to a minimum of 4 (four) credit for Project Work.
   iv) Total credit in each semester shall vary between 18 to 22.
   v) No course shall have less than 2 credits and more than 5 credits.

1. Elective courses shall be spread over either in the Third & Fourth Semesters combined.
2. Audit Courses: There will be two Audit Courses (Ability Enhancement Course & Professional Competency Course) with 4 credits each. These have to be done one each in the first two semesters. The credits will not be counted for evaluating the overall SGPA & CGPA. The colleges shall conduct examinations for these courses and have to intimate /upload the results of the same to the University on the stipulated date during the III Semester. Students have to obtain only minimum pass requirements in the Audit Courses.
3. A student shall accumulate a minimum of 80 credits for the successful completion of the Programmes.

## 8. REGISTRATION

1. A student shall be permitted to register for a Programme at the time of admission.
2. A student who registers for a Programme shall complete it within 4 years.
3. The college shall send a list of students registered for each Programme in each semester giving the details of courses registered to the university in the prescribed form within 45 days of the commencement of the semester.
4. Students shall be normally permitted to register for the examination if they have required minimum attendance. If the student has a shortage of attendance in a semester, the student shall be permitted to move to the next semester and can write the examination for the entire courses of the semester in which shortage of attendance occurs as supplementary examination only after the completion of the entire Programme. In such cases, a request from the student may be forwarded through the Principal of the college to the Controller of Examinations within two weeks of the commencement of the semester. There will not be any Repeat semester in CBCSS PG 2021.
5. The students who have attendance within the limit, but could not register for the semester examinations, have to apply for token registration, within two weeks of the commencement of the next semester.

## 9. ATTENDANCE

1. The students admitted in the PG Programmes in affiliated colleges shall be required to attend at least 75 percent of the total number of classes (theory/practical) held during each semester. The students having less than prescribed percentage of attendance shall not be allowed to appear for the University examination.
2. Condonation of shortage of attendance for a maximum of 9 days (10% of the working days in a semester) in the case of single condonation and 18 days (20% of the working days in a semester) in the case of double condonation in a semester subject to a maximum of two times (for single condonation only) during the whole period of Post Graduate Programme may be granted by the University as per the existing procedures. In the case of double condonation, only one condonation shall be allowed during the entire Programme.
3. Benefit of condonation of attendance will be granted to the students on health grounds, for participating in University Union activities, meeting of the University bodies /Govt. bodies and participation in other extracurricular activities on production of genuine supporting documents, with the recommendation of the Head of the Department concerned.
4. A student who is not eligible for such condonation shall be observed the provisions as per clause 6.4 of this regulation. The principal should intimate the details of these candidates at the commencement of the next semester.
5. Women students can avail maternity leave as per the existing university rules.

## 10. EXAMINATION

1. There shall be a University examination at the end of each semester.
2. Practical examinations shall be conducted by the University at the end of each semester. There will be one internal and one external examiner for the conduct of End Semester Practical examination.
3. Project Work / Dissertation shall be evaluated at the end of the Programme only. There shall be both Internal and External evaluation for the Project Work.
4. There shall be one end-semester examination of 3 hours duration for each theory course and practical course.

## 11. EVALUATION AND GRADING

1. Evaluation: The evaluation scheme for each course shall contain two parts; (a) Internal / Continuous Assessment (CA) and (b) External / End Semester Evaluation (ESE).
2. Of the total, 20% weightage shall be given to Internal evaluation / Continuous assessment and the remaining 80% to External/ESE and the ratio and weightage between Internal and External is 1:4.
3. Primary evaluation for Internal and External shall be based on 6 letter grades (A+, A, B, C, D and E) with numerical values (Grade Points) of 5, 4, 3, 2, 1 & 0 respectively.
4. Grade Point Average: Internal and External components are separately graded and the combined grade point with weightage 1 for Internal and 4 for external shall be applied to calculate the Grade Point Average (GPA) of each course. Letter grade shall be assigned to each course based on the categorization based on Ten-point Scale.
5. Evaluation of Audit Courses: The examination and evaluation shall be conducted by the college itself either in the normal structure or MCQ model from the Question Bank and other guidelines provided by the University/BoS. The Question paper shall be for minimum 20 weightage and a minimum of 2 hour duration for the examination. The result has to be intimated / uploaded to the University during the Third Semester as per the notification of the University.

## 12. INTERNAL EVALUATION – CONTINUOUS ASSESSMENT

1. This assessment shall be based on a predetermined transparent system involving periodic written tests, assignments, seminars and viva-voce in respect of theory courses and based on tests, lab skill and records/viva in respect of practical courses.

2. The criteria and percentage of weightage assigned to various components for internal evaluation are as follows:

(a) Theory: The weightage assigned to various components for internal evaluation for theory papers is as shown below.

| Sl.No | Component | Percentage | Weightage |
|---|---|---|---|
| 1 | Examination /Test | 40% | 2 |
| 2 | Seminars / Presentation | 20% | 1 |
| 3 | Assignment | 20% | 1 |
| 4 | Attendance | 20% | 1 |

To ensure transparency of the evaluation process, the internal assessment grade awarded to the students in each course in a semester shall be published on the notice board at least one week before the commencement of external examination. There shall not be any chance for improvement for internal grade.

The course teacher shall maintain the academic record of each student registered for the course, which shall be forwarded to the University, through the college Principal.

(b) Practical: The mark distribution to award internal continuous assessment marks for practical course should be as follows:

| Sl.No | Component | Percentage | Weightage |
|---|---|---|---|
| 1 | Lab Skill | 40% | 4 |
| 2 | Records/viva | 30% | 3 |
| 3 | Practical Test | 30% | 3 |

Note:

- All students should have a rough record (observation note book) in which they write all the works to be carried out in the lab prior to his/her entering the lab. (S)he may also note down the i/p and o/p that (s)he gives for program verification in the observation note book (rough record).
- All lab works should be neatly recorded in a Laboratory Record Book (Fair Record) in written form. However, program results can be pasted in the left-hand side of the fare record.
- Chairperson, Board of Examination (PG) has to prepare the modalities of the practical papers (list of experiments to be done, number of minimum experiments required in the practical record etc.) and distributed to all departments concerned, at the beginning of each semester itself. Model lists of experiments are provided with the syllabus for each practical session.
- No candidate will be permitted to attend the end-semester test unless he/she produces a certified record of the laboratory.

3. Grades shall be given for the internal evaluation based on the grades A+, A, B, C, D & E with grade points 5,4,3,2, 1 & 0 respectively. The overall grades shall be as per the Ten Point scale.
4. There shall be no separate minimum Grade Point for internal evaluation.
5. To ensure transparency of the evaluation process, the internal assessment marks awarded to the students in each course in a semester shall be published on the notice board before 5 days of commencement of external examination.
6. There shall not be any chance for improvement of internal marks.
7. The course teacher shall maintain the academic record of each student registered for the course, which shall be forwarded to the University, through the college Principal, after being endorsed by the Head of the Department.
8. For each course there shall be class test/s during a semester. Grades should be displayed on the notice board. Valued answer scripts shall be made available to the students for perusal.
9. Each student shall be required to do assignment/s for each course. Assignments after valuation must be returned to the students. The teacher shall define the expected quality of the above in terms of structure, content, presentation etc. and inform the same to the students. Punctuality in submission is to be considered.

10. Every student shall deliver Seminar / Presentation as an internal component for every course and must be evaluated by the respective course teacher in terms of structure, content, presentation and interaction. The soft and hard copies of the seminar report are to be submitted to the course teacher.
11. All the records of Continuous Assessment (CA) must be kept in the college and must be made available for verification by university, if asked for. Calculation of overall internal grade for one theory course will be done as shown below:

| Components | Weightage (W) | Grade Awarded | Grade Point(GP) | Weighted GP | Overall Grade of the course |
|---|---|---|---|---|---|
| Examination /Test | 4 | A | 4 | 16 | Weighted GP/Total Weight 43/10 = 4.30 |
| Seminars / Presentation | 3 | A+ | 5 | 15 | |
| Assignments | 3 | A | 4 | 12 | |
| Total | 10 | | | 43 | O |

Calculation of overall internal grade for one Lab Course will be done as shown below:

| Components | Weightage (W) | Grade Awarded | Grade Point(GP) | Weighted GP | Overall Grade of the course |
|---|---|---|---|---|---|
| Lab Skill | 2 | A | 4 | 8 | Weighted GP/Total Weight 22/5 = 4.40 |
| Records/viva | 1 | A+ | 5 | 5 | |
| Practical Test | 1 | A | 4 | 4 | |
| Viva-voce | 1 | A+ | 5 | 5 | |
| Total | 5 | | | 22 | |

## 13. EXTERNAL / END SEMESTER EVALUATION (ESE)

1. The semester-end examinations in theory courses shall be conducted by the University with question papers set by external experts. The evaluation of the answer scripts shall be done by examiners based on a well-defined scheme of valuation.
2. After the external evaluation, only Grades are to be entered in the space provided in the answer script for individual questions and calculations need to be done only up to the Cumulative Grade Point (CGP) and all other calculations including grades are to be done by the University.
3. Students shall have the right to apply for revaluation or scrutiny as per rules within the time permitted for it.
4. Photocopies of the answer scripts of the external examination shall be made available to the students for scrutiny on request by them as per rules.

4. The external evaluation shall be done immediately after the examination preferably in a Centralized Valuation Camp.
5. The language of writing the examination shall be English.
6. Pattern of questions for external/ESE (theory courses):
   a. Questions shall be set to assess the knowledge acquired, standard, and application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. Due weightage shall be given to each module based on content/teaching hours allotted to each module.
   b. It has to be ensured that questions covering all skills are set. The setter shall also submit a detailed scheme of evaluation along with the question paper.
   c. A question paper shall be a judicious mix of short answer type, short essay type /problem solving type and long essay type questions.
   d. The question shall be prepared in such a way that the answers can be awarded A+, A, B, C, D, E Grades.
   e. Weightage: Different types of questions shall be given different weightages to quantify their range given in the following model:

| Sl. No. | Type of Questions | Individual weightage | Total Weightage | Number of questions to be answered |
|---|---|---|---|---|
| 1 | Short Answer type questions | 2 | 2×4 = 8 | 4 out of 7 |
| 2 | Short essay/ problem solving type | 3 | 3×4 = 12 | 4 out of 7 |
| 3 | Long Essay type questions | 5 | 5×2 = 10 | 2 out of 4 |
| Total | | | 30 | 18 |

   f. Questions should be asked as far as possible from all modules following a uniform distribution.

A sample ESE evaluation sheet of a theory course is illustrated below:

| Type of Question | Qn. No | Grade Awarded | Grade Point | Weightage | Weighted Grade Point | Calculation |
|---|---|---|---|---|---|---|
| Short Answer type | 1 | A+ | 5 | 2 | 10 | Overall Grade of the theory paper = Sum of Weighted Grade Points / Sum of the weightage 115/30 = 3.83 = Grade A+ |
| | 2 | - | - | - | - | |
| | 3 | A | 4 | 2 | 8 | |
| | 4 | C | 2 | 2 | 4 | |
| | 5 | - | - | - | - | |
| | 6 | A | 4 | 2 | 8 | |
| | 7 | - | - | - | | |
| Medium Essay type | 8 | B | 3 | 3 | 9 | |
| | 9 | A+ | 5 | 3 | 15 | |
| | 10 | - | - | - | - | |
| | 11 | - | - | - | - | |
| | 12 | - | - | - | - | |
| | 13 | A | 4 | 3 | 12 | |
| | 14 | B | 3 | 3 | 9 | |
| Long Essay type | 15 | A+ | 5 | 5 | 25 | |
| | 16 | - | - | - | - | |
| | 17 | - | - | - | - | |
| | 18 | B | 3 | 5 | 15 | |
| TOTAL | | | | 30 | 115 | |

7. End Semester Evaluation in Practical Courses shall be conducted and evaluated by both Internal and External Examiners.Mark distribution for practical courses shall be as follows:

| **Component** | **Weightage** |
|---|---|
| Algorithm/Flow diagram/UI diagram/Class | 6 |
| Implementation | 6 |
| Result/ Output | 6 |
| Record | 6 |
| Viva | 6 |
| **Total** | **30** |

A sample ESE evaluation sheet of a theory course is illustrated below:

| Type of Question | Grade Awarded | Grade Point | Weightage | Weighted Grade Point | Calculation |
|---|---|---|---|---|---|
| Algorithm/Flow diagram/UI diagram/Class Diagram | A | 4 | 6 | 24 | 114/30 = 3.80 |
| Implementation | A | 4 | 6 | 24 | |
| Result/ Output | B | 3 | 6 | 18 | |
| Record | A | 4 | 6 | 24 | |
| Viva | A | 4 | 6 | 24 | |
| **Total** | | | **30** | **114** | |

## 14. EVALUATION OF PROJECT WORK / DISSERTATION

1. There shall be External and Internal evaluation for Project Work done and the grading system shall be followed.
2. One component among the Project Work evaluation criteria shall be Viva-voce (Project Work related) and the respective weightage shall be 40%.
3. Consolidated Grade for Project Work is calculated by combining both the External and Internal in the Ratio of 4:1 (80% & 20%).
4. For a pass in Project Work, a student has to secure a minimum of P Grade in External and Internal examination combined. If the students could not secure minimum P Grade in the Project work, they will be treated as failed in that attempt and the students may be allowed to rework and resubmit the same in accordance with the University exam stipulations. There shall be no improvement chance for Project Work.
5. The External and Internal evaluation of the Project Work shall be done based on the following criteria and weightages as detailed below:

| **Sl. No** | **Criteria** | **% of Weightage** | **Weightage** | |
|---|---|---|---|---|
| | | | **External** | **Internal** |
| 1 | Relevance of the topic and Statement of problem, Methodology & Analysis Quality of Report & Presentation | 60% | 24 | 6 |
| 2 | Viva-voce | 40% | 16 | 4 |
| **Total Weightage** | | **100%** | **40** | **10** |

The first component for 60% weightage can be sub-divided into following project implementation components:

| SlNo | Components | Weightage | |
|---|---|---|---|
| | | **External** | **Internal** |
| 1 | Relevance of the Topic, Statement of Objectives, Methodology | 2 | 2 |
| 2 | Quality of Literature Survey/Product Review | 2 | |
| 3 | Quality of Analysis Phase | 2 | |
| 4 | Quality of Design Phase | 2 | |
| 5 | Quality of Implementation/Simulation | 4 | 2 |
| 6 | Quality of Testing/Result Analysis | 2 | |
| 7 | Quality of Contributions | 2 | |
| 8 | Identification of Future Work | 1 | 2 |
| 9 | Quality of Project Report | 4 | |
| 10 | Publications/Presentations out of the Project Work* | 1 | |
| 11 | Quality of Presentation | 1 | |
| 12 | Demonstration of the Project Work | 1 | |
| 13 | General Viva Voce | 16 | 4 |
| | **Total** | **40** | **10** |

## 15. DIRECT GRADING SYSTEM

1. Direct Grading System based on a 10 – Point scale is used to evaluate the performance (External and Internal Examination of students)
2. For all courses (Theory & Practical)/Semester/Overall Programme, Letter grades and GPA/SGPA/CGPA are given on the following way:
   a. First Stage Evaluation for both Internal and External done by the Teachers concerned in the following Scale:

| Grade | Grade Points |
|---|---|
| A+ | 5 |
| A | 4 |
| B | 3 |
| C | 2 |
| D | 1 |
| E | 0 |

b. The Grade Range for both Internal & External shall be :

| Letter Grade | Grade Range | Range of Percentage (%) | Merit Indicator |
|---|---|---|---|
| O | 4.25 - 5.00 | 85.00 - 100.00 | Outstanding |
| A+ | 3.75 - 4.24 | 75.00 - 84.99 | Excellent |
| A | 3.25 - 3.74 | 65.00 - 74.99 | Very Good |
| B+ | 2.75 - 3.24 | 55.00 - 64.99 | Good |
| B | 2.50 - 2.74 | 50.00 - 54.99 | Above Average |
| C | 2.25 - 2.49 | 45.00 - 49.99 | Average |
| P | 2.00 -2.24 | 40.00 - 44.99 | Pass |
| F | < 2.00 | Below 40 | Fail |
| I | 0 | - | Incomplete |
| Ab | 0 | - | Absent |

3. No separate minimum is required for Internal evaluation for a pass, but a minimum P Grade is required for a pass in the external evaluation. However, a minimum P grade is required for pass in a course.
4. A student who fails to secure a minimum grade for a pass in a course will be permitted to write the examination along with the next batch.
5. Improvement of Course- The candidates who wish to improve the grade / grade point of the external examination of a course/s they have passed already can do the same by appearing in the external examination of the concerned semester along with the immediate junior batch
6. Betterment Programme One time- A candidate will be permitted to improve the CGPA of the Programme within a continuous period of four semesters immediately following the completion of the Programme allowing only once for a particular semester. The CGPA for the betterment appearance will be computed based on the SGPA secured in the original or betterment appearance of each semester whichever is higher.

## 16. SEMESTER GRADE POINT AVERAGE (SGPA)

The SGPA is the ratio of sum of the product of the number of credits with the grade pointsscored by a student in all the courses taken by a student and the sum of the number of credits ofall the courses taken by a student.

After the successful completion of a semester, Semester Grade Point Average (SGPA) of a student in that semester is calculated using the formula given below.

Semester Grade Point Average - SGPA (Sj) = Σ(Ci x Gi) / Cr

(SGPA= Total Credit Points awarded in a semester / Total credits of the semester)

Where ‘Sj‘ is the $j^{th}$ semester , ‘Gi’ is the grade point scored by the student in the $i^{th}$ course 'Ci ‘is the credit of the $i^{th}$ course, 'Cr' is the total credits of the semester.

## 17. CUMULATIVE GRADE POINT AVERAGE (CGPA) - CALCULATION

Cumulative Grade Point Average (CGPA) = **Σ** (Ci x Si) / Cr

(CGPA= Total Credit points awarded in all semesters/Total credits of the programme)

Where $C_1$ is the credit of the I$^{st}$ semester S1 is the SGPA of the 1$^{st}$ semester and Cr is the total number of credits in the programme. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme. The SGPA and CGPA shall be rounded off to 2 decimal points.

For the successful completion of a semester, a student should pass all courses and score a minimum SGPA of 2.0. However, the students are permitted to move to the next semester irrespective of their SGPA.

## 18. GRADE CARD

1. The University shall issue to the students grade card on completion of each semester, which shall contain the following information:
    - Name of University
    - Name of College
    - Title of PG Programme
    - Semester concerned
    - Name and Register Number of the student.
    - Code number, Title and Credits of each Course opted in the semester including Audit Courses
    - Letter grade in each course in the semester
    - The total credits, total credit points and SGPA in the Semester (corrected to three decimal places)
2. The final Grade card issued at the end of the final semester shall contain the details of all courses taken during the entire Programme, including those taken over and above the prescribed minimum credits for obtaining the degree. The final grade card shall show CGPA (corrected to three decimal places), percentage of marks (corrected to two decimal places) and the overall letter grade of a student for the entire Programme. The final Grade card will also contain the list of Audit courses.

## 19. AWARD OF DEGREE

The successful completion of all the courses with P Grade shall be the minimum requirement for the award of the degree.

## 20. POSITION CERTIFICATE

The University publishes list of top 10 positions for each Programme after the publication of the Programme results. Position certificates shall be issued to candidates who secure positions from 1st to $10^{th}$ in the list. The position list shall be finalized after the result of revaluation.

The position list shall be prepared in the order of merit based on the CGPA scored by the students. Grace Grade points awarded to the students shall not be counted for fixing the position.

## 21. GRIEVANCE REDRESSAL COMMITTEE

**Department Level Committee:**

The college shall form a Grievance Redressal Committee in each department comprising of course teacher, one senior teacher and elected representative of Students (Association Secretary) as members and the Head of the Department as Chairman. The committee shall have initial jurisdiction over complaints against Continuous Assessment.

**College Level Committee:**

There shall be a college level grievance redressal committee comprising of student adviser, two senior teachers, two staff council members (one shall be elected member) and elected representative of students (College Union Chairperson) as members and the Principal as Chairman. This committee shall address all grievances relating to the internal assessment grades of the students.

**University level:**

The University shall form a Grievance Redressal Committee as per the existing norms.

# II M.Sc COMPUTER SCIENCE(CBCSS)-PROGRAMME STRUCTURE

| LEGEND | |
|---|---|
| **Item** | **Description** |
| C | Credits |
| E | External Component (%) |
| I | Internal Component (%) |
| L | Lecture Hours |
| P | Practical Hours |
| T | Total |

## SEMESTER I

| No | Course Code | Course Name | C | Weightage | | | Hrs/Week | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | I | E | T | L | P | T |
| 1.1 | CSS1C01 | Discrete Mathematical Structures | 4 | 1 | 4 | 5 | 4 | 0 | 4 |
| 1.2 | CSS1C02 | Advanced Data Structures | 4 | 1 | 4 | 5 | 3 | 2 | 5 |
| 1.3 | CSS1C03 | Theory of Computation 0 | 4 | 1 | 4 | 5 | 4 | 0 | 4 |
| 1.4 | CSS1C04 | The Art of Programming Methodology | 4 | 1 | 4 | 5 | 2 | 2 | 4 |
| 1.5 | CSS1C05 | Computer Organization Architecture | 4 | 1 | 4 | 5 | 4 | 0 | 4 |
| 1.6 | CSS1L01 | Practical I | 2 | 1 | 4 | 5 | 0 | 4 | 4 |
| 1.7 | CSS1A01 | Introduction to Research (Ability Enhancement Audit Course) | 4 | 5 | 0 | 5 | 0 | 0 | 0 |
| **Total Credits (Excluding Audit Course): 22** | | | | | | | **17** | **8** | **25** |

## SEMESTER II

| No | Course Code | Course Name | C | Weightage | | | Hrs/Week | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | I | E | T | L | P | T |
| 2.1 | CSS2C06 | Design and Analysis of Algorithms | 4 | 1 | 4 | 5 | 4 | 0 | 4 |
| 2.2 | CSS2C07 | Operating System Concepts | 4 | 1 | 4 | 5 | 3 | 2 | 5 |
| 2.3 | CSS2C08 | Computer Networks | 4 | 1 | 4 | 5 | 4 | 0 | 4 |
| 2.4 | CSS2C09 | Computational Intelligence | 4 | 1 | 4 | 5 | 2 | 2 | 4 |
| 2.5 | CSS2C10 | Principles of Software Engineering | 4 | 1 | 4 | 5 | 4 | 0 | 4 |

| No | Course Code | Course Name | C | Weightage | | | Hrs/Week | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | I | E | T | L | P | T |
| 2.6 | CSS2L02 | Practical II | 2 | 1 | 4 | 5 | 0 | 4 | 4 |
| 2.7 | CSS2A02 | Term Paper (Professional Competency Audit Course) | 4 | 5 | 0 | 5 | 0 | 0 | 0 |
| **Total Credits (Excluding Audit Course): 22** | | | | | | | **17** | **8** | **25** |

## SEMESTER III

| No | Course Code | Course Name | C | Weightage | | | Hrs/Week | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | I | E | T | L | P | T |
| 3.1 | CSS3C11 | Advanced Database Management System | 4 | 1 | 4 | 5 | 3 | 1 | 4 |
| 3.2 | CSS3C12 | Object Oriented Programming Concepts | 4 | 1 | 4 | 5 | 2 | 3 | 5 |
| 3.3 | CSS3C13 | Principles of Compilers | 4 | 1 | 4 | 5 | 4 | 0 | 4 |
| 3.4 | CSS3E01 | Elective I | 4 | 1 | 4 | 5 | 4 | 0 | 4 |
| 3.5 | CSS3E02 | Elective 2 | 4 | 1 | 4 | 5 | 4 | 0 | 4 |
| 3.6 | CSS3L03 | Practical III | 2 | 1 | 4 | 5 | 0 | 4 | 4 |
| **Total Credits (Excluding Audit Course): 22** | | | | | | | **17** | **8** | **25** |

| List of Elective Courses for CSS3E01 | |
|---|---|
| Course Code | Course Name |
| CSS3E01a | Computer Graphics |
| CSS3E01b | Introduction to Soft Computing |
| CSS3E01c | Web Technology |
| CSS3E01d | Bioinformatics |
| CSS3E01e | Computer Optimization Techniques |
| CSS3E01f | Numerical and Statistical Methods |

| List of Elective Courses for CSS3E02 | |
|---|---|
| Course Code | Course Name |
| CSS3E02a | Pattern Recognition |
| CSS3E02b | Wireless and Mobile Networks |
| CSS3E02c | Cryptography and Network Security |
| CSS3E02d | Advanced Web Technology |
| CSS3E02e | Virtualisation and Cloud Computing |
| CSS3E02f | Data Warehousing and Data Mining |

## SEMESTER IV

| No | Course Code | Course Name | C | Weightage | | | Hrs/Week | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | I | E | T | L | P | T |
| 4.1 | CSS4E03 | Elective 3 | 3 | 1 | 4 | 5 | 5 | 0 | 5 |
| 4.2 | CSS4E04 | Elective 4 | 3 | 1 | 4 | 5 | 5 | 0 | 5 |
| 4.3 | CSS4P01 | Project Requirements Analysis & Design Related Discussion | 8 | 1 | 4 | 5 | 3 | 1 | 4 |
| | | Project Coding, Testing & Implementation Related Discussion | | | | | 2 | 2 | 4 |
| | | Project Evaluation & Assessment | | | | | 2 | 0 | 2 |
| | | Project Lab Work | | | | | 0 | 5 | 5 |
| **Total Credits (Excluding Audit Course): 14** | | | | | | | **17** | **8** | **25** |

| List of Elective Courses for CSS4E03 | |
|---|---|
| Course Code | Course Name |
| CSS4E03a | Data Compression |
| CSS4E03b | Pervasive Computing |
| CSS4E03c | System Security |
| CSS4E03d | Molecular Simulation and Modelling |
| CSS4E03e | Fundamentals of Big Data |
| CSS4E03f | Web Engineering |

| List of Elective Courses for CSS4E04 | |
|---|---|
| Course Code | Course Name |
| CSS4E04a | Digital Image Processing |
| CSS4E04b | Advanced Topics In Database Design |
| CSS4E04c | Software Development for Portable Devices |
| CSS4E04d | Storage Area Networks |
| CSS4E04e | Semantic Web |
| CSS4E04f | Advanced Java Programming |

# III. DETAILED SYLLABUS

## SEMESTER I

### CSS1C01 – DISCRETE MATHEMATICAL STRUCTURES

**Objectives**: To introduce discrete mathematics concepts necessary to understand the basic foundation of Computer Science.

**Course Outcome**

CO1: Verify the validity of an argument using propositional and predicate logic.
CO2: Understand allocations of set theory by applying operations on set.
CO3: Apply operations of relations and functions in discrete structures.
CO4: Understand applications of Lattices and Boolean algebra in computer science domain.
CO5: Identify Group, Ring and Field in Group Theory
CO6: Understand applications of Graph Theory and Tree
CO7: Apply the concepts of graph theory and trees to formulate problem solving

**Course Outline**

**Unit I:** Sets and Mathematical Logic: Set Theory - Types of sets, Set operations, Principles of Inclusion and Exclusion. Mathematical Logic - Propositional Calculus - Statement, Connectives, Conditional and Biconditional, Equivalence of Formula, Well Formed Formula, Tautologies, Duality Law, Functionally Complete Sets of Connectives, Normal Forms, Theory of Inference for the Statement Calculus, Predicate Calculus - Statement Functions, Variables and Quantifiers, Free and Bound Variables, Theory of Inference for the Predicate Calculus.

**Unit II:** Functions and Relations: Functions – Types of Functions, Composition of Functions and Inverse Functions. Relations - Relations and Their Properties, Functions as relations, Closure of Relations, Composition of relations, Equivalence Relations and Partitions. Partial Ordering, Hasse Diagram. The Pigeon Hole Principle.

**Unit III:** Lattices and Boolean Algebra - Lattices and Algebraic Systems, Principles of Duality, Basic Properties of Algebraic Systems Defined by Lattices, Distributive Lattices and Complemented Lattices. Boolean Lattices and Boolean Algebras. Boolean Functions and Boolean Expressions.

**Unit IV:** Group Theory – Definition and Elementary Properties - Permutation Groups, Cyclic Groups – Subgroups - Cosets and Lagrange’s Theorem, Semigroup and Monoid. Homeomorphism and Isomorphism. Rings, Integral Domains and Fields.

**Unit V:** Graph Theory – Introduction, Directed Graph, Undirected Graph, Connected and Disconnected Graphs, Bipartite Graph, Complete Bipartite Graph, Isomorphic Graphs, Subgraph. Paths and Circuits. Shortest Paths in Weighted Graphs - Dijkstra's Algorithm. Eulerian Paths and Circuits, Hamiltonian Paths and Circuits. Trees - Spanning Trees and Cut-Sets, Minimum Spanning Trees - Kruskal's Algorithm, Prim's Algorithm.

**References:**

1. C Liu and D. Mohapatra, *Elements of Discrete Mathematics - A Computer Oriented Approach*, TMH, ISBN: 1259006395.
2. Alan Doerr and Kenneth Levassur, *Applied Discrete Structure for Computer Science*, Galgotia Publications Pvt. Ltd, ISBN: 9780574217554.
3. J. K. Sharma, *Discrete Mathematics*, Macmillan Publishers India Limited, ISBN: 1403924759.
4. J. P. Tremblay and R. Manohar, *Discrete Mathematical Structures with Application to Computer Science*, McGraw-Hill Companies, ASIN: B001FPXR5Y.

## CSS1C02 – ADVANCED DATA STRUCTURES

**Objective:** To introduce basic and advanced data structures dealing with algorithm development and problem solving.

### Course Outcome

CO1: Summarize different categories of data structures.
CO2: Design algorithms to perform operations with linear and non – linear data structures.
CO3: Describe how arrays, linked lists, stacks, queues, trees and graphs are represented in memory and used by algorithms.
CO4: Describe common applications for arrays, linked lists, stack, queue, tree and graphs.
CO5: Demonstrate different methods for traversing trees.
CO6: Design and implement an appropriate hashing function for an application.
CO7: Discuss the computational efficiency of the principal algorithms for sorting, searching and hashing.
CO8: Describes various types of trees and heap structures.

### Course Outline

**Unit I:** Data structure - definition - types & operations, characteristics of data structures - Abstract Data Type (ADT) – algorithms - concepts - definition - objectives of algorithms - quality of an algorithm - space complexity and time complexity of an algorithm.

**Unit II:** Counting Techniques: Basic counting techniques - permutations and combinations, asymptotic behaviour of functions. Linear data structures - Arrays - records - representation - data structure operations - traversing, inserting and deleting - sorting and searching - sorting algorithms - linear search & binary search - complexity. Linked lists - operations and implementations, - Stack - operations and its implementations (both array and linked list) - Applications - parsing arithmetic expressions, conversion and evaluating expressions. Recursion - characteristics of recursion, types of recursion applications of recursion in algorithms - comparison of recursive and non-recursive algorithms. Queue - operations and its implementations (both array and linked list) - circular queue - dequeue - priority queues, recursive lists, heterogeneous lists, deterministic skip lists, doubly linked lists and circular lists sparse matrix- representation.

**Unit III:** Non-linear Data Structures - trees - terminology - tree traversals algorithms - Binary trees - threaded binary trees - binary search trees - traversals and operations on BST heap Tree - balanced trees - M-way trees - B and B+ trees, Red Black Tree, Digital Search Tree, Tries, Treaps, Huffman algorithm for extended binary tree - operations and their implementation. Graphs - representation of graphs – operations - traversals and their implementation.

**Unit IV:** Hashing - overview of hashing - hash tables - hash functions and their computations open addressing - linear probing - quadratic probing - double hashing algorithms and their implementations - rehashing - extendable hashing - separate chaining - hashing efficiency - heaps - overview of heaps - implementation and operations.

**Unit V:** Heap structures - Min-Max heaps - Deaps - leftist heaps - binomial heaps - Fibonacci heaps -binary heaps - skew heaps - pairing heaps - applications - amortized analysis an unrelated puzzle - Binomial queues - skew heaps - Fibonacci heaps - Splay trees.

**References:**


1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, *Data Structures and Algorithms*, Addison-Wesley, ISBN: 978-0201000238.
2. Horowitz E and Sahni S, *Fundamentals of Data Structures*, Computer Science Press, ISBN: 9780716780427.
3. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, *Fundamentals of Data Structures in C*, Silicon Press, ISBN: 0929306406.
4. Richard F. Gilberg and Behrouz A. Forouzan, *Data Structures: A Pseudocode Approach With C*, Thomson Brooks/Cole Publications, Course Technology, ISBN: 9780534390808.
5. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, *Data Structure using C*, Prentice- Hall, ISBN: 9780131997462.
6. Robert Kruse, Tondo C L and Bruce Leung, *Data Structures & Program Design in C*, Pearson India, 2nd Edition, ISBN: 9788177584233.
7. U. A. Deshpande and O. G. Kakde, *Data Structures & Algorithms*, ISTE Learning Materials Centre, New Delhi, ISBN: 9788188057054.
8. Thomas H Cormen, Charles E Leiserson, and Ronald L Rivest, *Introduction to Algorithms*, 3rd Edition, Prentice Hall of India Private Limited, New Delhi, ISBN: 978-0262033848.
9. Seymour Lipschutz, *Data Structures With C*, 1st Edition, Tata Mcgraw Hill Education Private Limited, ISBN: 0070701989.
10. Jean-Paul Tremblay, Paul G. Sorenson, P. G. Sorenson, *Introduction to Data Structures with Applications*, 2nd Edition, Mcgraw-Hill College, ISBN: 0070651574.

## CSS1C03 – THEORY OF COMPUTATION

**Objectives:** To provide the students with an understanding of basic concepts in the theory of computation.

### Course Outcome

CO1: Describe broad overview of the theoretical foundations of computer science.

CO2: Understand regular languages and finite automata.

CO3: Apply the concept of context free languages in problem solving.

CO4: Solve various problems of applying normal form techniques, push down automata and Turing Machines.

CO5: Propose solutions for the problems based on computability and decidability.

### Course Outline

**Unit I:** Preliminaries - Introduction to formal proof and inductive proofs - The central concepts of Automata Theory - Alphabets, Strings. Languages - Introduction to automata and grammar - Deterministic Finite Automata, Non-deterministic Finite Automata - Equivalence of Deterministic and Nondeterministic Finite Automata - Finite Automata with Epsilon Transitions - Equivalence of NFA with and without epsilon moves.

**Unit II:** Regular Expressions, Finite Automata and Regular Expressions, Properties of Regular Languages - Pumping lemma and proof for existence of non-regular languages, Closure properties, homomorphism, substitution - Decision Properties - Equivalence and Myhill Nerode and DFA state minimization - Regular Grammar.

**Unit III:** Context Free Languages - Equivalence of CFG and PDA - Normal forms (CNF and GNF) - Closure properties of CFL's - DCFL's and their properties - Decision procedures -CYK algorithm - Pumping lemma and proof for existence of non-context - free languages- Context sensitive languages: Equivalence of LBA and Context Sensitive Grammar (CSG).

**Unit IV:** Turing machines - TM computations - Equivalence of standard TM with multi tape and non deterministic TM's - Turing acceptable, Turing decidable and Turing enumerable language classes - Equivalence of type 0 grammars with TM's - Church thesis - Chomsky hierarchy - Closure properties of recursive and recursively enumerable languages.

**Unit V:** Computability and Decidability - halting problem - reductions - post correspondence problem. Computational complexity - Time and space bounded simulations- Classes P and NP - NP completeness - Cook's theorem.

**References:**


1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, *Introduction to Automata Theory*, Languages of Computation, 3rd Edition, Prentice Hall, ISBN: 0321455363.
2. Linz P, *An Introduction to Formal Languages and Automata*, Narosa Publishing House Pvt. Ltd., New Delhi, ISBN: 9788173197819.
3. Michael Sipser, *Introduction to Theory of Computation*, Cengage Learning India Private Limited, Indian Edition, ISBN: 8131505138.
4. H.R. Lewis and C.H. Papadimitriou, *Elements of Theory of Computation*, 2nd Edition, Prentice Hall, ISBN: 0132624788.
5. J. E. Savage, *Models of Computation*, *Exploring the Power of Computing*, Addison Wesley, 1998, Available at http://cs.brown.edu/~jes/book/.
6. Martin J.C, *Introduction to Languages and Theory of Computation*, Tata McGraw Hill, 3rd Edition, ISBN: 9780070660489.

## CSS1C04 – THE ART OF PROGRAMMING METHODOLOGY

### Objectives:

- To learn the art of designing algorithms and flowcharts.
- To introduce the concept of an algorithmic approach for solving real-life problems.
- To develop competencies for the design and coding of computer programs.
- To learn designing programs with advanced features of C.

### Course Outcome

CO1: Improve ability to develop effective algorithms.
CO2: Understand the fundamental principles of problem-solving using computers.
CO3. Demonstrate the applications of the programming constructs including decision making, looping, arrays and strings.
CO4. Conceptualize modular programming basics using functions, structures and Unions
CO5. Understand features like pointers and macros and to become familiar with programming with files
CO6: Design, develop, implement, test and document well-structured and reliable computer programs using the C programming language.

### Course Outline

Unit I: Part A: Problem Solving - Flow Chart for Structured Programming - Program Charts System Charts - Variables, data names, programming statements - Flow Chart Symbols - Terminal Symbols - I/O - Comments - Connectors - Process - Decision - Loops- Flow Charts of Fundamental Algorithms (mentioned in Part B). Part B: Algorithm Design - Problem Solving Aspect - Top down Design - Formal Conventions Writing Algorithms - Fundamental Algorithms (Discuss the Design of Algorithms only). Part C: Program, Characteristics of a good program - Modular Approach - Programming style - Documentation and Program Maintenance - Compilers and Interpreters - Running and Debugging Programs - Syntax Errors - Run-Time Errors - Logical Errors - Concept of Structured Programming.

Unit II: Introduction to C Programming - overview and importance of C - C Program Structure and Simple programs - Creation and Compilation of C Programs under Linux and Windows Platforms. Elements of C Language and Program constructs - structure of C program - character set, tokens, keywords, identifier - Data types, constants, symbolic constants, variables, declaration, data input and output, assignment statements. Operators in C - arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, special operators, precedence of operators - arithmetic expressions - evaluation of expressions, type conversion in expressions - precedence and associativity - mathematical functions - I/O operations.

Unit III: Decision making - if statement, if else statement, nesting of if else and else if ladder, switch statement, break statement, continue statement, goto statement, return statement. looping - while, do-while, and for loops, nesting of loops, skipping & breaking loops. Arrays - single dimension arrays - accessing array elements - initializing an array, two dimensional & multi-dimensional arrays - memory representation - strings - processing of strings - string manipulation functions.

Unit IV: The Concept of modularization - defining function - types of functions - User defined functions - function prototype and definition - arguments - passing parameters - call by reference - call by value - returning - nesting of functions and recursion - passing arrays & strings to function - returning multiple values - recursion - scope and life time of variables storage class specifiers - automatic, extern, static storage, register storage. Structures & Union definition, giving values to members, structure initialization, comparison of structure variables, arrays of structures, arrays within structures, structures within arrays, structures and functions, Unions, bit-fields.

Unit V: Pointer - pointer operator - pointer expression - declaration of pointer - initializing pointer - de-referencing - pointer to pointer, constant pointer, array of pointers, pointer to function. Files - file handling - defining & opening a file - closing a file - Input/output operations on files - error handling, random access to files, command line arguments - dynamic memory allocation - linked lists (concepts only) - preprocessor directives: macro substitution directives - simple macros - macros with arguments - nesting of macros, compiler control directives.

References:


1. Martin M. Lipschutz and Seymour Lipschutz, *Schaum's Outline of Theory and Problems of Data Processing*, ISBN: 9780070379831 (Unit I Part A).
2. Anil Bikas Chaudhuri, *The Art Of Programming Through Flowcharts & Algorithms*, Laxmi Publications, New Delhi (Unit I Part A).
3. Jean Paul Trembley and Pual G Sorenson, *An Introduction to Data Structures with Applications*, Tata McGraw Hill (Unit I Part B).
4. R G Dromey, *How to Solve by Computer*, Pearson Education, 5th Edition, ISBN: 0134340019 (Unit I Part B).
5. J.B Dixit, *Computer Fundamentals and Programming in C*, Firewall Media, ISBN: 8170088828. (Unit I Part C).
6. Dennie Van Tassel, Program Style, *Design, Efficiency, Debugging, and Testing*, PHI, ISBN: 0137299478 (Unit I Part C).
7. E Balagruswamy, *Programming in ANSI C*, TMH, 5th Edition, ISBN: 0070681821.
8. Kamthane, *Programming in C*, 2nd Edition, Pearson India, ISBN: 8131760316.
9. Brian W. Kernighan and Dennis M. Ritchie, *C Programming Language*, PHI, ISBN: 0131103628.
10. Kanetkar, *Let Us C*, BPB Publications, 8th Edition, ISBN: 1934015253.

## CSS1C05 – COMPUTER ORGANIZATION & ARCHITECTURE

Objectives: To familiarize with the digital fundamentals, computer organization, computer architecture and assembly language programming.

### Course Outcome

CO1: Identify, understand and apply different number systems and codes.

CO2: Understand the digital representation of data in a computer system.

CO3: Understand the general concepts in digital logic design and their use in sequential and combinational circuit design.

CO4: Describe fundamental organization of a computer system.

CO5: Explain addressing modes, instruction formats and program control statements.

CO6: Understand computer arithmetic formulae and solve problems.

CO7: Distinguish the organization of various parts of a system memory hierarchy.

CO8: Identify and compare different methods for computer I/O.

### Course Outline

Unit I: Number systems and Conversions, Boolean Algebra - Truth Tables - Logic gates and Map simplification - flip-flops - design of combinational and sequential circuits - examples of digital circuits - adders, multiplexers, decoders, counters, shift registers - register transfer language and micro operations - data representation - data types, sign and magnitude, complements, fixed-point representation, floating-point representation, other binary codes, error detection codes.

Unit II: Basic computer organization - machine instructions - classification, function, addresses, size, addressing modes - instruction cycle - instruction sequencing. Fundamental concepts - registers, register transfers, performing arithmetic or logic operations, memory read and write, execution of a complete instruction, branch instruction, single bus, two bus, three bus organization, a complete processor - Control unit - hardwired control, micro programmed control, micro instructions-types.

Unit III: Arithmetic & Logic Unit - addition of positive numbers - fast adders - signed addition and subtraction - addition/subtraction logic unit - multiplication of positive numbers - array multiplier, sequential multiplier - signed number multiplication - multiplication using Booth's algorithm - fast multiplication - bit pair recording of multiplication, division-restoring and non-restoring algorithms, floating point numbers and operations.

Unit IV: Main Memory - memory hierarchy - main memory - RAM, ROM - memory cells-cell organization - working - performance considerations - cache memory - virtual memory- memory management requirements - secondary storage - memory interleaving. Input / Output Organization - Accessing I/O ,devices - programmed I/O, interrupt I/O - interrupts - interrupt processing - hardware interrupts - programmable interrupt controller - vectored interrupts - interrupt nesting - daisy chaining - direct memory access (DMA) - DMA operations & DMA Controller, Introduction to I/O interfaces, I/O channels, IO Processors.

Unit V: Architecture - General 8-bit microprocessor and its architecture - 8085 - Functional block diagram - architecture functions of different sections - architecture of 8086 CPU. Instruction Sets - Instruction format - addressing modes - instruction set of 8085 CPU

- Instruction cycle - timing diagrams - different machine cycles - fetch and execute operations

- estimation of execution time - estimation of execution time. Intel 8051 Micro controller - Architecture - basic instructions - basic assembly language programs peripherals: interrupts, timers, parallel port, serial port.

References:


1. V Carl Hamacher, Zvonko Vranesic and Safwat Zaky, *Computer Organization*, Mc-Graw Hill International Edition, 5th Edition, ISBN: 9780071122184.
2. Morris Mano, *Digital Logic and Computer Design*, Prentice Hall of India, ISBN: 0876924178.
3. M Morris Mano, *Computer System Architecture*, Prentice Hall, 3rd Edition. ISBN: 0131755633.
4. William Stallings, *Computer Organization and Architecture*, 9th Edition, Prentice Hall, ISBN: 013293633X.
5. Andrew S Tanenbaum, *Structured Computer Organization*, Prentice Hall, 6th Edition, ISBN: 0132916525.
6. Floyd Thomas L, *Digital Fundamentals*, Pearson Education, 10th Edition, Prentice Hall, ISBN: 0132359235.
7. Albert Paul Malvino, Donald P Leach, *Digital Principles and Applications*, McGraw Hill, 4th Edition, ISBN: 0070398836.
8. Thomas C Bartee, *Digital Computer Fundamentals*, McGraw Hill, 6th Edition, ASIN: B004H0SL5K.
9. Ramesh. S. Gaonkar, *Microprocessor Architecture*, Programming, and Applications with the 8085, 6th Edition, Wiley Eastern Ltd, New Delhi, ISBN: 9788187972884.
10. Mohamed Rafiquzzaman, *Introduction to Microprocessors and Microcomputer Based System Design*, 2nd Edition, CRC Press, ISBN: 9780849344756.
11. Muhammad Ali Mazidi, Janice Mazidi, Rolin Mckinlay, Janice M. Mazidi, Janice Gillispie Mazidi and Rolin D., *The 8051 Microcontroller and Embedded Systems*, Pearson Education Asia, 5th Indian Reprint, ISBN: 013119402X.

## CSS1L01 – PRACTICAL I

Objectives: To practically implement the theory portions covered in The Art of Programming Methodology (CSS1C04) and Advanced Data Structures (CSS1C02).

Course Outcome

CO1: Develop programming skills using the fundamentals and basics of C language.

CO2: Develop programs using the basic elements like control statements, arrays and strings.

CO3: Design and implement the effective usage of arrays, structures, functions and pointers.

CO4: Implement files handling and command line arguments.

CO5: Demonstrate the concepts of stack, queue and linked list and apply various operations on them.

CO6: Demonstrate the concept of tree traversal and its operations.

CO7: Design program based on the concepts of sorting and searching techniques.

Course Outline

Unit I: C Programming

1. Simple C Programs like area of a circle, checking whether a given number is odd or even.
2. Implementation of programs using Loops (pyramid printing, factorial computation, number reversing, checking for Armstrong numbers, finding first N or Nth Prime numbers etc).
3. Use of 1D and 2D Arrays (searching, sorting and vector operations, matrix addition, matrix multiplication).
4. String Manipulations.
5. Structures and Unions (like addition of two complex numbers, student record creation and manipulation etc).
6. Writing functions.
7. Implementation of recursion (recursive function to compute a factorial, reverse string etc).
8. Command line arguments.
9. Pointers - simple programs to learn concept of pointers, array operation using pointers etc.
10. File operations – file and structures.

## Unit 2: Data Structures and Algorithms

1. Implementation of stacks using arrays.
2. Implementation of queues, circular queue using arrays.
3. Implementation of sequential search and binary search techniques.
4. Implementation of linked lists and operations (add, insert, delete, search) on linked lists.
5. Implementation of stacks using linked list.
6. Implementation of queues using linked list.
7. Implementation of doubly linked list.
8. Implementation of circular linked list.
9. Implementation of binary tree and traversals.
10. Implementation of Binary search trees and perform the operations on BST.
11. Implementation of various sorting algorithms.
12. Conversion of an infix expression to the postfix form using stacks.
13. Evaluation of a postfix expression.
14. Implementation of graphs and graph traversals.
15. Implementation of heap tree and operations.

# CSS1A01 – INTRODUCTION TO RESEARCH
# (ABILITY ENHANCEMENT AUDIT COURSE)

## Objectives:

Large numbers of students are actively considering and taking up research and associated higher studies. An introductory course on research aims to introduce students to the important aspects of research. The intent of such a course is to make students aware of the details associated with formal research. By going through this introductory course on research, students are likely to be able to take up research activities in a more systematic and formal manner right from the beginning.

## Course Outcome

CO1: Understand research terminology.

CO2: Apply the ethical principles of research.

CO3: Identify the components of a literature review process.

CO4: Critically analyze published research works.

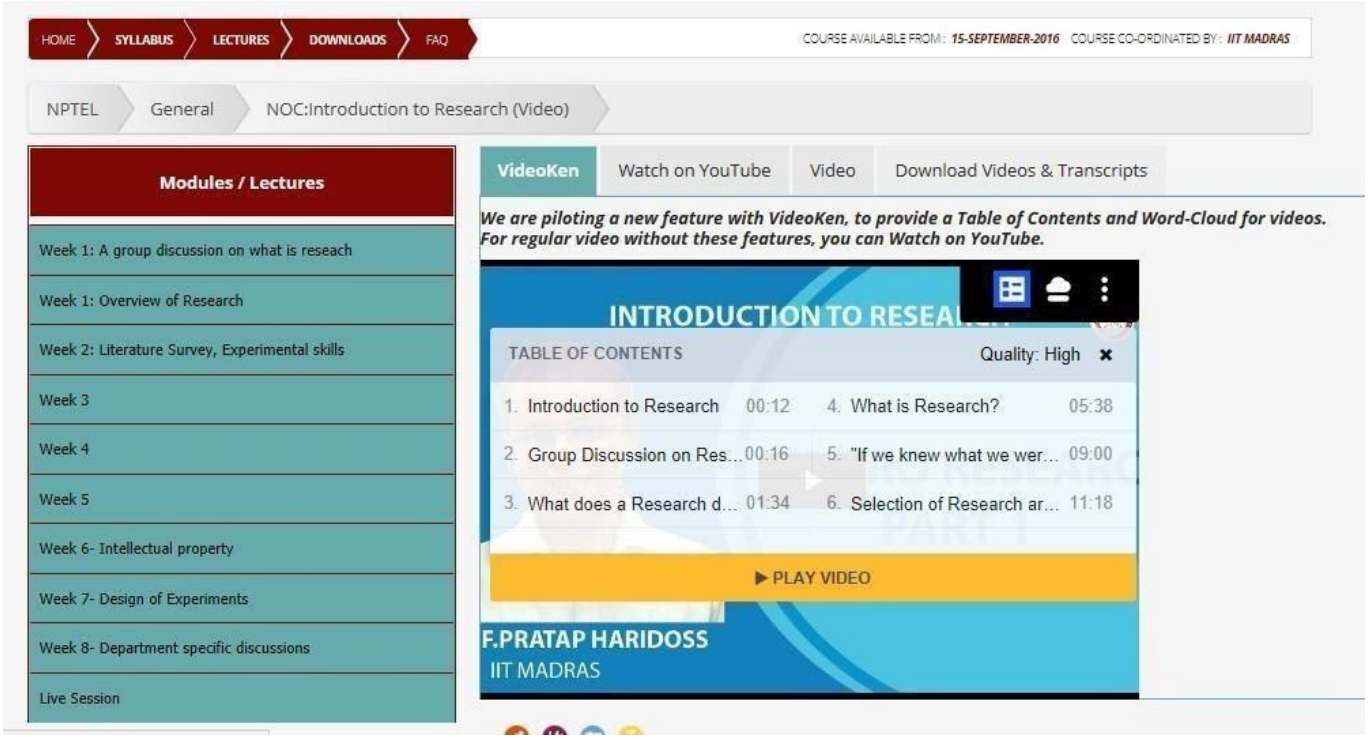
CO5: Innovate and apply research methods in the discipline of computing.

## Course Evaluation & Course Credit

The Ability Enhancement Audit Course has 4 credits which will not be counted for evaluating the overall SGPA & CGPA. The College/Department shall conduct examination of 2 Hrs duration with a minimum of 20 weightage before the conclusion of first semester classes and have to intimate /upload the results of the same to the University on the stipulated date during the III Semester. Students have to obtain only minimum pass requirements in this Audit Course.

## Course Delivery Mode

This course is an Ability Enhancement Audit Course. The course content is not delivered in the classrooms. Instead, the students have enrol themselves for the online course offered at NPTEL. The online course is available at https://nptel.ac.in/courses/121106007/. Students can either view the video module online or can download the video lessons and transcripts to view or read them offline.




## Course Outline

The students are encouraged to cover the following modules of the course *Introduction to Research* from NPTEL:

- Week1: Overview of Research
- Week2: Overview of Literature Survey: Literature Survey using Web of Science, Literature Survey using Scopus, Writing Up, Tutorial on using BibTeX with LaTeX to add references to a document, Tutorial on using Microsoft Word with Bibliographic Sources, Tutorial on using Microsoft Word with endnote entries
- Week3: Data Analysis
- Week4: How to make Technical presentation – Technical Writing
- Week 6: Intellectual property
- Week8: Research in Computer Science & Engineering

## References:

1. Video Lessons and Transcripts available (including in the regional language) at https://nptel.ac.in/courses/nptel_download.php?subjectid=121106007.

## SEMESTER II

### CSS2C06 – DESIGN AND ANALYSIS OF ALGORITHMS

**Objectives:**

- To introduce the concept of an algorithmic approach for solving real-life problems.
- To teach basic principles and techniques of computational complexity.
- To familiarize with parallel algorithms and related techniques.
-

**Course Outcome**

CO1: Design algorithms in context of space and time complexity and apply asymptotic notation.
CO2: Analyze the problem and develop the algorithms related to these problems.
CO3: Classify the problems and apply the appropriate design strategy to develop algorithms.
CO4: Analyze the problem and develop the algorithms related to these problems.
CO5: Demonstrate the use of parallel algorithms.

**Course Outline**

**Unit I:** Algorithm Design: Introduction, Steps in developing algorithm, Methods of specifying an algorithm, Decisions prior to designing: based on the capabilities of the device, based on the nature of solutions, based on the most suitable data structures. Model of Computation: RAM model and PRAM model. Important Problem Types (Introductory concepts): Sorting, Searching, String processing, Graph problems, Combinatorial problems, Geometric problems and Numerical problems.

**Unit II:** Basic Technique for Design of Efficient Algorithm: Brute Force approach (String matching), Divide-and-Conquer approach (Merge sort), Branch-and-Bound technique (Knapsack problem). Greedy approach (Kruskal's algorithm and Prim's Algorithm), Dynamic Programming (Longest Common Subsequence), Backtracking (Sum of subsets problem).

**Unit III:** Algorithm Analysis: Importance of algorithm analysis, Time and Space Complexity. Growth of Functions: Asymptotic notations, Cost estimation based on key operations- Big Oh, Big Omega, Little Oh, Little Omega and Theta notations, Big Oh Ratio Theorem, Big Theta Ratio Theorem, Big Omega Ratio Theorem. Analyzing Algorithm Control Structures, Solving Recurrences: Iteration Method, Substitution Method, The Recursion Tree Method, Master's Theorem, Problem solving using Master's Theorem Case 1, Case 2 and Case 3. Analysis of Strasser's algorithm for matrix multiplication, Analysis of Merge sort.

**Unit IV:** Complexity - Complexity Classes: P, NP, NP Hard and NP Complete problems. NP Completeness reductions for Travelling Salesman Problem and Hamiltonian Cycle. P versus NP problem.

**Unit V:** Analysing Parallel Algorithms: Time Complexity, Cost, Number of Processors, Space Complexity, Speed up, Efficiency, Scalability, Amdahl's Law. Parallel merging and sorting, Euler tour technique, Parallel prefix computation, Deterministic symmetry breaking.

**References:**


1. Thomas H Cormen, Charles E Leiserson, and Ronald L Rivest, *Introduction to Algorithms*, 3rd Edition, Prentice Hall of India Private Limited, New Delhi, ISBN: 9780262033848 (Unit I, II, III and IV).
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, *The Design and Analysis of Computer Algorithms*, 1st Edition. Addison Wesley, ISBN: 0534915728 (Unit I, II, III and IV).
3. Pallaw, V K, *Design and Analysis of Algorithms*, Asian Books Private Ltd, 2012, ISBN: 8184121687 (Unit I, II, III and IV).
4. Sanjay Razdan, *Fundamentals of Parallel Computing*, Narosa Publishing House, 2014, ISBN: 9788184873481 (Unit V).
5. Pandey H M, *Design and Analysis of Algorithms*, University Science Press, 2013, ISBN: 9788131803349 (Unit I, II, III and IV).
6. Upadhyay N, *Design and Analysis of Algorithms*, SK Kataria & Sons, 2008 (Unit I, II, III and IV).
7. U. Manber, *Introduction to Algorithms: A Creative Approach*, Addison Wesley, ISBN: 9780201003277 (Unit I, II, III and IV).
8. Gilles Brassard and Paul Bratley, *Fundamentals of Algorithmics*, Prentice-Hall of India, ISBN: 0133350681 (Unit I, II, III and IV).
9. Goodman S E and Hedetniemi, *Introduction to the Design and Analysis of Algorithms*, Mcgraw Hill, ISBN: 0070237530 (Unit I, II, III and IV).
10. Horowitz E and Sahni S, *Fundamentals of Computer Algorithms*, Galgotia Publications Pvt. Ltd, ISBN: 8175152575 (Unit I, II, III and IV).
11. Oded Goldreich, P, *NP and NP - Completeness*, Cambridge University Press, 2011. ISBN: 0521122546 (Unit V).
12. Donald Knuth, *The Art of Computer Programming*, *Fundamental Algorithms*, Volume 1, Addison Wesley, 1997, ISBN: 8177587544 (Unit I).
13. Sanjeev Arora and Boaz Borak, *Computational Complexity - A Modern Approach*, Cambridge University Press; 2009, ISBN: 0521424267 (Unit III).
14. Daniel Hills W and Bruce M Boghosian, *Parallel Scientific Computation*, Science, 13 August 1993, Vol. 261 (5123), pp.856-863 (Unit V).

# CSS2C07 – OPERATING SYSTEM CONCEPTS COURSE

## Course Outcome

CO1: Understand the basic components of a computer operating system.

CO2: Compare and interpret the applications of Process and threads.

CO3: Describe the policies for scheduling, deadlocks, synchronization, system calls, and file systems.

CO4: Illustrate the functioning of process management, memory management and file management Modules present in an OS.

CO5: Differentiate various types of scheduling algorithms.

CO6: Understand the concepts of Three-Tier Client/Server Architecture, Middleware and the characteristics of mobile operating systems.

## Course Outline:

**Unit I:** Operating System Overview - Objectives and functions - Evolution of Operating System - Major Achievements - Process Description and Control - Process, Creation & Termination of Processes, Five State Model, Suspended Process, Process Description, Process Control - Modes of Execution, Process Creation, Process and Mode Switching. Threads - Processes Vs Threads, Multithreading, Thread States, Types of Threads, Multi Core and Multithreading. Case Study - Unix SVR4 Process Management, Linux Process and Thread Management.

**Unit II:** Concurrency - Principles, Race Condition, Operating System Concerns, Process Interaction, Completion for Resources, Cooperation by Sharing. Mutual Exclusion - Requirements, Hardware Support, Semaphores, Producer Consumer Problem, Monitors, Message Passing, Readers/Writers Problem. Deadlock - Principles, Prevention, Avoidance, Detection, Recovery, Dining Philosophers Problem. Case Study: Unix Concurrency Mechanisms.

**Unit III:** Memory Management, Address binding, Logical Vs Physical address space, Dynamic Loading, Dynamic Linking and Shared Libraries, Overlays, Swapping, Contiguous Memory allocation, Paging, Segmentation, Virtual memory, Demand paging, Page replacement, Thrashing. Case Study: Windows Memory Management.

**Unit IV:** Uniprocessor Scheduling - types, scheduling algorithms - criteria, nonpreemptive, preemptive. Comparative study of scheduling algorithms - FCFS, SJF, Priority, RR, Multilevel, Feedback Queue. Multiprocessor Scheduling - Classification, Granularity, Design Issues, Process Scheduling, Thread Scheduling. Real Time Scheduling - Background, Characteristics of Real Time OS, Scheduling, Deadline Scheduling, Rate Monotonic Scheduling, Priority Inversion. Case study: Linux Scheduling.

**Unit V:** Client/Server Computing - Definition, Applications, Classes, Three-Tier Client/Server Architecture, Middleware. Service-Oriented Architecture- Distributed Message Passing - Remote Procedure Calls - Clusters. Mobile Operating Systems - Characteristics - Comparative Study of the Features of iOS and Android.

## References

1. William Stallings, *Operating System- Internals and Design Principles*, 7th Edition, Pearson, ISBN: 9780273751502.
2. Abraham Silberschatz, Peter B. Galvin and, Greg Gagne, *Operating System Concepts*, 9th Edition, John Wiley & SonsTISBN: 9781118063330.
3. Ann Mclver McHoes and Ida M. Flynn, *Understanding Operating Systems*, 6th Edition, Cengage Learning, 2010, ISBN: 9781439079201.
4. Mukesh Singhal and Niranjan G. Shivaratri, *Advanced Concepts in Operating Systems - Distributed, Database, and Multiprocessor Operating Systems*, Tata McGraw-Hill Education Private Limited, ISBN: 9780070575721.
5. Current Literature (for Mobile Operating Systems).

# CSS2C08 – COMPUTER NETWORKS

## Objectives:

- To provide the student with a top-down approach of networking starting from the application layer.
- To introduce computer networking in the backdrop of Internet protocol stack.

## Course Outcome

CO1: Understand the basics concepts of computer network organization and implementation.

CO2: Describe theoretical understanding of layered network models - OSI and TCP/IP Models.

CO3: Illustrate the functionalities of different network layers.

CO4: Analyze the network application such as data transmission between client and server, file transfer, real-time and multimedia transmission.

CO5: Explain the security aspects in networks and principles of cryptography.

## Course Outline:

**Unit I:** Introduction to Computer networks - introduction - topology - categories of networks Internetwork - Internet - network modes- layered model - OSI and TCP/IP Models, Transmission media - Wired and unwired media. Computer networks and Internet - the network edge - the network core - network access - delay and loss - protocol layers and services - history of computer networking and Internet.

**Unit II:** Application layer protocols – principles – the web and HTTP – FTP – Email in Internet – DNS. Socket programming – building a Web server - content distribution.

**Unit III:** Transport layer services – introduction – relationship between Transport and Network layer – UDP – reliable data transfer – TCP - congestion control - Network layer services – routing – IP - routing in Internet - router - IPV6 - multicast routing – mobility.

**Unit IV:** Link layer services - error detection and correction - multiple access protocols – LAN address – ARP – Ethernet – hubs – bridges – switches - wireless links – PPP - ATM.

**Unit V:** Security in Networks – Principles of Cryptography – Authentication – Integrity –Key Distribution and Certification – Firewalls – Attacks and Counter Measures.

**References:**


1. J. F. Kurose and K. W. Ross, *Computer Networking: A Top-Down Approach Featuring Internet*, 6th Edition, Perason Education, ISBN: 0132856204.
2. Behrouz Forouzan, *Data Communications and Networking*, 4th Edition, McGraw- Hill Reprint, ISBN: 0073250325.
3. Peterson L.L. and Davie B .S., *Computer Networks, A Systems Approach*, 5th Edition, Morgan Kaufmann, ISBN: 9780123850591.
4. Keshav, *An Engineering Approach to Computer Networking*, Pearson Education Asia, ISBN: 97898123598652000.
5. Andrew S. Tanenbaum, *Computer Networks*, 5th Edition, PHI, ISBN: 9788131787571.
6. Herbert Scheldt, *Java Complete Reference*, 7th Edition, McGraw-Hill Osborne Media, ISBN: 9780072263855.

## CSS2C09 – COMPUTATIONAL INTELLIGENCE

**Objectives**: To introduce concepts of Artificial Intelligence and Machine Learning.

**Course Outcome:**

CO1: Apply the basic principles, models, and algorithms of AI to recognize, model, and solve problems in the analysis and design of information systems.

CO2: Conceptualize various knowledge representation techniques.

CO3: Analyze the problem-solving methods and algorithms related to searching, reasoning, game playing and machine learning.

CO4: Understand the functioning of expert systems and its importance.

CO5: Demonstrate the implementation various AI algorithms to solve real life problems.

**Course Outline**

**Unit I:** Introduction - Artificial Intelligence - problems, scope and applications, problem space and search - production system- characteristics - the predicate calculus, inference rules, structures and strategies for state space search, strategies for space search, using state space to represent reasoning with the predicate calculus.

**Unit II:** Heuristics Search: control and implementation of state space search, generate and test, hill climbing, Best-first search, problem reduction, constraint satisfaction, means- ends analysis, heuristic in games, complexity issues.

**Unit III:** Knowledge representation issues, representation and mappings, representing simple facts in logic, representing instances and ISA relationships, computable functions and predicates, resolution, natural deduction, knowledge representation using rules, logic programming, forward versus backward reasoning, symbolic reasoning under uncertainty- non-monotonic reasoning, depth first search, breadth first search.

**Unit IV:** Game playing - the mini-max search procedure, adding alpha-beta cut-offs, additional refinement, iterative deepening, planning system and its components, understanding, understanding as constrained satisfaction. Slot and filler structures: semantic nets, frames, conceptual dependency, scripts. Definition and characteristics of expert system, representing and using domain knowledge, expert system shells. Knowledge engineering, knowledge acquisition, expert system life cycle & expert system tools, MYCIN & DENDRAL examples of expert system.

**Unit V:** Machine learning - rote learning, learning by taking advice, learning in problem solving, learning from examples, explanation-based learning, analogy, formal learning theory, connectionist models - hopfield networks, learning in neural networks, back propagation, the genetic algorithm, classifier systems and genetic programming, artificial life and society-based learning.

**References:**


1. Elaine Rich, Kevin Knight and Shivshankar B. Nair, *Artificial Intelligence*, 3rd Edition, Tata - McGraw Hill, New Delhi, ISBN: 0070087709.
2. V S Janakiraman, K Sarukesi and P Gopalakrishnan, *Foundations of Artificial Intelligence and Expert System*, Macmillan India Limited, ISBN: 0333926250.
3. Stuart Russell and Peter Norvg, *Artificial Intelligence: A Modern Approach*, 3rd Edition, Prentice Hall, ISBN: 0136042597.'
4. G. F. Luger and W.A Stubblefield, *Artificial Intelligence - Structures and Strategies for Complex Problem Solving*, Addison-Wesley, 6th Edition, ISBN: 9780321545893.
5. P. H. Winston, *Artificial Intelligence*, Addison-Wesley, 3rd Edition, ISBN: 0201533774.
6. Nils J. Nilsson, Artificial Intelligence, A New Synthesis, 1st Edition, Morgan Kaufmann Publishers, Inc, ISBN: 1558604677.

## CSS2C10 – PRINCIPLES OF SOFTWARE ENGINEERING

### Objectives:

- To develop familiarity with software engineering principles and practices.
- To have an understanding about the process of product/literature survey, techniques of problem definition, and methods of report writing.

### Course Outcome

CO1: Understand the software process and development models.

CO2: Understand the software design process and structured analysis of systems.

CO3: Distinguish different types of modelling like DFD and UML.

CO4: Illustrate the knowledge about the design of user interface.

CO5: Apply the skill of project management and report preparation.

### Course Outline:

**Unit I:** Introduction – problem domain - software engineering challenges – approaches– software process and development models – agile models – SDLC - software process.

**Unit II:** Software requirements analysis & specification - feasibility study - types of feasibility – software requirements - problem analysis – requirement specification – functional specification – metrics. Software design – outcome – cohesion and coupling – layered arrangement of modules – approaches to software design - structured analysis – DFD – extending DFD technique for applying to real-time systems – structured design – detailed design - object oriented modelling – use case model – class diagram – interaction diagram - activity diagram - data diagram – state chart diagram - ER diagram.

**Unit III:** User Interface (UI) design – characteristics – basic concepts – types – fundamentals of component-based GUI Development – UI design methodology – process planning – cost estimation – project scheduling – configuration management – risk management - software coding – review – documentation – software testing - software testing basics - steps involved in test plan - software testing strategies.

**Unit IV:** Managing project – time management – setting aims and objectives – techniques for generating ideas – literature survey – types of information sources – writing literature survey.

**Unit V:** Project story preparation – key deliverables – communicating with experts – forms of communication – presenting ideas – common problems faced by a research scholar – report writing.

**References:**


1. Pankaj Jalote, *An Integrated Approach to Software Engineering*, 3rd Edition, Narosa Publishing House, ISBN: 9788173197024.
2. Rajib Mall, *Fundamentals of Software Engineering*, 3rd Edition, PHI Learning Pvt Ltd, ISBN: 9788120338197.
3. Rohit Khurana, *Software Engineering: Principles and Practices*, 2nd Edition, Vikas Publishing House Pvt Ltd, ISBN: 8125939466.
4. Andy Hunt, *Your Research Hunt, How to Manage it*, Routledge, ISBN: 0415344085.
5. Michael Jay Polonsky, David S. Waller, *Designing and Managing a Research Project: A Business Student's Guide*, Sage, ISBN: 1412977754.
6. Richard Bullock, Maureen Daly Goggin and Francine Weinberg, *The Norton Field Guide to Writing (with Readings and Handbook)*, 3rd Edition, W. W. Norton & Company, ISBN: 0393919595.
7. Kavadia Garg, Agrawal and Agrawal, *An introduction to Research Methodology*, Rbsa Publishers ISBN: 8176111651.

## CSS2L02 – PRACTICAL II

**Objectives:** To practically implement the theory portions covered in the courses *Operating System Concepts* (CSS2C07) and *Computer Networks* (CSS2C08) and to extend the programming knowledge acquired through course *The Art of Programming Methodology* (CSS1C04).

### Course Outcome

CO1: Discuss and formulate the problems based on the basic principles of networks.

CO2: Implementation of different memory management techniques in OS.

CO3: Implement various system operations of the operating system and also the various process scheduling algorithms.

CO4: Understand the TCP/IP configuration for Windows and Linux.

CO5: Design and implement various network applications such as data transmission between client and server, file transfer, real-time multimedia transmission.

CO6: Understand different Linux/UNIX shell scripts and execute various shell programs.

### Course Outline

### Unit I: Computer Networks

1. Design a LAN with a given set of requirements. The design should include topology, hardware and software requirements like cable, connectors, hubs/switches/bridges, interface cards along with a budget for the LAN. (Faculty in charge should give the requirements to the students)*.
2. Establish a LAN that consists of at least one server and two clients*.
3. Study of network utilities in Linux/Windows (hostname, ping, ifconfig, ipconfig, netstat, nslookup, telnet, traceroute, finger, telnet, tracert, arp, ftp etc)*.
4. Implementation of TCP Client.
5. Implementation of TCP Server.
6. Write a program to check the Date and Time in TCP Date Time Client.
7. Write a program to check the Date and Time in TCP Date Time Server.
8. Implementation of UDP client and server.
9. Write a program to transfer Files using UDP.
10. Implementation of transferring files using FTP.
11. Write a program to simulate the sliding window protocol.
12. Study of Network Simulators (NS2/Glomosim)*.

**These questions are NOT meant for examination purpose. However, Viva questions can be asked based on these experiments.*

## Unit II: Operating System Concepts

1. Write programs using the following system calls: fork(), execl() and wait().
2. Write File System Calls to write, append and display.
3. To accept the burst time for a set of processes for FCFS scheduling and create chart consisting of the burst time, turnaround time and wait time of each process.
4. To accept the burst time for a set of processes for SJF scheduling and create chart consisting of the burst time, turnaround time and wait time of each process.
5. To accept the burst time and priority for a set of processes for Priority scheduling and create chart consisting of the burst time, priority, turnaround time and wait time of each process.
6. To create n Fibonacci numbers and prepare a list of prime numbers amongst them (use pipe for IPC).
7. To demonstrate IPC using shared memory.
8. To allocate memory requirements for processes using best fit allocation- Accept n processes with their memory requirements and *n* holes with their sizes. Perform memory allocation using Best Fit algorithm. Display a chart consisting of the process and the allocated hole.
9. To accept n processes with their memory requirements and n holes with their sizes. Perform memory allocation using First Fit algorithm. Display a chart consisting of the process and the allocated hole.
10. To demonstrate the process of contiguous allocation of memory blocks to store files of varying sizes.
11. To implement Producer Consumer problem using semaphores.

## CSS2A02 – TERM PAPER (PROFESSIONAL COMPETENCY AUDIT COURSE)

### Objectives:

- To introduce the student to the techniques of literature survey.
- To acquaint him/her with the process of presenting his/her work through seminars and technical reports.

### Course Outcome:

CO1: Apply critical thinking skills analytical ability in problem solving.

CO2: Apply foundational research skills to address research problem.

CO3: Innovate, experiment and analyze research findings.

CO4: Demonstrate capacity to lead and manage change through a collaborative environment.

CO5: Innovate, experiment and analyze research findings and practice the process of scientific publishing.

### Course Outline

The student is expected to do an extensive literature survey and analysis in an area related to computer science, chosen by him/her, under the supervision of a faculty member from the department. The student has to choose an area for his/her work after due consultation and approval from the guide. The study should preferably result in a critical review of the present works/design ideas/designs/algorithms/theoretical contributions in the form of theorems and proofs/new methods of proof/new techniques or heuristics with analytical studies/implementations and analysis of results.

The student should give a seminar on his/her work, during the semester, and submit a technical report. Technical report should be prepared in TEX in IEEE conference style format.

### Course Delivery Mode

Students are given choice to opt for the supervisor according to his/her area of interest. The Department Council will finally decide and distribute the students among the faculty members by accommodating the choice and interest of the students, as far as possible. The faculty in charge must give proper directions and guidance to the students in carrying out the literature review effectively and systematically.

### Course Evaluation & Course Credit

The Professional Competency Audit Course has 4 credits which will not be counted for evaluating the overall SGPA & CGPA. The Department shall conduct the final evaluation of the course based on the following criteria and have to intimate /upload the results of the same to the University on the stipulated date during the III Semester.

| Component | Weightage |
|---|---|
| Publication of the Review Paper in a UGC Listed, Peer Reviewed or other peer reviewed refereed Journals | 20% (Maximum weightage be given to UGC listed Journal and weightage be reduced in other cases) |
| Presentation in an International/ National/ Regional Conference | 20% (Maximum weightage be given to International Conferences with Proceeding having ISBN and weightage be reduced in other cases) |
| Quality of the Technical Report | 40% |
| Quality and Effectiveness of the Report Presentation | 20% |

Students have to obtain only minimum pass requirements in this Audit Course.

**Reference:**

Articles from ACM/IEEE/INFLIBNET Journals/Conference Proceedings and/or equivalent documents, standard textbooks and web-based material, approved by the supervisor.

## SEMESTER III

### CSS3C11 – ADVANCED DATABASE MANAGEMENT SYSTEM

**Objectives:**

- To understand the relational model, and know how to translate requirements captured in an Entity-Relationship diagram into a relational schema.
- To reason about dependencies in a relational schema.
- To understand normal form schemas, and the decomposition process by which normal forms are obtained.
- To familiarize with advanced SQL' statements.
- To understand advanced features of database technologies.

**Course Outcome**

CO1: Explain the basics of database management system, concepts of relational data model, entity-relationship model, relational database design, relational algebra and calculus.

CO2: Apply the normalization techniques to improve the database design.

CO3: Describe various database manipulation commands in SQL.

CO4: Understand Transaction Processing & Locking using the concept of Concurrency control.

CO5: Conceptualize advanced features of Object-Oriented Database Management Systems and Distributed databases.

**Course Outline**

**Unit I:** Introduction - purpose of database systems, views of data - data abstraction, instances and schemas, data independence, data models - hierarchical data model, network data model, relational data model, ER d&tg9,mg9lei. Database languages - DDL, DML, transaction management, storage management, database administrator, database users, overall system structure. Relational data model - relational model concepts, keys, integrity constraints - domain constraints, key constraints, entity integrity constraints, referential integrity constraints. ER data model - basic concepts, constraints, keys, design issues, entity relationship diagram, weak entity sets, extended ER features, design of an ER database schema, reduction of an ER schema to tables. Relational algebra and calculus - relational algebra - selection and projection, set operations, renaming, joins, division. Relational calculus - tuple relational calculus, domain relational calculus. Expressive power of algebra and calculus.

**Unit II:** Relational database design - anomalies in a database - functional dependency - lossless join and dependency- preserving decomposition - normalization - normal forms - first, second and third normal form - Boyce Codd normal form - multivalued, dependency- fourth normal form - join dependency - project join normal form - domain key normal form.

**Unit III:** Relational database query languages - basics of QBE and SQL. Data definition in SQL data types, creation, insertion, viewing, updation, deletion of tables, modifying the structure of the tables, renaming, dropping of tables. Data constraints - I/O constraints, primary key, foreign key, unique key constraints, ALTER TABLE command database manipulation in SQL - computations done on table data - SELECT command, logical operators, range searching, pattern matching, grouping data from tables in SQL, GROUP BY, HAVING clauses. Joins - joining multiple tables, joining a table to it. DELETE - UPDATE. Views - creation, renaming the column of a view, destroys view. Program with SQL - data types Using SET and SELECT commands, procedural flow, IF, IF /ELSE, WHILE, GOTO, global variables. Security - locks, types of locks, levels of locks. Cursors - working with cursors, error handling, developing stored procedures, CREATE, ALTER and DROP, passing and returning data to stored procedures, using stored procedures within queries, building user defined functions, creating and calling a scalar function, implementing triggers, creating triggers, multiple trigger interaction (Use MySQL as the RDBMS).

**Unit IV:** Transaction management, concurrency control and query processing - concept, definition and states of transactions, ACID properties - concurrency control, serializability - conflict serializability, view serializability, recoverability-recoverable schedules, non-cascading schedules, strict schedules. Concurrency control schemes - locking- two phase locking, deadlock, granularity, timestamp ordering protocol. Basics of query processing.

**Unit V:** Object Oriented Database Management Systems (OODBMS) - concepts, need for OODBMS, composite objects, issues in OODBMSs, advantages and disadvantages of OODBMS. Distributed databases - motivation - distributed database concepts, types of distribution, architecture of distributed databases, the design of distributed databases, distributed transactions, commit protocols for distributed databases.

**References:**

1. Elmasri and Navathe, *Fundamentals of Database Systems*, 5th Edition, Pearson, ISBN: 9788131758984.
2. Abraham Silbersehatz, Henry F. Korth and S.Sudarshan, *Database System Concepts*, 6th Edition, Tata McGraw-Hill, ISBN: 0071325220.
3. CJ Date, *An Introduction to Database Systems*, 8th Edition, Addison Wesley, ISBN: 0321197844.
4. Ramakrishnan and Gehrke, *Database Management Systems*, 3rd Edition, McGraw - Hill Education, ISBN: 9339213114.
5. Alexis Leon and Mathews Leon, *Database Management Systems*, 1st Edition, Vikas Publishers, ISBN: 8182092221.
6. Vikram Vaswani, *MySQL The complete Reference*, 1st Edition, Tata Mcgraw Hill Education Private Limited, ISBN: 0070586845.
7. Joel Murach, *Murach's Mysql*, Mike Murach & Associates Inc, ISBN: 9350237695.
8. Paul DuBois, *MySQL Cookbook*, 2nd Edition, O'Reilly Media, ISBN: 8184042809.

## CSS3C12 – OBJECT ORIENTED PROGRAMMING CONCEPTS

**Objectives:** To learn object-oriented concepts and programming concepts and methodologies and to learn its implementation using Java.

**Course Outcome:**

CO1: Recall the object-oriented programing concepts and basics of Java.
CO2: Design and implement object-oriented programs including packages and interfaces.
CO3: Explain and handle exceptions and threads.
CO4: Develop interactive programs using applets, AWT and swings.
CO5: Explain the concepts of JDBC, sockets and gives an introduction to Unified Modelling Language (UML).

**Course Outline:**

**Unit I:** Introduction to OOPS - basic principles of object orientation (objects , attributes and methods, encapsulation and information hiding, state retention, object identity, messages, class hierarchy, inheritance, polymorphism, genericity) - introduction to Java -history, versioning, the Java Virtual Machine, byte code, features of Java, language components - primitive data types, comments, keywords, literals, variables scope & declarations, control structures - FOR, IF, WHILE, DO WHILE, SWITCH, BREAK, CONTINUE statements - operators - casts and conversions - arrays.

**Unit II:** Object - oriented programming – classes - class fundamentals - declaring objects - new operator – methods – parameter passing – constructors - parameterized constructors - this keyword – finalize method. Overloading methods and constructors, access controls, static and final, nested and inner classes. Inheritance - extends, member access and inheritance, super keyword, polymorphism, method overriding, dynamic method dispatch, abstract classes, packages and interfaces.

**Unit III:** Exceptions, threads & IO in Java - The file and standard streams, stream classes and interfaces, using byte streams and character streams, threads - threads vs. processes, creating threads, runnable interface, thread class, inter thread communication, synchronization. Exceptions - basic of Java exception handling, hierarchy, developing user defined exception classes.

**Unit IV:** Applets, AWT & Swing - applet class, types of applet, skeleton, applet tag, passing parameters, event handling, delegation event model, event classes, listeners, AWT classes and window fundamentals, frames, working with fonts, graphics and colors, AWT controls, layouts and menus, dialogue boxes. Swings - Japplets, icon, labels, buttons, textbox, combo box, tables and panes.

**Unit V:** Database and sockets - JDBC - introduction, architecture, drivers, connections, statements, resultset and meta data (Use MySQL as the RDBMS). Sockets: introduction to networking, InetAddress, url, socket, server sockets, datagrams. Introduction to Unified Modelling Language (UML), UML diagrams, class diagrams, object interaction diagrams, state and activity diagrams, component diagrams, deployment diagrams. Introduction to analysis - object oriented system analysis, design and implementations.

**References:**

1. Herbert Scheldt, *Java Complete Reference*, 8th Edition, Tata Mcgraw Hill Education Private Limited, ISBN: 1259002462.
2. E Balaguruswamy, *Programming in Java: A Primer*, 4th Edition, Tata Mcgraw Hill Education Private Limited, ISBN: 007014169X.
3. Kathy Sierra, *Head First Java*, 2nd Edition, Shroff Publishers and Distributors Pvt Ltd, ISBN: 8173666024.
4. David Flanagan, Jim Farley, William Crawford and Kris Magnusson, *Java Enterprise in a Nutshell: A Desktop Quick Reference*, 3rd Edition, O'Reilly Media, ISBN: 0596101422.
5. Grady Booch, James Rumbaugh and Ivar Jacobson, *The Unified Modeling Language User Guide*, 2nd Edition, Pearson, ISBN: 8131715825.

## CSS3C13 – PRINCIPLES OF COMPILERS

**Objectives:** To introduce the fundamental concepts and various phases of compiler design.

### Course Outcome

CO1: Understand the major phases of compilation, identify tokens of a typical high -level programming language, define regular expressions for tokens, design and implement a lexical analyzer.

CO2: Develop the parsers and experiment the knowledge of different parsers design without automated tools.

CO3: Construct the intermediate code representations and generation.

CO4: Explain the role of different types of runtime environments and memory organization for implementation of typical programming languages.

CO5: Apply the optimization techniques to have a better code for code generation.

### Course Outline

**Unit I:** Introduction to compiling - definition of compiler, translator, interpreter, analysis of the source program, the phases of a compiler, compiler construction tools- applications of compiler technology – programming language basics - lexical analysis – role of lexical analyser - input buffering - specification of tokens – recognition of tokens using finite automata - regular expressions and finite automata - from NFA to DFA - Regular Expression to an NFA - Design of a lexical analyser generator.

**Unit II:** Syntax analysis – role of parser – error handling and recovery – definitions of parsing, top-down parsing and bottom-up parsing - context free grammars – derivations - parse tree – ambiguity – associativity and precedence of operators - writing a grammar – top- down parsing – recursive descent parsing - FIRST and FOLLOW – LL (1) Grammars – recursive predictive parsing - bottom up parsing – reductions – handle pruning – shift reduce parsing - operator precedence parsing, simple LR parsing.

**Unit III:** Intermediate code generation – DAG – three address code – addresses and instructions – quadruples – triples – Static Simple Assignment form – types and declarations-type expressions - type equivalences – declarations – type checking – rules – type conversion - function and operator overloading – type inference and polymorphic functions – control flow – boolean expressions – short circuit code – flow-control statements – control-flow translation for boolean expressions – BREAK CONTINUE and GOTO statements.

**Unit IV:** Run time environments – storage optimization – static Vs dynamic allocation – stack allocation of space - activation trees and records – calling sequences – access to non local data on the stack – data access without nested procedures – issues with nested procedures – heap management – the memory manager – the memory hierarchy – locality in programs – reducing fragmentation - manual deallocation requests.

**Unit V:** Code generation – issues in the design of a code generator – the target language – a simple target machine model – the program and instruction costs – address in the target code – static allocation – stack allocation – run-time address for names – basic blocks and flow graphs – representation of flow graphs. Code optimization - the principal sources of optimization – data flow analysis – abstraction – data flow analysis schema – data flow schemas on basic blocks – reaching definitions – live variable analysis – available expressions. Region based analysis – regions – region hierarchies for reducible flow graphs – overview of a region-based analysis.

**References:**

1. V Aho A, Ravi Sethi, D Ullman J, *Compilers Principles*, Techniques and Tools, 2nd Edition, Pearson Education Singapore Pte Ltd, ISBN: 8131721019.
2. K. V. N. Sunitha, *Compiler Construction*, Pearson, ISBN:9789332500297.
3. W Appel and Andrew, *Modern Compiler Implementation in C*, 1st Edition,Cambridge University Press, ISBN: 817596071X.
4. Allen I Holub, *Compiler Design in C*, 1st Edition, PHI Learning Pvt Ltd, ISBN: 812030778X.
5. Tremblay and Sorenson, *The Theory and Practice of Compiler Writing*, 1st Edition, BSP Books Pvt Ltd, ISBN: 8178000776.
6. Torben Ægidius Mogensen, *Basics of Compiler Design*, Department of Computer Science, University of Copenhagen (Online Edition).

## CSS3L03 – PRACTICAL III

**Objectives:** To practically implement the theoretical aspects covered in Advanced Database Management System (CSS3C11) and Object-Oriented Programming Concepts (CSS3C12) and to extend the programming knowledge acquired through The Art of Programming Methodology (CSS1C04) to encompass object-oriented techniques.

### Course Outcome

CO1: Design and development of relational database systems.
CO2: Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger and views.
CO3: Apply various software to design and build ER Diagrams, UML, Flowchart for related database systems.
CO4: Design and implement database applications on their own.
CO5: Apply JDBC to provide a program level interface for communicating with database using Java programming.
CO6: Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
CO7: Understand Java programming concepts and utilize Java Graphical User Interface in program writing.
CO8: Design and develop Java programs that solve real-world problems.

### Course Outline:

### Unit I: Advanced Database Management System

1. Creating database tables and using data types (create table, modify table, drop table).
2. Data Manipulation (adding data with INSERT, modify data with UPDATE, deleting records with DELETE).
3. Implementing the Constraints (NULL and NOT NULL, primary key and foreign key constraint, unique, check and default constraint).
4. Retrieving Data Using SELECT (simple SELECT, WHERE, IN, BETWEEN, ORDERED BY, DISTINCT and GROUP BY).
5. Aggregate Functions (AVG, COUNT, MAX, MIN, SUM).
6. String functions.
7. Date and Time Functions.
8. Use of union, intersection, set difference.
9. Implement Nested Queries & JOIN operation.
10. Performing different operations on a view.
11. Stored Procedure Programming - Simple Procedures - decision making - Loops - Error handlers - Cursors - Functions - Triggers - Calling Stored Procedure from Triggers.

## Unit II: Object Oriented Programming Concepts

1. Simple Java programs like computing formulas expressions.
2. Programs involving loops and decisions like generating Fibonacci, prime, strange series.
3. Programs involving arrays.
4. Programs involving class and objects.
5. Illustrate method overloading.
6. Illustrate single level inheritance.
7. Illustrate multiple inheritances using interface.
8. String sorting, pattern matching etc.
9. Illustrate threads and thread priorities.
10. Illustrate the use of Packages.
11. Exception handling (user-defined).
12. Abstract class.
13. Method overriding.
14. Illustrate usage of Applets like moving ball, face etc.
15. Create an AWT application for a simple calculator.
16. Frame application to illustrate the window events.
17. Frame application to illustrate mouse and keyboard event handling.
18. Swing applications.
19. Create a JDBC application to add the details of a student into a table (Use MySQL as the RDBMS).
20. Socket Programming.

# CSS3E01a – COMPUTER GRAPHICS

## Objectives:

- To understand the fundamentals of the modern computer graphics.
- To pipeline the mathematics of affine transformations in three dimensions.
- To understand the common data structures to represent and manipulate geometry, colour and light representation and manipulation in graphics systems.
- To have an exposure to programming in Open GL.

## Course Outcome

CO1: Understand the basics of computer graphics, different graphics systems and applications of computer graphics.

CO2: Extract scene with different clipping methods and its transformation to graphics display device.

CO3: Explore projections and visible surface detection techniques for display.

CO4: Explore object representations and surface detection methods.

CO5: Understand techniques and OpenGL programming concepts.

## Course Outline

**Unit I:** Introduction – Application of computer graphics, Video Display Devices- refresh CRT, raster and random scan display, color CRT, flat panel, LCD, LED, DVST. Raster - Scan Systems-video controller, display processor, Random-Scan Systems.

**Unit II:** 2D Graphics: Line drawing algorithms – DDA, Bresenham's – Midpoint Circle drawing algorithm –Filling-Scan line polygon fill algorithm, boundary fill algorithm, floodfill algorithm, 2D Transformations-translation, rotation, scaling, shearing and reflection, composite transformations. 2D Viewing –the viewing pipeline, viewing coordinate reference frame, window-to- viewport coordinate transformation. Clipping-point clipping, Cohen Sutherland line clipping, Sutherland Hodgeman polygon clipping, text clipping.

**Unit III:** 3D Graphics: 3D Transformations- translation, rotation, scaling, shearing and reflection,3D Viewing-viewing pipeline, viewing coordinates, projections- parallel & perspective projections.

**Unit IV:** 3D object representation - wireframe model, curve representation, surfaces, spline representation, bezier curves, cubic spline. Visible surface detection methods- classification, back-face detection, Z-buffer algorithm.

**Unit V:** Discrete Techniques and OpenGL programming - Texture mapping, Bit and Pixel operations, Compositing, Sampling and Aliasing Techniques. Introduction to OpenGL, Features in OpenGL, OpenGL operations, Abstractions in OpenGL - GL, GLU & GLUT, a few examples of OpenGL programs.

**References:**


1. Donald Hearn and M. Pauline Baker, *Computer Graphics*, 2nd Edition, Prentice Hall, ISBN: 0135309247.
2. Donald D. Hearn, M. Pauline Baker and Warren Carithers, *Computer Graphics with Open GL*, 4th Edition, Prentice Hall, ISBN: 9780136053583.
3. Hill, *Computer Graphics using OpenGL*, 3rd Edition, Prentice Hall of India Private Ltd. New Delhi, ISBN: 8120338294.
4. Mason Woo, Jackie Neider, Tom Davis, Dave Shreiner, Dave Shriner and Tom David, *Open GL Programming Guide*, 6th Edition, Person, ISBN: 9780201604580.
5. *The Official Guide to Learning OpenGL*, Version 1.1, Available at http://www.glprogramming.com/red/.
6. Shreiner and Angel, *Interactive Computer Graphics: A Top-Down Approach with Shader-Based OpenGL*, 6th Edition, Pearson Education, ISBN: 0132545233.

# CSS3E01b – INTRODUCTION TO SOFT COMPUTING

## Objectives

- To give students the fundamental knowledge of soft computing theories.
- To expose the fundamentals of non-traditional technologies and approaches to solving hard real-world problems.

## Course Outcome

CO1: Understand soft computing techniques and their role in problem solving.

CO2: Conceptualize and parameterize various algorithms in problem solving.

CO3: To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations.

CO4: Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic.

CO5: Conceptualize advanced topics of evolutionary algorithms and swarm intelligence.

## Course Outline

**Unit I:** Introduction - introduction to statistical, syntactic and descriptive approaches - features and feature extraction - learning - Bayes Decision theory - introduction - continuous case - 2-category classification - minimum error rate classification - classifiers - discriminant functions - decision surfaces – error probabilities and integrals - normal density - discriminant functions for normal density.

**Unit II:** Introduction to genetic algorithm, genetic operators and parameters, genetic algorithms in problem solving, theoretical foundations of genetic algorithms, implementation issues – systems.

**Unit III:** Neural model and network architectures, perceptron learning, supervised hebbian learning, back-propagation, associative learning, competitive networks, hopfield network, computing with neural nets and applications of neural network.

**Unit IV:** Introduction to fuzzy sets, operations on fuzzy sets, fuzzy relations, fuzzy measures, applications of fuzzy set theory to different branches of science and engineering.

**Unit V:** Advanced topics - support vector machines, evolutionary computation (EC) - evolutionary algorithms, harmony search, swarm intelligence.

**References:**

1. Chuen-Tsai Sun, Eiji Mizutani and Jyh-Shing Roger Jang, *Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence*, Prentice Hall India, ISBN: 8120322436.
2. M. Mitchell, *An Introduction to Genetic Algorithms*, Prentice-Hall, ISBN: 0262631857.
3. D. E. Goldberg, *Genetic Algorithms in Search, Optimization, and Machine Learning*, Addison-Wesley, ISBN: 0785342157673.
4. S. V. Kartalopoulos, *Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications*, Wiley-IEEE Press, 1st Edition, ISBN: 07803112802004.
5. S. Rajasekaran and G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications*, PHI, ISBN: 9788120321861.

## CSS3E01c – WEB TECHNOLOGY

**Objectives:** To introduce the tools for creating and maintaining websites – content development (HTML), client-side scripting (JavaScript), web server (Apache), server side scripting (PHP) and content management system (Joomla!).

### Course Outcome

CO1: Understand the basics of HTML, XML and CSS.
CO2: Learn client-side programming and basics of Javascript.
CO3: Explore web servers and server-side technologies.
CO4: Able to do server-side programming with PHP.
CO5: Illustrate and apply content management systems and its features.

### Course Outline

**Unit I:** Introduction to web programming - introduction to SGML features - HTML, XHTML, DHTML, XML - HTML Vs XML - creating XML documents - parsing an XML document writing well-formed documents - organizing elements with namespaces - defining elements in a DTD - declaring elements and attributes in a DTD. Overview of HTML basic formatting tags - heading, paragraph, underline break, bold, italic, underline, superscript, subscript, font and image. Attributes - align, color, bgcolor, font face, border, size. Navigation links using anchor tag - internal, external, mail and image links. Lists - ordered, unordered and definition, table tag, HTML form controls - form, text, password, textarea, button, checkbox, radio button, select box, hidden controls, frameset and frames. CSS.

**Unit II:** Client-side programming – introduction – popular client side scripting languages-Java Script - introduction, identifiers, operators, functions, event handling, classes, objects, array, math, string, window object, navigator DHTML font, text, image change, table expansion. JavaScript's object model- strengths and weaknesses of JavaScript - building and extending objects in JavaScript - events in JavaScript - event handlers - creating interactive forms – cookies - storing users choices in cookies - encoding cookies - browser objects - object hierarchy, creating browser objects, working with window, document, history & location -browser detection, Java to JavaScript communication.

**Unit III:** Web server – role - Apache web server – introduction – architecture – features - Apache's role in the Internet – LAMP – WAMP - installation and configuration - build and install Apache web server - verify initial configuration start, stop, and status the Apache server process. Configure Apache core modules security - basic security with Apache - host-based authentication - user-based authentication - secure sockets layer (SSL) - delivering dynamic web content - Apache's role in the dynamic web - server side includes (SSIs) - configure Apache web server to support CGI – CGI Alternative Technologies. virtual hosts, redirection, indexing – virtual hosting with Apache, virtual host configuration redirection, directory indexing. Proxy servers and firewalls - apache proxy configuring, proxy services firewalls and apache, firewall architecture models monitoring apache web server - error logs, logging http access, web server status and server information, user tracking - proxy caching.

**Unit IV:** Server-side programming – server side scripts – PHP – designing dynamic web pages using PHP - defining PHP variables – variable types – operators – control flow constructs in PHP – passing form data between pages - establishing connection with MySQL database – managing database.

**Unit V:** Overview of content management system - coding for reusability (header.php) – user management - article publishing - additional CMS features – Web site development using Joomla.

**References:**


1. Thomas A. Powell, *The Complete Reference HTML*, 3rd Edition, McGraw- Hill/Osborne Media, ISBN: 0072129514.
2. Thomas A. Powell, *Web Design: The Complete Reference*, 2nd Sub-Edition, McGraw-Hill/Osborne Media, ISBN: 0072119772
3. Robert W. Sebesta, *Programming with World Wide Web*, 7th Edition, Addison- Wesley, ISBN: 9780132665810.
4. Xue Bai, Michael Ekedahl, Joyce Farrell, Don Gosselin, Diane Zak, Bill Morrissey, Michael V. Ekedahl, Peter Macintyre and Shashi Kaparthi, *The Web Warrior Guide to Web programming*, Thomson Learning, ISBN: 9780619064587.
5. Chris Bates, *Web Programming: Building Internet Applications*, 3rd Edition, Wiley Academic Catalog, ISBN: 9780470017753.
6. Paul J. Deitel, Harvey M. Deitel, Harvey Deitel, Paul Deitel and Abbey Deitel, *Internet and World Wide Web: How to Program*, 5th Edition, Prentice Hall, ISBN: 9780132151009.
7. R. Allen Wyke and Richard Wagner, *JavaScript Unleashed*, 3rd Edition, SAMS, ISBN:9780672317637.
8. Richard Bowen Ken Coar, Ken A Coar and Matthew Marlowe, *Apache Server Unleashed*, SAMS, ISBN: 0672318083.
9. Elizabeth Naramore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz and Michael K Glass, Beginning PHP5, *Apache, and MySQL Web Development*, Wrox, ISBN: 0764579665.
10. Jennifer Marriott and Elin Waring, *The Official Joomla! Book*, Addison-Wesley Professional, ISBN: 978-0321821546.
11. Ron Severdia and Kenneth Crowder, *Using Joomla: Building Powerful and Efficient Web Sites*, 1st Edition, O'Reilly Media, ISBN: 9780596804947.

## CSS3E01d – BIOINFORMATICS

**Objectives:** Expose students to the popular genomic and proteomic databases and to impart knowledge in processing and analysing genomic data and to introduce advanced topics in Bioinformatics.

### Course Outcome

CO1: Understand the basic concepts of Bioinformatics and its significance in Biological data analysis.

CO2: Demonstrate various techniques, algorithms and tools employed in computational biology.

CO3: Identify steps in sequence alignment.

CO4: Analyze various databases and tools on nucleic acids and protein.

CO5: Understand the types of data found at NCBI and EBI resources.

### Course Outline

**Unit I:** Bioinformatics - introduction to - nature and scope of computational biology and Bioinformatics. Cells - prokaryotes and eukaryotes - DNA double helix - central dogma - RNA, Amino acids, Proteins - string representations. A glossary of Bioinformatics terms - file format for bio-molecular sequences, sequence alignment, phylogeny, gene finding, microarray analysis, homology and evolutionary relationships.

**Unit II:** Basic algorithms in Computational Biology - exhaustive search methods and their applications in Computational Biology - string matching algorithms. Motif finding - tandem repeats - concept of dynamic programming - graph algorithms - clustering algorithms.

**Unit III:** Sequence alignment - pair-wise sequence alignment, need of scoring schemes - penalizing gaps, scoring matrices for amino acid sequence alignment, PAM probability matrix and log odds matrix, BLOSUM, Dot-plot visualization, Needleman- Wunsch algorithm- effect of scoring schemes - evalues - BLAST and FASTA, Smith - Waterman algorithm for local alignment.

**Unit IV:** Multiple sequence alignment - sequence alignment using dynamic programming, N dimensional dynamic programming. Tools for MSA - muscle and T-Coffee. Phylogenetic algorithms - evaluation of phylogenetic trees, significance.

**Unit V:** Introduction to the major resources - NCBI, EBI and ExPASy - nucleic acid. sequence databases - GenBank, EMBL, DDBJ – Protein sequence databases - SWISS- PROT, TrEMBL, PIR_PSD - genome databases at NCBI, EBI, TIGR, SANGER – procedures to access these databases and to make use of the tools available.

**References:**


1. Mount D, *Bioinformatics; Sequence & Genome Analysis*, 2nd Edition, Cold spring Harbor Press, ISBN: 978-087969712.
2. Dan Gusfield, *Algorithms on Strings Trees and Sequences*, 1st Edition, Cambridge University Press, ISBN: 0521585198.
3. Pevzner P A, *Computational Molecular Biology: An Algorithmic Approach*, MIT Press, Cambridge, MA, ISBN: ISBN: 9780262161978.
4. Jeremy J. Ramsden, *Bioinformatics: An Introduction*, Springer, ISBN: 9789401570961.
5. Sushmita M and Tinku A, *Data Mining: Multimedia, Soft Computing and Bioinformatics*, Wiley-Interscience, ISBN: 9780471460541.
6. Richard M. Karp, *Mathematical Challenges from Genomics and Molecular Biology*, Notices of the American Mathematical Society, vol. 49, no. 5, pp. 544553.
7. Glyn Moody, *Digital Code of Life: How Bioinformatics is Revolutionizing Science, Medicine and Business*, ISBN: 9780471327882.
8. Tao Jiang, Ying Xu and Michael Q. Zhang, *Current Topics in Computational Molecular Biology Edible OH Processing*, 1st Edition, Ane Books Pvt Ltd, ISBN: 9788180520525.
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14. Pevzner P A and Waterman M S, Open Combinatorial Problems in Computational Molecular Biology, *Proc. Third Israel Symp. Theo. Comp. Syst*.

    IEEE Computer Society Press, (1995) 158 - 173.

## CSS3E01e – COMPUTER OPTIMIZATION TECHNIQUES

### Objectives:

- To give an exposure for the student to the area of modelling techniques, numerical methods and algorithms.
- To realize the importance of various aspects of optimization techniques in industries like IT.
- To implement the knowledge of optimization techniques in real life problems.

### Course Outcome

CO1: Understand linear programming methods and formulate real world problems into mathematical problems.

CO2: Apply linear programming methods like transportation and network problems.

CO3: Understand different linear programming methods and applications.

CO4: Understand integer linear programming and algorithms to solve it.

CO5: Understand the basics of dynamic programming and nonlinear programming.

### Course Outline

**Unit I:** Linear programming and sensitivity analysis - two variable LP model, graphical and algebraic LP solutions, some LP applications, the simplex method and sensitivity analysis, primal-dual relationships and economic interpretation, dual simplex and generalized simplex algorithms and post-optimal analysis.

**Unit II:** Transportation and Network models - The transportation models and algorithm, the assignment and trans-shipment models, minimum spanning tree algorithm, shortest- route problem, maximum flow and min-cost models, critical path method and algorithms for matching.

**Unit III:** Advanced linear programming and applications - simplex method fundamentals, revised simplex method and computational considerations, bounded variables algorithm, duality, parametric linear programming, goal programming formulations and algorithms.

**Unit IV:** Integer linear programming - illustrative applications, integer programming algorithms, unimodularity and cutting-plane methods, travelling salesperson problem.

**Unit V:** Dynamic programming (DP) and its application - recursive nature of computations in DP, forward and backward recursion, selected DP applications, problem of dimensionality, branch and bound method and dynamic programming, some deterministic inventory models. Nonlinear programming - convex programming problems, unconstrained problems and algorithms, constrained problems and algorithms.

### References:

1. H. A. Taha, *Operations Research: An Introduction*, 9th Edition, Pearson Prentice Hall, ISBN: 013255593X.
2. C. H. Papadimitriou, K. Steiglitz, *Combinatorial Optimization: Algorithms and Complexity*, Dover Publications, ISBN: 9780486402581.

## CSS3E01f – NUMERICAL AND STATISTICAL METHODS

**Objectives:** To provide the student with basic concepts in statistics, probability that can be applied for mathematical modelling of computer applications.

### Course Outcome

CO1: Recognize the error in the number generated by the solution.

CO2: Compute solution of algebraic and transcendental equation by numerical methods like the Bisection method and Newton Rapshon method.

CO3: Understand the concepts of solving integrals mathematically.

CO4: Understand different probabilities and its properties.

CO5: Solve linear programming problems.

### Course Outline

**Unit I:** Approximation and errors in computing - introduction, significant digits - inherent errors - numerical error - modelling errors - blunders - absolute and relative errors - conditioning and stability. Roots of non-linear equations - introduction - iterative methods - bisection - false position - Newton - Raphson's, Secant and Bairstow's methods.

**Unit II:** Introduction solution of linear equations - Gauss elimination - Gauss-Jordan method Jacobi Iteration method - Gauss-Seidal methods. Interpolation - linear interpolation Newton's forward backward & divided difference interpolation methods - Lagrange's method.

**Unit III:** Integration - trapezoidal rule, Simpson's 1/3, & 3/8 rules. Differential equations: Heunn's polygon, Range-Kutta fourth order, Milne-Simpson, Adams-Bashforth and Adams-Moulton methods.

**Unit IV:** Classical definition of probability – statistical definition of probability – axiomatic approach to probability – addition and multiplication theorem on probability - compound and conditional probability – independence of events – Bayes theorem random variables – discrete and continues – pmf, pdf and distribution functions.

**Unit V:** Introduction linear programming - mathematical formulation - graphical method of solution - simplex method - duality - dual simplex - transportation - assignment problems.

### References

1. E. Balagurusamy, *Numerical Methods*, 1st Edition, Tata McGraw Hill Education Private Limited, ISBN: 0074633112.
2. S.G. Gupta and V.K. Kapoor, *Fundamentals of Mathematical Statistics*, 11th Edition, Sultan Chand & Sons , ISBN: 9788180545283.
3. V.Rajaraman, *Computer Oriented Numerical Methods*, 3rd Edition, Prentice Hall Of India, ISBN: 81203078601993.
4. Satyendra Mittal and C. P. Sethi, *Linear Programming*, Pragati Prakashan.

## CSS3E02a – PATTERN RECOGNITION

### Objectives:

- To understand the concept of a pattern and the basic approach to the development of pattern recognition algorithms.
- To understand and apply methods for pre-processing, feature extraction, and feature selection to multivariate data.
- To understand supervised and unsupervised classification methods to detect and characterize patterns in real-world data.

### Course Outcome

CO1: Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.

CO2: Recognize the principles of Bayesian parameter estimation.

CO3: Understand pattern recognition theories, such as Bayes classifier, linear discriminant analysis.

CO4: Apply pattern recognition techniques for pre-processing, feature extraction and feature selection.

CO5: Understand supervised and unsupervised classification methods to detect and characterize patterns in real-world data.

### Course Outline

**Unit I:** Introduction - introduction to statistical - syntactic and descriptive approaches - features and feature extraction - learning - Bayes Decision theory - introduction - continuous case 2 - category classification - minimum error rate classification - classifiers - discriminant functions - decision surfaces – error probabilities and integrals - normal density - discriminant functions for normal density.

**Unit II:** Parameter estimation and supervised learning - maximum likelihood estimation - the Bayes classifier - learning the mean of a normal density - general Bayesian learning nonparametric technique - density estimation - parzen windows - k-nearest neighbour estimation - estimation of posterior probabilities - nearest-neighbour rule - k-nearest neighbour rule.

**Unit III:** Linear discriminant functions - linear discriminant functions and decision surfaces - generalized linear discriminant functions - 2-category linearly separable case – non- separable behaviour - linear programming algorithms, support vector machines - multilayer neural networks - feed forward operation and classification, back propagation algorithm, error surface, back propagation as feature mapping.

**Unit IV:** Syntactic methods - stochastic search - Boltzmann learning - Nonmetric methods - decision trees - CART - other tree methods, grammatical methods, grammatical inference.

**Unit V:** Unsupervised learning and clustering - mixture densities and identifiability, maximum likelihood estimates, applications to normal mixtures, unsupervised Bayesian learning, data description and clustering.

**References:**

1. Richard O. Duda, Peter E. Hart and David G. Stork, Pattern Classification, CBS Publishers & Distributors, 2nd Edition, ISBN: 9788126511167.
2. Gonzalez R.C. and Thomson M.G., Syntactic Pattern Recognition: An Introduction, 1st Edition, Addison-Wesley, ISBN: 0201029316.
3. Fu K. S., Syntactic Pattern Recognition and Applications, Prentice Hall, ISBN: 0138801207.
4. Rajjan Shinghal, Pattern Recognition: Techniques and Applications, 1st Edition, Oxford University Press India, ISBN: 0195676858.

# CSS3E02b – WIRELESS & MOBILE NETWORKS

## Objectives

- To understand the fundamental concepts of wireless and mobile networks.
- To familiarize with wireless application Protocols to develop mobile content applications.
- To understand about the security aspects of wireless networks.
- To learn programming in the wireless mobile environment.

## Course Outcome

CO1: Understand the fundamental concepts of wireless and mobile networks.

CO2: Illustrate the wireless application protocols for mobile content development.

CO3: Analyze various wireless mobile programming methodologies.

CO4: Understand security aspects of wireless networks.

CO5: Understand TCP/IP extensions for wireless mobile networking.

## Course Outline

**Unit I:** Introduction - applications - brief history of wireless communication – open research problems – wireless transmission – frequencies for radio transmission – signals – antennas – signal propagation – multiplexing – modulation – spread spectrum – cellular systems – medium access control – motivation – SDMA – FDMA – TDMA – CDMA – comparison.

**Unit II:** Different generations of Wireless Cellular Networks - 1G, 2G, 2.5G, 3G, 4G. Telecommunication systems – GSM – DECT – TETRA – UMTS – IMT-2000. Wireless LAN – Infrared Vs Radio transmission – Infrastructure Vs Adhoc networks – IEEE 802.11 – HIPERLAN – Bluetooth.

**Unit III:** Mobile network layer - Mobile IP - Dynamic Host Configuration Protocol - Routing - DSDV - DSR - Alternative Metrics. Transport and application layers - traditional TCP classical TCP improvements - WAP, WAP 2.0.

**Unit IV:** Wireless network security - IEEE 80211i security - Wireless Transport Layer Security sessions and connections - protocol architecture - WAP end-to-end security.

**Unit V:** Java for wireless devices - setting up the development environment - basic data types, libraries (CLDC, MIDP) - UI controls - displayable and display image - events and event handling - list and choice - text box - alerts - persistent storage - record stores - records - record enumeration - network MIDlets - the connection framework - connection interface - connection using HTTP - datagram connection.

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1. Jochen Schiller, *Mobile Communications*, Pearson Education, 2nd Edition, ISBN 8131724263.
2. Raj Kamal, *Mobile Computing*, 2nd Edition Oxford Univ Press, ISBN: 0198068913.
3. William Stallings, *Network Security Essentials Applications and Standards*, 4th Edition, Pearson India, ISBN: 8131761754.
4. Yu Feng and Jun Zhu, *Wireless Java Programming with J2ME*, 1st Edition, Sams, ISBN: 0672321351.
5. Dreamtech Software Team, *Wireless Programming with J2ME*: Cracking the Code, Wiley, ISBN: 0764548859. C,
6. William Stallings, *Wireless Communications and Networks*, 2nd Edition, Pearson India, ISBN: 8131720934.
7. Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtorff and Thomas Schaeck, *Pervasive Computing Technology and Architecture of Mobile Internet Applications*, 14th Edition, Pearson Education, ISBN: 8177582801.
8. Nishit Narang and Sumit Kasera, *2G Mobile Networks: GSM and HSCSD*, Tata McGraw Hill Education, ISBN: 0070621063.
9. Hasan Ahmed, Roopa Yavagal and Asoke K Talukder, *Mobile Computing: Technology, Applications and Service Creation*, 2nd Edition, Tata Mcgraw Hill Education Private Limited, ISBN: 0070144575.

## CSS3E02c – CRYPTOGRAPHY AND NETWORK SECURITY

### Objectives:

- To be familiar with classical and modern encryption and decryption techniques and apply in the security system.
- To understand various aspects of network security standards.

### Course Outcome

CO1: Understand the fundamentals of cryptography.

CO2: Describe data integrity, authentication, digital signatures.

CO3: Analyze different network security applications

CO4: Familiarize standard algorithms that provide confidentiality, integrity and authenticity.

CO5: Understand network security technologies.

### Course Outline

**Unit I:** Computer security concepts – challenges – security attacks – security services – security mechanisms – a model for network security. Cryptography – symmetric encryption principles – cryptography – cryptanalysis – Feistal Cipher structure. symmetric block encryption algorithms - DES – Triple DES – AES – random and pseudorandom numbers – stream cipher and RC4 – cipher block modes of operation.

**Unit II:** Message authentication – approaches – MAC – one way Hash function – secure Hash functions – Message Authentication Codes. Public key cryptography principles –algorithms – digital Signatures.

**Unit III:** Network security applications - symmetric key distributions using symmetric encryption - Kerberos version 4 - key distributions using asymmetric encryption - X.509 certificates - public key infrastructure - federated identity management.

**Unit IV:** Transport level security - web security considerations - secure socket layer and transport layer security - SSL architecture - SSL record protocol - change cipher spec protocol - handshake protocol. Transport layer security - HTTPS - SSH. IP Security - overview - policy - encapsulating security payload - combining security associations - internet key exchange.

**Unit V:** Intruders - intruders, intrusion detection, password management. Malicious software - types, viruses, countermeasures, worms, DDoS. Firewalls - need - characteristics, types, firewall basing, location and configuration - DMZ networks, VPN - distributed firewalls.

### References:

1. William Stallings, Network Security Essentials Applications and Standards, 4th Edition, Pearson India, ISBN: 8131761754.
2. William Stallings, Cryptography and Network Security: Principles and Practice, 6th Edition, Pearson India, ISBN: 9332518777.
3. Atul Kahate, Cryptography and Network Security, 3rd Edition, Tata McGraw- Hill Publishing, ISBN: 9789332900929.
4. Eric Maiwald, Fundamental of Network Security, 1st Edition, Tata McGraw - Hill Education, 0071070931.
5. Charlie Kaufman, Radia Perlman and Mike Speciner, Network Security: Private Communication in Public WorJd, 2nd Edition, PHI Learning Pvt Ltd, ISBN: 8120322134.

## CSS3E02d – ADVANCED WEB TECHNOLOGY

**Objective:** To introduce the advanced concepts of web development tools - Web 2.0, Web Services, Python, SQLite and MVC architecture.

### Course Outcome

CO1: Understand the concepts of Web 2.0.

CO2: Conceptualize web services and its architecture.

CO3: Develop applications using Python programming language.

CO4: Analyze server-side programming with Python.

CO5: Develop applications with Python-SQLite integration.

### Course Outline

**Unit I:** Web 2.0 - definition, characteristics, key features, client side technologies (Ajax and JavaScript frameworks - YUI library, Dojo toolkit, MooTools, jQuery, Ext JS and prototype JavaScript framework), server side technologies (Ruby, Perl, Python, Enterprise Java J2EE and Microsoft.NET Framework), concepts (Rich Internet Application — Web-Oriented Architecture — Social Web), SLATES.

**Unit II:** Fundamentals of Web Services - Definition, Components, benefits, behavioural characteristics. Web services architecture - web service roles, web service protocol stack, service transport. Web services components - XML-RPC, SOAP, WSDL, UDDI. web services security (notions) - confidentiality (XML-RPC and SOAP run on top of HTTP) - support for Secure Sockets Layer (SSL) for HTTP - encrypted communication via SSL, authentication (HTTP's built-in support for Basic and Digest authentication - SOAP security extensions - Digital Signature - SOAP - DSIG - SAML).

**Unit III:** Introduction to Python - installation - Python interpreter - usage and customization - editor setup - variables, expressions and statements - functions. Strings - lists - list comprehensions - stacks - queues - tuples - sequences - sets - dictionaries - sets - modules, I/O and exception handling - modules - search path - compiled modules - standard modules - packages - input and output functions - files - read and write - exception - handling and raising - user defined exceptions.

**Unit IV:** Server side programming using Python - server side scripting - CGI - role of Web server – Apache web server – Python server side script – developing Python Server Side Pages (PSP) – capturing form data – validation – processing data – exchange of data between form and server.

**Unit V:** Python-SQLite integration - features of SQLite data types, introduction to SQL commands - SELECT, DELETE, UPDATE, INSERT. Python functions for SQLite operations - database connection, database and table creation, selection, query, fetching results - insertion and deletion of data using Python - displaying data from SQLite in webpage. Case study - server MVC design pattern - Django.

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1. James Governor, Web 2.0 Architectures: What Entrepreneurs & Information Architects Need to Know, 1st Edition, Shroff Publisher & Distributors, ISBN: 8184047355.
2. S. V. Subrahmanya and B. V. Kumar, Web Services: An Introduction, 2nd Edition, Tata Mc-graw Hill Publishing Co. Ltd, ISBN: 1259002764.
3. Web 2.0, http://en.wikipedia.org/wiki/Web_2.0
4. Web Services, http://www.tutorialspoint.com/webservices/
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8. Allen Downey, Jeffrey Elkner and Chris Meyers, How to Think Like a Computer Scientist: Learning with Python, Createspace, 2009, ISBN: 1441419071. Online Version: http://openbookproject.net/thinkcs/python/english3e/
9. Python Documentation. Available at http://www.python.org/doc/
10. Swarooph CH, A Byte of Python. Available at http://swaroopch.com/ notes/python/
11. Wesley J Chun, Core Python Programming, 2nd Edition, Pearson Education, ISBN: 8131711889.

# CSS3E02e – VIRTUALISATION AND CLOUD COMPUTING

## Objectives

- Understand the technical capabilities and business benefits of virtualization and cloud computing and how to measure these benefits.
- Describe the landscape of different types of virtualization and understand the different types of clouds.
- Illustrate how key application features can be delivered on virtual infrastructures.
- Explain typical steps that lead to the successful adoption of virtualization technologies.

## Course Outcome

CO1: Understand the basics of cloud computing.

CO2: Describe different types of virtualization.

CO3: Identify the cloud infrastructure and the key application features delivered on virtual infrastructures.

CO4: Describe parallel and distributed programming models and programming paradigms.

CO5: Understand mapping applications and Hadoop configuration.

CO6: Analyze security challenges in the cloud.

## Course Outline

**Unit I:** Introduction - evolution of cloud computing - system models for distributed and cloud computing - NIST cloud computing reference architecture - Infrastructure as a Service (IaaS) - resource virtualization - Platform as a Service (PaaS) - cloud platform & management - Software as a Service (SaaS) - available service providers.

**Unit II:** Virtualization - basics of virtualization - types of virtualization - implementation levels of virtualization - virtualization structures - tools and mechanisms - virtualization of CPU, memory, I/O devices - desktop virtualization - server virtualization - Linux KVM, Xen, Qemu, LXC, OpenVZ.

**Unit III:** Cloud infrastructure - FOSS cloud software environments - Eucalyptus, Open Nebula, OpenStack - OpenStack architecture - compute, object storage, image service, identity, dashboard, networking, block storage, metering, basic cloud orchestration and service definition.

**Unit IV:** Programming model - parallel and distributed programming paradigms – Mapreduce, twister and iterative Mapreduce – mapping applications - programming support – Apache Hadoop – HDFS, Hadoop I/O, Hadoop configuration, MapReduce on Hadoop.

**Unit V:** Security in the cloud - security overview – cloud security challenges – software-as- a service security – security governance – risk management – security monitoring – security architecture design – data security – application security – virtual machine security – Qubes – desktop security through Virtualization.

**References:**


1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing (From Parallel Processing to the Internet of Things), Elsevier Science, ISBN: 9780128002049.
2. John W. Rittinghouse and James F. Ransome, Cloud Computing: Implementation, Management, and Security, 1st Edition, CRC Press, ISBN: 1439806802.
3. Toby Velte, Robert Elsenpeter and Anthony Velte, Cloud Computing, A Practical Approach, TMH, ISBN: 9780071626958.
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5. Ravi Nair and Jim Smith, Virtual Machines: Versatile Platforms for Systems and Processes, 1st Edition, Elsevier Science / Morgan Kaufmann, ISBN: 9780080525402/ 1558609105.
6. Katarina Stanoevska - Slabeva, Thomas Wozniak, Santi Ristol, Grid and Cloud Computing - A Business Perspective on Technology and Applications, Springer, ISBN: 3642051928.
7. Open stack Operations Guide, http://docs.openstack.org/ops/.
8. Tom White, Hadoop: The Definitive Guide, O'Reilly Media, ISBN: 9780596551360.

# CSS3E02f – DATA WAREHOUSING AND DATA MINING

## Objectives

- To provide the fundamentals on information retrieval and data mining techniques
- To focus on practical algorithms of textual document indexing, relevance ranking, web usage mining, text analytics, as well as their performance evaluations.
- To give an exposure to the fundamentals of Data Analytics.

## Course Outcome

CO1: Understand the basic concepts of Data mining and warehousing.

CO2: Identify the different techniques of data preprocessing.

CO3: Analyze patterns that can be discovered by classification and clustering.

CO4: Understand data mining techniques of clustering.

CO5: Identify complex data types based on spatial and web mining.

## Course Outline

**Unit I:** Data warehouse - definition - operational database systems Vs data warehouses - multidimensional model - from- tables and spreadsheets to Data Cubes - schemas for multidimensional databases - measures - concept hierarchies - OLAP operations in the multidimensional data model - data warehouse architecture.

**Unit II:** Data mining - introduction - definition - data mining functionalities - major issues in data mining - data pre-processing - data cleaning - data integration and transformation - data reduction - data discretization and concept hierarchy generation. Association rule mining - efficient and scalable frequent item set mining methods - mining various kinds of association rules - association mining to correlation analysis - constraint- based association mining.

**Unit III:** Classification and prediction - issues regarding classification and prediction - classification by decision tree introduction - Bayesian classification - rule based classification - classification by back propagation - support vector machines - associative classification - lazy learners - other classification methods - prediction - accuracy and error measures - evaluating the accuracy of a classifier or predictor - ensemble methods - model section.

**Unit IV:** Cluster analysis - types of data in cluster analysis - a categorization of major clustering methods - partitioning methods - hierarchical methods - density-based methods - grid-based methods - model-based clustering methods - clustering high dimensional data - constraint-based cluster analysis - outlier analysis.

**Unit V:** Graph mining - mining object, spatial, multimedia, text and web data - multidimensional analysis and descriptive mining of complex data objects - spatial data mining - multimedia data mining - text mining - mining the World Wide Web.

**References:**

1. Jain Pei, Jiawei Han and Micheline Kamber, *Data Mining Concepts and Techniques*, 3rd Edition, Elsevier, ISBN: 9380931913.
2. Alex Berson and Stephen J. Smith, *Data Warehousing, Data Mining & OLAP*, Computing Mcgraw-Hill, ISBN: 0070062722.
3. K.P. Soman, Shyam Diwakar and V. Ajay, *Insight into Data mining Theory and Practice*, 1st Edition, Prentice Hall of India, ISBNy.8120328973.
4. G. K. Gupta, *Introduction to Data Mining with Case Studies*, 3rd Edition, PHI Learning Pvt. Ltd, ISBN: 8120350022.
5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, *Introduction to Data Mining*, 1st Edition, Pearson India, ISBN: 9332518653.

# SEMESTER IV

## CSS4P01 – PROJECT WORK

### Objectives:

- To give a practical exposure to the process of software development life cycle.
- To develop a quality software solution by following the software engineering principles and practices. Students are also encouraged to take up a research-oriented work to formulate a research problem and produce results based on its implementation/simulation/experimental analysis.

### Course Outcome:

CO1: Demonstrate a depth of knowledge of modern technology.

CO2: Practice to communicate effectively and to present ideas clearly and coherently to specific audiences in both the written and oral forms.

CO3: Understand the project requirements, reflect on their learning and take appropriate actions to implement it.

CO4: Estimate, plan, calculate, and adjust project variables.

CO5: Understand the importance of iteration, evaluation and prototyping in design of a software system.

### Course Outline

Major project work is to be done individually by each student, under the guidance of a faculty member of the concerned department.

Guide has to constantly monitor the works done by the student, imparting him/her the necessary inputs for the successful completion of the project work. Students can either take up real-life application-oriented project work or research and development projects. The student can formulate a project problem with the help of her/his guide and submit the project proposal of the same. Approval of the project proposal is mandatory. If approved, the student can commence working on it, and complete it.

### Guidelines for Submission of Report

The distinguishing mark of a dissertation is an original contribution to knowledge. The dissertation is a formal document whose sole purpose is to prove that you have made an original contribution to knowledge. Failure to prove that you have made such a contribution generally leads to failure.

It is a test of the student's ability to undertake and complete a sustained piece of independent research and analysis / application development, and to write up the work in a coherent form according to the rules and conventions of the academic community. The role of the supervisor too is very crucial in this context.

A satisfactory dissertation should not only be adequate in its methodology, in its analysis and in its argument, and adequately demonstrate its author's familiarity with the relevant literature; it should also be written in correct, coherent language, in an appropriate style, correctly following the conventions of citation. It should, moreover, have a logical and visible structure and development that should at all times assist the reader understand the arguments being presented. The layout and physical appearance of the dissertation should also conform to university standards.

The dissertation is to be prepared in TEX format (either Latex or a suitable Windows TEX variant). The format of the report is included in Appendix A. Students are also encouraged to present their work in IT fest/conference/workshop/journal with the assistance and guidance of the supervisor. This should pave as a good start for the student in the art of publishing/presenting his/her work to the outside world. Due weightage is accommodated for publications out of the project work in the final evaluation.

# CSS4E03a – DATA COMPRESSION

## Objectives

- To understand the physical significance of some basic concepts of information theory including entropy, average mutual information and the rate distortion bound.
- To learn the design of entropy codes including Huffman codes and arithmetic coding.
- To understand the operation of lossless compression schemes.
- To understand the operation of popular lossy compression schemes including delta modulation, differential pulse code modulation, transform coding, and vector quantization.

## Course Outcome

CO1: Understand various database systems, data models and schemas.
CO2: Understand database architecture, ER and duties of DBA.
CO3: Analyze compression techniques for strings and images
CO4: Illustrate various relevant transforms in image compression.
CO5: Recognize video-audio file formats and the compression techniques used
CO6: Compare and analyze different algorithms used in audio and video file formats

## Course Outline

**Unit I:** Introduction to database systems, file systems *>Vs DBMS, view of data - data abstraction, view levels, data models, instances and schemas, data independence, database languages, database architecture, database users, database administrator, role of DBA. The entity - relationship (ER) model - entity sets, relationship sets, attributes, constraints, mapping cardinalities, keys, ER diagrams, weak entity sets, strong entity sets.

**Unit II:** Dictionary methods - string compression, LZ77 sliding window, MZW, GIF images. Image compression - approaches to image compression, intuitive methods and image transform, test images, JPEG, progressive image compression, vector quantization.

**Unit III:** Wavelet methods - Fourier transform, frequency domain, Fourier image compression, CWT and inverse CWT, Haar transform, filter bank, DWT, JPEG 2000. Video compression - analogue video, composite and component video, digital video, video compression, MPEG.

**Unit IV:** Audio compression - sound, digital audio, human auditory system, MPEG-1 audio layer. Fractal based compression - IFS. Comparison of compression algorithms. Implementation of compression algorithms.

## References

1. David Solomon, *Data Compression: The Complete Reference*, 4th Edition, Springer,ISBN: 8184898002.
2. Stephen Welstead, *Fractal and Wavelet Image Compression Techniques*, Lap Lambert Academic Publishing, ISBN: 384651845X.
3. Khalid Sayood, *Introduction to Data compression*, 4th Edition, Elsevier India Pvt. Ltd, ISBN: 8131234088.

# CSS4E03b – PERVASIVE COMPUTING

## Objectives:

- To provide a sound conceptual foundation in the area of Pervasive Computing aspects.
- To provide the students the ability to conceptualize, analyze and design select classes of pervasive computing systems.

## Course Outcome

CO1: Familiarize conceptual foundation in pervasive computing area.

CO2: Understand various application fields associated to pervasive computing

CO3: Identify the devices, interfaces, security and protocols in pervasive computing field.

CO4: Understand pervasive computing in web applications

CO5: Understand the WAP architecture, languages and security issues.

CO6: Apply knowledge on personal digital assistant devices and java programming for pervasive computing

CO7 Understand pervasive computing web application architecture, MVC and user interfaces.

## Course Outline

**Unit I:** Introduction to pervasive computing - past, present, future - the pervasive computing market, m-Business, challenges and future of pervasive computing. Application examples of pervasive computing: retail, airline check-in and booking, sales force automation, healthcare, tracking, car information systems, Email access via WAP and voice.

**Unit II:** Device technology for pervasive computing - hardware, human-machine interfaces, biometrics, operating systems, Java for pervasive devices, outlook. Device connectivity - protocols, security, device management.

**Unit III:** Web application concepts for pervasive computing - history, WWW architecture, protocols, trans-coding, client authentication via the Internet for pervasive computing. WAP and beyond - introduction, components of the WAP architecture, WAP infrastructure, WAP security issues, Wireless Markup Language, WAP push, products, i-Mode, outlook.

**Unit IV:** Web voice technology - basics of speech recognition, voice standards, speech applications, speech and pervasive computing, security personal digital assistants - history, device categories, personal digital assistant operating systems, device characteristics, software components, standards, mobile applications and personal digital assistant browsers. Server side programming (Java) for pervasive computing - Java 2 Enterprise Edition (Overview), servlets, Enterprise Java Beans, Java Server Pages, Extensible Markup Language, Web Services, Model-View-Controller pattern.

**Unit V:** Pervasive web application architecture - background, scalability & availability - development of pervasive computing web applications, pervasive application architecture - example pervasive application - introduction, user interface overview, architecture, implementation. Access from PCs - smart-card authentication via the Internet, ordering goods. Access via WAP - WAP functionality, implementation - access from personal digital assistants - extending the example application to personal digital assistants, implementation for synchronized devices, implementation for intermittently connected devices, implementation for connected devices - access via voice: extending the example application to voice access, implementation.

**References:**

1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaec and Klaus Rindtorff, *Pervasive Computing: Technology and Architecture of Mobile Internet Applications*, 14th Edition, Pearson Education, ISBN: 8177582801.
2. Stefen Poslad, *Ubiquitous Computing: Smart Devices, Environments and Interactions*, Wiley India Pvt Ltd, ISBN: 8126527331.
3. Guruduth S. Banavar, Norman H. Cohen and Chandra Narayanaswami, Pervasive Computing: *An Application-Based Approach*, Wiley-Blackwell, ISBN: 0471777404.
4. Frank Adelstein, S K S Gupta, GG Richard and L Schwiebert, *Fundamentals of Mobile and Pervasive Computing*, Tata McGraw-Hill, New Delhi, ISBN: 0070603642.
5. Genco and S. Sorce, *Pervasive Systems and Ubiquitous Computing*, 1st Edition, WIT Press, ISBN: 1845644824.
6. Somprakash Bandyopadhyay, Amitava Mukherjee and Debashis Saha, *Networking Infrastructure for Pervasive Computing Enabling Technologies and Systems*, 1st Edition, ISBN: 8184898037.

## CSS4E03c – SYSTEM SECURITY

**Objectives:** To provide an understanding of the differences between various forms of computer security, where they arise, and appropriate tools to achieve them.

### Course Outcome

CO1: Familiarize with different types of securities in information systems, security goals and CIA.

CO2: Illustrate computer system threats and various types of system attacks

CO3: Identify different issues associated with system attacks and how attacking occurs; and various types of attackers

CO4: Provide knowledge in operating system security, file protections, security assurance

CO5: Understand important elements of Database security

CO6: Define security planning, various types of security policies and risk analysis

### Course Outline

**Unit I:** Notion of different types of securities - information security - computer security - security goals, relation between security, confidentiality, integrity, availability and authorization, vulnerabilities - principles of adequate protection. Notions of operating security, database security, program security, network security attacks - threats, vulnerabilities and controls. The kind of problems - interception, interruption, modification, fabrication. Computer criminals - amateurs, crackers, career criminals. Methods of defence control, hardware controls, software controls, effectiveness of controls.

**Unit II:** Program security - secure programs - fixing faults, unexpected behaviour, types of flaws. Non-malicious program errors - buffer overflows, incomplete mediation. Viruses and other malicious code - kinds of malicious code, how viruses attach, how viruses gain control, prevention, control example - the brain virus, the internet worm, web bugs. Targeted malicious code - trapdoors, Salami attack. Controls against program threats - development controls, peer reviews, hazard analysis.

**Unit III:** Operating system security - protected objects and methods of protection - memory address protection - fence, relocation, base/bounds registers, tagged architecture, segmentation, paging. Control of access to general objects - directory, access control list. File protection mechanism - basics forms of protection, single permissions. Authentication - authentication basics, password, authentication process challenge - response, biometrics. Trusted operating systems - security policies for operating systems, models of security - requirement of security systems, multilevel security, access security, limitations of security systems. Trusted operating system design - elements, security features, assurance, system flaws and assurance methods.

**Unit IV:** Database Security - security requirements - integrity of database, confidentiality and availability, reliability and integrity, sensitive data, interface, multilevel database, proposals for multilevel security.

**Unit V:** Administrating security - security planning - contents of a security planning, team members, commitment to a security plan, business continuity plans. Risk analysis - the nature of risk, steps of risk analysis. Arguments for and against risk analysis, organizational security policies - purpose and goals of organizational security. Audience, characteristics of a good security policy. Nature of security policies - data sensitivity policy, government agency IT security policy. Physical security - natural disaster, human vandals, interception of sensitive information.

## References

1. C. P. Pfleeger and S. L. Pfleeger, Security in Computing, 4th Edition, Pearson India, ISBN: 9788131727256.
2. Matt Bishop, Computer Security: Art & Science, 1st Edition, Pearson, ISBN: 0201440997.
3. William Stallings, Cryptography and Network Security: Principles and Practice, 6th Edition, Pearson India, ISBN: 9332518777.
4. Michael E. Whitman and Herbert J. Mattord, Principles of Information Security, 4th Edition, Ceneage Learning India Pvt Ltd, ISBN: 8131516458.

# CSS4E03d – MOLECULAR SIMULATION AND MODELLING

## Objectives:

- To understand application of simulation techniques to study molecular dynamics and derive properties.
- To learn and apply the statistical approaches and models for phylogenetic analysis and tree reconstruction.
- To understand the basis and nature of protein-protein interactions.
- To understand principles of decking simulations.

## Course Outcome

CO1: Understand different molecular modelling methods and model types.

CO2: Illustrate concepts, principles of mathematical modelling and discrete system simulation.

CO3: Analyze different mapping techniques and Microarray technology

CO4: Analysis of different prediction strategies of Structural Modelling

CO5: Demonstrate protein structure classification and prediction

CO6: Familiarize steps in molecular visualization, protein family databases, software tools and basic operations

## Course Outline

**Unit I:** Overview of molecular modelling - molecular modelling methods - semi-empirical method and empirical method. Model Type - static, dynamic and probabilistic models. Models of growth and decay

**Unit II:** System modelling - concept, principles of mathematical modelling, static physical model, stochastic activities, continuous and discrete simulation. Discrete system simulation - probability concepts in simulation, random number generations and their testing, stochastic variable generation. Model execution - event driven versus time driven.

**Unit III:** Computational gene mapping - genetic mapping, gene expression, gene prediction methods, gene prediction tools, mutational analysis, introduction to restriction mapping and map assembly, mapping with restriction fragment fingerprints, Lander - Waterman statistics. Software Packages for Phylogenetic Analysis - PHYLogeny Inference Package (Phylip), Phylogenetic Analysis using Parsimony (PAUP) and Phylogenetic Analysis by Maximum Likelihood (PAML). Microarray technology - techniques for microarray data analysis - microarray databases. Scatter Plots, Principal Component A nalysis, Cluster Analysis, Applications of Microarray Technology.

**Unit IV:** Structural Modelling: Protein structure prediction - Prediction of protein secondary structure from the amino acid sequences. Prediction of three dimensional protei n structure. Protein structure classification: Two major classification schemes - CATH and SCOP. Protein structure prediction: Steps involved in homology modeling. Protein- Protein Interactions: Prediction methods for Protein- Protein interactions. Protein- protein interaction Databases. Computer Assisted Drug Design (CADD): Protein based drug design cycle, drug discovery pipeline. Docking Simulations: Rigid docking and Flexible docking.

**Unit V:** Molecular Visualization: Visualization of protein structure, Methods of studying proteins, Proteomics databases, Protein family databases, PDB file format. Software tools for 3D molecular graphic visualization: Rasmol - basic operations and steps in Rasmol to visualize the molecule, advantages of Rasmol, advantages of Swiss-PdbViewer.

## References:


1. Stephen Misener and Stephen A. Krawetz, Bioinformatics: Methods and Protocols, 1st Edition, Humana Press, iSBN: 1617371564.
2. Geoffrey Gordan, System SimuS&nr 2nd Edition,' PHI, ISBN: 9788120301405.
3. Tamar Schlick, Molecular Modeling and Simulation: An Interdisciplinary Guide, 2nd Edition, Springer, ISBN: 14w1426902.
4. Narsingh Dev, System Modelling with Digital Computer, PHI, ISBN: 0138817898.
5. Andrew Leach, Molecular Modelling: Principles and Applications, Prentice Hall. 2nd Edition, ISBN: 81317286092001.
6. Prakash S Lohar, Bioinformatics, MJP publishers, Chennai, ISBN: 9788180940668.
7. H-D Holtje, Molecular Modeling - Basic Principles and Applications, 3rd Edition, Wiley-VCH, ISBN-13: 9783527315680.
8. Alan Hinchliffe, Molecular Modelling for Beginners, 2nd Edition, John Wiley and Sons Ltd, ISBN: 9780470513149.
9. N Cohen, Guidebook on Molecular Modeling in Drug Design, 1st Edition, ISBN :9780121782450
10. Masatoshi Nei and Sudhir Kumar, Molecular Evolution and Phylogenetics, Oxford University Press, ISBN: 0195135857.
11. Asheesh Shanker, Vinay Sharma and Ashok Munjal, A Textbook of Bioinformatics, 1st Edition, Rastogi Publications, New Delhi, ISBN: 9788171339174.
12. Des Higgins (Ed), Willie Taylor (Ed), Bioinformatics: Sequence, Structure and Databanks - A Practical Approach, 3rd Edition, New Delhi Oxford University Press, ISBN: 0195667530.

# CSS4E03e – FUNDAMENTALS OF BIGDATA

## Objectives:

- To cover the basics of bigdata.
- To familiarize with bigdata technology and tools.

## Course Outcome

CO1: Understand basic concepts of Bigdata, its dimensions and currently available other Databases.
CO2: Describe bigdata analytics and familiarize data analytics using a tool – R
CO3: Understand NOSQL databases and introduce MongoDB
CO4: Understand in basic functions of NOSQL database
CO5: Illustrate the basics of the HADOOP Ecosystem
CO6: Understand the elementary concepts of MapReduce

## Course Outline

**Unit I:** Introduction to Bigdata – definition & importance of Big Data - four dimensions of Big data - volume, velocity, variety, veracity – importance of big data – structured data, unstructured data - the role of a CMS in bigdata management - integrating data types into a bigdataenvironment - distributed computing and Bigdata. Bigdata stack – layer 0,1 and 2 – Bigdata management – operational databases – relational databases – non relational databases – NoSQL
- key-value pair databases – document databases - columnar databases - graph databases - spatial databases.

**Unit II:** Bigdata analysis - basic analytics - operationalized analytics - modifying business intelligence products to handle Bigdata - Bigdata analytics examples - Analytics solutions
- text analytics - exploring unstructured data - understanding text analytics analysis and extraction techniques - the extracted information - text analytics tools for Bigdata - custom applications for Bigdata analysis - R Environment - Google Prediction API - Characteristics of a Bigdata Analysis Framework.

**Unit III:** NoSQL databases - types - Advantages over Relational Databases - MongoDB - introduction - MongoDB philosophy - the data model - designing the database - collections
- documents - data types - the _id Field - indexes - viewing available databases and collections
- opening a database - inserting data - querying for data - retrieving documents - aggregation commands - grouping results - conditional operators - specifying an array of matches - applying criteria for search - $slice - $size - $exists - $type - $elemMatch - $not (meta- operator) - update()
- save() - $inc - $set - $unset - $push - $pushAll - $addToSet - removing elements from an array atomic operations - modifying and returning a document atomically renaming a collection - removing data - referencing a database - implementing index-related functions - min() and max().

**Unit IV:** Hadoop - history - components - HDFS - MapReduce Basics - origins of MapReduce map function - reduce function - putting them together - Hadoop common components - application development in Hadoop - Pig and Pig Latin - Load - Transform - Dump and Store - Hive - Jaql - getting our data into Hadoop - basic copy data - Flume - Zookeeper ^ HBase -Oozie - Ltycene - Avro.

**Unit V:** Understanding MapReduce - key/value pairs - the Hadoop Java API for MapReduce - the Mapper class - the Reducer class - the Driver class - writing simple MapReduce programs - Hadoop-provided mapper and reducer implementations - Hadoop- specific data types - the Writable and WritableComparable interfaces - wrapper classes - Input/output - InputFormat and RecordReader - OutputFormat and RecordWriter. Implementing WordCount using streaming - analyzing a large dataset - summarizing the UFO data - summarizing the shape data - a relational view on data with Hive - creating a table for the UFO data - inserting the UFO data - redefining the table with the correct column separator - creating a table from an existing file - SQL views.

**References**

1. Hurwitz, Alan Nugent, Fern Halper and Marcia Kaufman, *Big Data for Dummies*, ISBN: 9781118504222.
2. Eelco Plugge, Peter Membrey and Tim Hawkins, *The Definitive Guide to MongoDB*: *The NoSQL Database for Cloud and Desktop Computing*, 1st Edition, Apress, ISBN: 9781430230519.
3. Chris Elaton, Derk Deroos, Tom Deutsch, George Lapis and Pual Zikopoulos, *Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*, 1st Edition, ISBN: B006UWBBO6.
4. Garry Turkington, *Hadoop Beginner's Guide*, Packt Publishing Ltd, ISBN: 1849517304.

## CSS4E03f – WEB ENGINEERING

**Objectives:** To understand the concepts, principles, strategies, and methodologies of web applications development.

### Course Outcome

CO1: Understand basic concepts Web engineering
CO2: Describe Requirements Engineering (RE) for web applications and familiarize Web application architecture and architecture for multimedia data.
CO3: Understand NOSQL databases and introduce MongoDB
CO4: Understand the basics of Modelling web applications and web application design
CO5: Understand the elementary concepts of testing web applications.

### Course Outline

**Unit I:** Web Engineering (WE) – introduction – motivation – categories & characteristics of web applications – product related, usage related and development related – evolution of WE.

**Unit II:** Requirements Engineering (RE) for web applications - introduction - fundamentals - sources of requirements - RE activities - RE specifications in WE - RE principles for web applications - adapting RE methods for web applications development - requirement types, notations, tools.

**Unit III:** Web application architecture - introduction - fundamentals - definition of architecture - developing and characterizing architectures - components of a generic web application architecture - layered architecture - database centric architecture - architecture for web document management - architecture for multimedia data.

**Unit IV:** Modelling web applications - introduction - modelling specifics in WE - levels – aspects phases of customizations - modelling requirements - hypertext modelling - hypertext structure modelling concepts - access modelling concepts. Web application design - web design from an evolutionary perspective - information design - software design merging information design & software design - problems and restrictions in integrated web design - a proposed structural approach - presentation design - presentation of nodes and meshes - device independent development - approaches - interaction design - user interaction - user interface organization - navigation design - deigning a link representation - designing link internals - navigation and orientation - structural dialog for complex activities - interplay with technology and architecture - functional design.

**Unit V:** Testing web applications - introduction - fundamentals - terminology - quality characteristics - test objectives - test levels - role of tester - test specifics in we - test approaches - conventional, agile - test schemes - three test dimensions - applying the scheme to web applications - test methods and techniques - link testing - browser testing - usability testing - load, stress and continues testing - testing security - test- driven development. Web project development - scope - refining frame work activities - building a WebE team - risk management - making schedule - managing quality, change - project tracking.

## References


1. Gerti Kappel, Birgit Proll, Siegried Reich and Werner Retschitzegger, *Web Engineering: The Discipline of Systematic Development of Web Applications*, John Wiley and Sons Ltd, ISBN: 9780470064894.
2. Roger S Pressman and David Lowe, Web Engineering: A Practitioner's Approach, 1st Edition, Tata Macgraw Hill Publications, ISBN: 9780073523293.
3. Leon Shklar and Rich Rosen, *Web Application Architecture: Principles, Protocols and Practices*, 2nd Edition, Wiley, ISBN: 047051860X.
4. Guy W Leeky-Thompson, *Just Enough Web Programming with XHTML, PHP, and MySQL*, 1st Edition, Cenagage Learning, ISBN: 159863481X.
5. Anders Moller and Michael Schwartzbach, *An Introduction to XML and Web Technologies*, 1st Edition, Pearson Education, New Delhi, 2009.
6. Chrits Bates, *Web Programming: Building Internet Applications*, 3rd Edition, Wiley India Edition, ISBN: 8126512903. MySQL, 1st Edition, Cenagage Learning, ISBN: 159863481X.

## CSS4E04a – DIGITAL IMAGE PROCESSING

**Objectives:** To be familiar with processing of the images, recognition of the pattern and their applications.

### Course Outcome

CO1: Understand the fundamental concepts of a digital image processing
CO2: Apply various image enhancement techniques
CO3: Describe various image enhancement techniques
CO4: Implement algorithms for handling intensive image restoration problems.
CO5: Identify and compare various image segmentation and representation techniques
CO6: Understand various image compression procedures.

### Course Outline

**Unit I:** Introduction - digital image representation - fundamental steps in image processing elements of digital image processing systems - digital image fundamentals - elements of visual perception - a simple image model - sampling and quantization - basic relationship between pixels - image geometry.

**Unit II:** Image transforms - introduction to Fourier transform - discrete Fourier transform (DFT) - properties DFT- other separable image transforms - Walsh, Hadamard and Discrete Cosine transforms. Hotelling transform.

**Unit III:** Image enhancement - basic grey level transformation - histogram equalization - image subtraction - image averaging - spatial filtering - smoothing, sharpening filters Laplacian filters. Enhancement in the frequency domain - frequency domain filters smoothing, sharpening filters - homomorphic filtering.

**Unit IV:** Image restoration - model of Image degradation/restoration process - noise models inverse filtering - least mean square filtering - constrained least mean square filtering. Edge detection - thresholding - region based segmentation - boundary representation.

**Unit V:** Image compression - fundamental concepts of image compression - compression models - information theoretic perspective. Lossless compression - Huffman coding - arithmetic coding - bit plane coding - run length coding. Lossy compression - transform coding - image compression standards.

### References

1. Richard E Woods and Rafael C Gonzalez, *Digital Image Processing*, 3rd Edition, Pearson Education Singapore Pte Ltd, ISBN: 8131726959.
2. B. Chanda and D.D. Majumder, *Digital Image Processing and Analysis*, 2nd Edition, PHI Learning Pvt Ltd, ISBN: 8120343255.
3. A.K. Jain, *Fundamentals of Digital Image Processing*, 2nd Edition, PHI Learning Pvt Ltd, ISBN: 8120309294.
4. W.K. Pratt, *Digital Image Processing: PIKS Scientific Inside*, 4th Edition, John Wiley, ISBN: 0471767778.
5. Milan Sonka, Vaclav Hlavac and Roger Boyle, *Image Processing Analysis and Machine Vision*, 3rd Edition, Ceneage Learning India Pvt Ltd, ISBN: 8131518833.

## CSS4E04b – ADVANCED TOPICS IN DATABASE DESIGN

**Objectives:** To study the advanced database techniques beyond the fundamental database techniques.

### Course Outcome

CO1: Understand the basic concepts of the database and data models. Design a database using ER and EER diagrams
CO2: Familiarize the students to OPPS Database concepts and its features
CO3: Understand the concepts of Object relational and extended database
CO4: Describe the basics of Client server, distributed and parallel Databases.
CO5: Exemplify XML data model and how-to retrieval information in Databases

### Course Outline

**Unit I:** The Extended Entity Relationship model and object model - The ER model revisited, motivation for complex data types, user defined abstract data types and structured types, subclasses, super classes, inheritance, specialization and generalization, constraints and characteristics of specialization and generalization, relationship types of degree higher than two.

**Unit II:** Object-Oriented databases - overview of object-oriented concepts, object identity, object structure, and type constructors, encapsulation of operations, methods, and persistence, type hierarchies and inheritance, type extents and queries, complex objects, database schema design for OODBMS, OQL, persistent programming languages, OODBMS architecture and storage issues, transactions and concurrency control, example of ODBMS.

**Unit III:** Object relational and extended relational databases - database design for an ORDBMS - nested relations and collections, storage and access methods, query processing and optimization, an overview of SQL3, implementation issues for extended type - systems comparison of RDBMS, OODBMS and ORDBMS.

**Unit IV:** Parallel and distributed databases and client-server architecture - architectures for parallel databases, parallel query evaluation, parallelizing individual operations, sorting, joins, distributed database concepts, data fragmentation, replication and allocation techniques for distributed database design, query processing in distributed databases, concurrency control and recovery in distributed databases. An overview of client-server architecture.

**Unit V:** Object databases on the web and semi structured data - web interfaces to the web, overview of XML - structure of XML data, document schema, querying XML data - storage of XML data, XML applications - the semi structured data model, implementation issues, indexes for text data. Enhanced data models for advanced applications - active database concepts, temporal database concepts, spatial databases concepts and architecture, deductive databases and query processing, mobile databases, geographic information systems.

**References:**

1. Elmasri and Navathe, *Database Systems - Models, Languages, Design and Application Programming*, 6th Edition, Pearson India, ISBN: 8131792471.
2. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, 3rd Edition, McGraw - Hill Education, ISBN: 9339213114.
3. Korth, Silberchatz and Sudarshan, *Database System Concepts*, 6th Edition, McGraw-Hill Education India Pvt. Ltd, ISBN: 9332901384.
4. Alexis Leon and Mathews Leon, *Database Management System*, 1st Edition, Vikas Publishers, ISBN: 8182092221. L»r
5. Peter Rob and Coronet, *Database Systems, Design, Implementation and Management*, 5th Revised Edition, Course Technology, ISBN: 061906269X.
6. C J Date, *Introduction to Database Systems*, 8th Edition, Addison-Wesley, ISBN: 0321197844. CSS4E01c | Software Development for Portable Devices

# CSS4E04c – SOFTWARE DEVELOPMENT FOR PORTABLE DEVICES

## Objectives

- Explain the key differences between development of systems to run on mobile devices and typical personal computing.
- Design effective applications for a mobile device by taking into consideration the underlying hardware-imposed restrictions such as screen size, memory size and processor capability.
- Identify potential security issues and suggest mechanisms to ensure the safety of applications on the mobile device.
- Critically analyze and communicate the differences in architecture and specialized topics such as event handling between applications on the mobile device and non- mobile platforms.

## Course Outline

CO1: Understanding on Mobile web and CSS3

CO2: Understand the role of jQuery - methods - manipulations

CO3: Describe the basics of Android and smartphones its architecture, environment, life cycle and various XML layouts

CO4: Understand the role of content providers and databases

CO5: Understand networking and location-based services.

CO6: Illustrate how exchange of data to and from a web server like JSON is taking place.

## Course Outline

**Unit I:** Introduction to Mobile Web (HTML 5) - Semantic Elements - Structural Elements - Basic formatting tags - heading, paragraph, underline break, bold, italic, underline, superscript, subscript, font and image. Different attributes like align, color, bgcolor, font face, border, size. Navigation Links using anchor tag - internal, external, mail and image links. Lists - ordered, unordered and definition, table tag, HTML5 form controls - form, input types - color, date, datetime, datetime-local, email, month, number, range, search, tel, time, url, week, text, password, textarea, button, checkbox, radio button, select box, hidden controls, calendar, date, time, email, url, search. Datalist, keygen, output - Introduction to CSS3.

**Unit II:** jQuery - introduction - Adding jQuery to web pages - downloading - accessing from CDNs - jQuery syntax - jQuery selectors - event methods - ready(), click(), dblclick(), mouseenter(), mouseleave(), mousedown(), mouseup(), hover(), foucs(), blur() - effects - hide, show, fading, sliding, animation - callback functions - chaining - methods for changing and manipulating HTML elements and attributes - adding new elements/content - append(), prepend(), after(), before() - removing elements - remove(), empty() - manipulating CSS3 - dimensions of elements and browser window - traversing - ancestors, descendants, siblings.

**Unit III:** Introduction to A ndroid and smart phones, Android architecture & virtual machine, mobile technology terminologies, setting up the environment, setting up emulators, Android fundamentals - activities and applications activity life cycles, activity stacks, activity states. Introduction to manifest, resources & R.java, assets, values - strings.xml form widgets, views, layouts & drawable resources - XML layouts, linear layouts, relative layouts, table layouts, A ndroid widgets, UI XML specifications events, bundles & intents - explicit intents implicit intents event broadcasting with intents event reception with broadcast receivers, adapters and data binding.

**Unit IV:** Files, content providers and databases - saving and loading files, SQLite databases Android database design - exposing access to a data source through a content provider, content provider registration, native content providers, Android Debug Bridge (adb) tool, Linkify.

**Unit V:** Adapters and widgets, notifications, custom components threads running on UI thread, Worker thread handlers & runnable asyntask (in detail), playing audio and video, recording audio and video, using the camera to take and process pictures. Networking & location based services - live folders, using sdcards – reading and writing, XML parsing - JSON parsing - including external libraries in applications, Map-based activities, Maps via intent and Map activity GPS, location based services configuration, geocoding, accessing phone services (Call, SMS, MMS), network connectivity services, using Wifi & Bluetooth action bar tabs and custom views on action bars.

**References:**

1. Terry Felke-Morris, *Web Development & Design Foundations with HTML5*, 7th Edition, Addison-Wesley, ISBN: 0133571785.
2. *Html5 Black Book: Covers CSS3, Javascript, XML, XHTML, Ajax, PHP and Jquery*, Kogent Learning Solutions Inc, ISBN: 9350040956.
3. Kessler, *Programming HTML 5Applications*, OReilly Media, ISBN: 9350235904.
4. Robin Nixon, *Html5 For IOS and Android: Beginner Guide*, 1st Edition, McGraw- Hill Education India Pvt .Ltd, ISBN: 101259003078.
5. Lauren Darcey and Shane Conder, *Android Wireless Application Development: Android Essentials* (Volume 1), 3rd Edition, Pearson Education, ISBN: 9332518882.
6. Zigurd Mednieks, Rick Rogers, Lombardo John and Blake Meike, *Android Application Development*, 1st Edition, O'Reilly Meida,
7. Reto Meier, *Professional Android 2 Application Development*, 1st Edition, Wiley India Pvt Ltd, ISBN: 8126525894.

# CSS4E04d – STORAGE AREA NETWORKS

## Objectives:

- Understand Storage Area Networks (SAN) characteristics and components.
- Learn about the SAN architecture and management.
- Understand about designing and building SAN.

## Course Outcome

CO1: Understand basic networking and SAN topologies
CO2: Illustrate SAN basics technology and configuration
CO3: Understand storage networking architecture and SAN emerging technologies
CO4: Illustrate the storage infrastructure and management activities
CO5: Demonstrate how to build SAN and security guidelines

## Course Outline

**Unit I:** Basic networking concepts and topologies - OSI reference model, common network devices, network topologies, MAC standards - need for storage networks – storage devices - techniques evolution - benefits of SANs - SAN components and building blocks - fibre channel basics - fibre channel topologies, fibre channel layers, classes of service SAN topologies.

**Unit 2:** SAN fundamentals - SAN operating systems software and hardware types of SAN technology - technology and configuration, high scalability and flexibility standards - storage management challenges - networked storage implementation challenges - storage subsystems for video services.

**Unit III:** Storage networking architecture storage in storage networking - challenges, cost and performance - Network in storage networking - fibre channel, emerging SAN interconnect technologies - basic software, advanced software, backup software implementation strategies.

**Unit IV:** Storage network management in-band management out-of-band management - SNMPHTTP - TELNET storage network management issues - storage resource management - storage management, storage, systems and enterprise management integration.

**Unit V:** Designing and building a SAN - design considerations - business requirements - physical layout, placement, storage, pooling, data availability, connectivity, scalability, migration, manageability, fault tolerance and resilience - prevention of congestion - routability - backup and restoration - SAN security & iSCSI technology - basic security guidelines - implementing SAN security - backup and restoration in iSCSI technology - future of SANS.

## References


1. Meeta Gupta, *Storage Area Network Fundamentals*, Cisco Press, ISBN: 158705065X.
2. John R. Vacca, *The Essential Guide to Storage Area Networks*, 1st Edition, Prentice Hall, ISBN: 0130935751.
3. Richard Barker and Paul Massiglia, *Storage Area Network Essentials*: *A Complete Guide to Understanding and Implementing SANs*, Wiley India Pvt Ltd, ISBN: 8126518588.
4. Tom Clark, *Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs*, 2nd Edition, Addison Wesley Professional, ISBN: 0321136500.
5. Robert Spalding, *Storage Networks: The Complete Reference*, 1st Edition, Tata McGraw-Hill Education, ISBN: 0070532923.
6. Christopher Poelke and Alex-Nikitin, *Storage Area Networks for Dummies*, 2nd Edition, ISBN: 9780470385135. '
7. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka and Nils Haustein, *Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE*, Wiley India Pvt Ltd, ISBN: 8126518324.

## CSS4E04e – SEMANTIC WEB

**Objectives:** To discover the capabilities and limitations of semantic web technology for different applications.

### Course Outline

CO1: Understand semantic web basics
CO2: Represent data from a chosen problem in XML with appropriate semantic tags
CO3: Conceptualize the phases of ontology learning, algorithm and evaluation
CO4: Understand ontology management, tools and development
CO5: Describe the implementation details of web services and security issues.

### Course Outline

**Unit I:** Components - types - ontological commitments - ontological categories - philosophical background - knowledge representation ontologies – top level ontologies - linguistic ontologies - domain ontologies - semantic web - need - foundation - layers - architecture.

**Unit I:** Languages for semantic web and ontologies - web documents in XML – RDF – schema – web resource description using RDF - RDF properties – topic maps and RDF – overview – syntax structure – semantics – pragmatics - traditional ontology languages – LOOM - OKBC – OCML - Flogic Ontology Markup Languages – SHOE – OIL – AML-OIL – OWL.

**Unit III:** Ontology learning for semantic web - taxonomy for ontology learning - layered approach - phases of ontology learning - importing and processing ontologies and documents - ontology learning algorithms - evaluation.

**Unit IV:** Ontology management and tools - overview - need for management - development process - target ontology - ontology mapping - skills management system - ontological class - constraints - issues. Evolution - development of tools and tool suites - ontology merge tools - ontology based annotation tools.

**Unit V:** Applications - web services - semantic web services - security issues - current trends.

### References

1. Asuncion Gomez-Perez, Oscar Corcho and Mariano Fernandez-Lopez, *Ontological Engineering: with examples from the areas of Knowledge Management, e- Commerce and the Semantic Web*, 1st Edition, Springer, ISBN: 1849968845.
2. Grigoris Antoniou and Frank van Harmelen, *A Semantic Web Primer*, The MIT Press, ISBN: 0262012103.
3. Liyand, *Introduction to the Semantic Web and Semantic Web Services*, Chapman, ISBN: 1584889330.
4. Alexander Maedche, *Ontology Learning for the Semantic Web*, Springer, 2002nd Edition.
5. John Davies, Dieter Fensel and Frank Van Harmelen, *Towards the Semantic Web: Ontology - Driven Knowledge Management*, 1st Edition, Wiley, ISBN: 0470848677.
6. Dieter Fensel, Wolfgang Wahlster, Henry Lieberman and James Hendler, *Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential*, The MITPress, ISBN: 9780262562126.

## CSS4E04f – ADVANCED JAVA PROGRAMMING

**Objectives:** To learn the advanced features of Java programming language that equip the students to develop web-based applications with RDBMS.

### Course Outline

CO1: Understand advanced concept of Java Programming, RMI and servlets
CO2: Develop manipulate servlets and configuration
CO3: Illustrate the basic functionalities of JNDI and EJB
CO4: Develop JSP pages by understanding the technology and execution
CO5: Understand the basics of ORM environment configuration mappings and HQL foundations

### Course Outline

**Unit I:** RMI & Servlets - introduction, architecture, defining remote objects, creating stubs and skeletons, serializable classes, accessing remote objects, factory classes, dynamically loaded classes, RMI activation, registering remote objects.

**Unit II:** Servlets, generic servlet, servlets that access request headers, develop servlets that manipulate response headers, HTTP servlets, forms, HTTP protocols - configuring Tomcat Server, servlet context, servlet context listener, servelet chaining.

**Unit III:** JNDI & EJB - architecture, context initial context class, objects in a context, binding objects, accessing directory services, attributes and attribute interface modifying directory entities, creating directories entities. EJB roles, architecture, container, implementing a basic EJB object, implementing session beans, implementing entity bean, deploying an enterprise bean object.

**Unit IV:** Java Server Pages (JSP) - developing JSP pages, technology, syntax using scripting elements, syntax using the courier page directive, create and use JSP error pages, building reusable web presentation, components, JSP technology syntax using the include directive, JSP technology syntax using the jsp:include standard action, developing JSP Pages using custom tags, problem with JSP technology scriptlet code, given an existing custom tag library, develop a JSP page using the library, developing a simple custom tag, structure and execution of a custom tag in a JSP page, tag handler class for a simple empty custom tag, custom tag that includes its body in the contour of the HTTP response, tag library description for a simple, empty custom tag.

**Unit V:** Hibernate - ORM overview - Hibernate overview, environment, configuration, sessions, persistent class - mapping files - mapping types - examples - O/R mappings - annotations - Hibernate Query Language - Hibernate criteria - queries - Hibernate Native SQL, caching, batch processing, interceptors.

## References

1. Jason Hunter and William Crawford, *Java Servlet Programming*, 2nd Edition, O'Reilly Media, ISBN: 0596000405.
2. Karl Moss, *Java Servlets*, McGraw-Hill, ISBN: 0074637398.
3. Barry Burd, *JSP: JavaServerPages*, IDG Books, ISBN: 0764535358.
4. Prashant Sridharan, *Javabeans Developer's Resource*, ISBN: 0138873089.
5. Chuck Cavaness, *Programming Jakarta Struts*, 2nd Edition, O'Reilly Media, ISBN: 0596006519.
6. Madhusudhan Konda, *Just Hibernate: A Lightweight Introduction to the Hibernate Framework*, Oreilly Meida, ISBN: 9781449334376.

# APPENDIX A

## Guidelines for Project Report & Layout

### Cover Page & First Page

**<TITLE>**

**A PROJECT REPORT**

**SUBMITTED BY**

**<NAME OF THE STUDENT>**

**FOR THE AWARD OF THE**

**DEGREE OF MASTER OF SCIENCE (M.Sc.)**

**COMPUTER SCIENCE**

**UNIVERSITY OF CALICUT**

**<COLLEGE EMBLEM>**

**<NAME OF THE DEPARTMENT>**

**<NAME OF THE INSTITUTION>**

**(AFFILIATED TO THE UNIVERSITY OF CALICUT)**

**<ADDRESS>**

**MONTH, YEAR**

## Acknowledgement

**ACKNOWLEDGEMENT**

Date: Name of the Student



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## Declaration by the Student

**DECLARATION**

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person or material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

Date: Signature:

Name:

Reg. No.:

## Certificate from Guide & HoD

### CERTIFICATE

This is to certify that the project report entitled <<TITLE HERE>> submitted by <<Name of the Student>> (Register Number: << Reg, No>>) to University of Calicut for the award of the degree of Master of Science (M.Sc.) in Computer Science is a bonafide record of the project work carried out by him/her under my supervision and guidance. The content of the report, in full or parts have not been submitted to any other Institute or University for the award of any other degree or diploma.

Signature
<Name Project Guide>
<Designation>

Signature
<Name of the HOD>
<Designation>

Place:

Date:

### PROJECT EVALUATION REPORT OF THE EXAMINERS

Certified that the candidate was examined by us in the Project Viva Voce Examination held on ..... and his/her Register Number is .....

Examiners:

1.

2.

## Contents

**CONTENTS**

## Abstract

# ABSTRACT

The abstract is a very brief summary of the report's contents. It should be about half a page long. Somebody unfamiliar with your project should have a good idea of what it's about having read the abstract alone and will know whether it will be of interest to them.

An abstract is a section at the beginning of a report, dissertation, thesis or paper summarizing the contents, significant results and conclusions of said document. It allows people to rapidly ascertain the documents purpose and if the document will be useful for them to read.

The abstract is not the same as a summary in the sense you are think of. It is a standalone account of the document giving purpose of the work (objectives), method used, scope of the work, results, conclusions and recommendations.

The abstract, although it comes first logistically, always should be written at the completion of the other chapters of the project report. It needs to be written last because it is the essence of your report, drawing information from all of the other sections of the report. It explains why the experiment was performed and what conclusions were drawn from the results obtained.

A general guideline for an abstract has five sections or areas of focus: why the experiment was conducted; the problem being addressed; what methods were used to solve the problem; the major results obtained; and the overall conclusions from the experiment as a whole.

Do not be misled, however, from this list into thinking that the abstract is a long section. In fact, it should be significantly shorter than all of the others. All of this information should be summarized in a clear but succinct manner if the abstract is going to be successful. An estimated average length for all of this information is only a single paragraph. Although this may seem as though it is a short length to contain all of the required information, it is necessary because it forces you to be accurate and yet compact, two essential qualities.

There are many useful web pages such as http://writing2.richmond.edu/training/proiect/ biology /abslit.html to get few sample abstracts and the common mistakes we make when we write an abstract.

## List of Figures

**LIST OF FIGURES**





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## List of Tables

**LIST OF TABLES**

# CHAPTER 1

## INTRODUCTION

This is a general introduction about the project. Briefly summarize the relevance and background information about the proposed work. It should have the following sections.

1. About the proposed work, underlying technologies and techniques – outline briefly the technological/engineering/scientific/socioeconomic/relevance or significance of the project work being reported.
2. Project Profile – Tile, Area and Category and other relevant information.
3. About the Organization – to whom the Project Work is carried out.
4. Major Contributions of the Project Work.

# CHAPTER 2

# PROBLEM DEFINITION AND METHODOLOGY

This chapter is meant for giving a detailed description about the problem. This chapter includes the following subsections.

1. Problem Definition
2. Objectives
3. Motivation
4. Methodology
5. Scope

# CHAPTER 3

# REQUIREMENT ANALYSIS AND SPECIFICATION

This chapter includes the following subsections.

1. Requirement Analysis/Literature Review
2. Existing System
3. Proposed System
4. Requirement Specification
    a. Functional Requirements
    b. Non-functional Requirements
    c. Environmental Details (Hardware & Software Requirements)
5. Feasibility Study
    a. Technical Feasibility
    b. Economical Feasibility
    c. Operational Feasibility
6. Project Planning and Scheduling
    a. PERT Chart
    b. GANTT Chart
7. Software Requirement Specifications (IEEE format preferred)

# CHAPTER 4

# REQUIREMENT ANALYSIS AND SPECIFICATION

This chapter includes the following subsections.

1. Users of the System
2. Modularity Criteria
3. Architecture Diagrams (whichever of the following if applicable)
    a. DFD
    b. UML Diagrams
    c. Flowchart
4. User Interface Layout
5. Structure of Reports Being Created
6. Database Design
    a. List of Entities and Attributes
    b. E R Diagram
    c. Structure of Tables

# CHAPTER 5

# IMPLEMENTATION

This chapter is about the realization of the concepts and ideas developed earlier. It can also describe any problems that may have arisen during implementation and how you dealt with them.

Do not attempt to describe all the code in the system, and do not include large pieces of code in this section. Instead pick out and describe just the pieces of code which, for example:

- Are especially critical to the operation of the system;
- You feel might be of particular interest to the reader for some reason;
- Illustrate a non-standard or innovative way of implementing an algorithm, data structure, etc.

You should also mention any unforeseen problems you encountered when implementing the system and how and to what extent you overcame them. Common problems are:

- Difficulties involving existing software, because of, e.g.,
    - its complexity,
    - lack of documentation;
    - lack of suitable supporting software;
    - over-ambitious project aims.

A seemingly disproportionate amount of project time can be taken up in dealing with such problems. The Implementation section gives you the opportunity to show where that time has gone.

Complete source code should be provided separately as an appendix.

This chapter includes the following subsections.

1. Brief description about the Tools/Scripts for Implementation
2. Module Hierarchy
3. Coding
4. Problems Encountered

# CHAPTER 6

# TESTING

This chapter includes the following subsections.

1. Test Plans
2. Unit Testing
    a. Test Items (Test Cases)
3. Integration Testing
4. System Testing
    a. Test Items (Test Cases)
5. Implementation - Changeover Plans

# CHAPTER 7

# CONCLUSION

The purpose of this section is to provide a summary of the whole thesis or report. In this context, it is similar to the Abstract, except that the Abstract puts roughly equal weight on all report chapters, whereas the Conclusion chapter focuses primarily on the findings, conclusions and/or recommendations of the project.

There are a couple of rules for this chapter:

- All material presented in this chapter must have appeared already in the report; no new material can be introduced in this chapter (rigid rule of technical writing).
- Usually, you would not present any figures or tables in this chapter (rule of thumb).

Conclusions section can have the following (typical) content. These contents must not be given in bulleted format.

- Re-introduce the project and the need for the work though more briefly than in the introduction.
- Reiterate the purpose and specific objectives of your project.
- Recap the approach taken similar to the road map in the introduction.
- However, in this case, you are re-capping the data, methodology and results as you go.
- Summarize the major findings and recommendations of your work.

Future Enhancements

Identify further works that can be added to make your system to meet the challenges of tomorrow. You can also include whatever requirements you could not fully due to the scarcity of time/resources.

## BIBLIOGRAPHY

Ideas or contents taken from other sources should be properly cited. It is important that you give proper credit to all work that is not strictly your own, and that you do not violate copyright restrictions.

References should be listed in alphabetical order of authors' surname, and should give sufficient and accurate publication details. IEEE format is to be followed while preparing citations.

## PUBLICATIONS OUT OF THE PROJECT WORK

A list of publications made or communicated out of the work done in the project is to be included here.

GENERAL INSTRUCTIONS

1. All chapters should contain an introduction and summary (summarizes the entire chapter content in one or two lines) sections.
2. Students have to take care that only chapters/sections relevant to their work are to be included in their report.
3. Instead of merely replicating the definitions for these sections from standard text books of Software Engineering, the student has to describe the information related to his/her work (For eg, Feasibility study should be about how the proposed work is technically/economically/operationally feasible).
4. Figures and tables are to be clear and legible.
5. Citations are to be provided wherever necessary.
6. Important code, screenshots, report formats and glossary of technical terms are to be attached as Appendices A, B, C and D respectively.

*********

Name……..

Reg.No…….

# FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION

# NOVEMBER 2024

**(SHPG)**

Computer Science

**CSS1C04 – THE ART OF PROGRAMMING METHODOLOGY**

(2024 admission onwards)

Time : Three Hours Maximum : 30 Weightage

**SECTION A** (Short Answer) Answer any **four** questions
Each question carries **2** Weightage

1. List out the classifications of flowchart?
2. Describe the Key features of multidimensional array.
3. What is conditional operators ? Explain with an example.
4. Define Loop, Write the syntax for Loop.
5. Discuss variable, How they are declared
6. Explain the use of Functions.
7. Distinguish between go to and continue.

( 4 x 2 = 8 Weightage )

**SECTION B** (Short ESSAY) Answer any **four** questions
Each question carries **3** Weightage

8. Define the term Datatypes with Example
9. Compare the difference between call by value and call by reference
10. Construct a program ,To sort n strings in ascending order
11. Show the different stages of c program with example
12. Explain Top down design approaches

13. Compute the term STRUCTURE and UNION

14. Discuss any user defined data types in C.

( 4 x 3 = 12 Weightage )

**SECTION** C (ESSAY) Answer any **two** questions
Each question carries **5** Weightage

15. Define the key features of C tokens and its type

16. Explain in detail decision making statements with example

17.Summarize the concepts of ARRAY and its type.

18. Discuss the term FILE, How to handle file operations.

( 2 x 5 = 10 Weightage )

Name……...

Reg.No…….

# FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION

# NOVEMBER 2024

(SHPG)

Computer Science

CSS1C05 – COMPUTER ORGANIZATION & ARCHITECTURE

(2019 admission onwards)

Time : Three Hours Maximum : 30 Weightage

**SECTION A** (Short Answer) Answer any four questions
Each question carries **2** Weightage

1. Define Combinational circuits.
2. How cache memory is used in computer organization.
3. Explain "microinstructions" with an example.
4. Describe IEEE format for double precision floating point representation.
5. What are the different types of 8086 instructions? Give one example each.
6. Draw full Adder circuit using logic gates.
7. Explain the steps in a memory READ operation.

( 4 x 2 = 8 Weightage )

**SECTION B** (Short Essay) Answer any four questions
Each question carries **3** Weightage

8. Explain fast multiplication techniques with example.
9. List out the instruction set of 8085.
10. Summarize Booth's Algorithm.
11. List out the functions in computer organization.
12. Give a note on the types of instruction formats.
13. Outline the working of 4-to- I multiplexer with suitable diagram.
14. Explain the different arithmetic instructions of 8086 microprocessor.

( 4 x 3 = 12 Weightage )

**SECTION C** (Essay) Answer any two questions
Each question carries 5 Weightage

15. Discuss about the control unit and its design.

16. Simplify using K-map F (P. Q. R. 5) 5=∑(1. 2. 4. 7, 10, 12, 13, 15).

17.Explain in detail about the basic logic gates.

18. Discuss the organization of hardwired control unit. Compare it with microprogrammed unit.

( 2 x 5 = 10 Weightage )

**Name……..**

**Reg.No…….**

# FIRST SEMESTER M.Sc. DEGREE (REULAR) /SUPPLEMENTARY EXAMINATION , NOVEMBER 2024

**(SHPG)**

Computer Science

**CSS1C02-ADVANCED DATA STRUCTURES**

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

**SECTION A** (Short Answer) Answer any **four** questions

Each question carries **2** Weightage

1. What is Separate chaining ?.
2. Define a Data structures .
3. Define linked list in data structure.
4. What is Digital search tree ?
5. Explain Binary tree and its representation in memory with example.
6. Differentiate B and B+ tree.
7. Explain the working principle of Selection sort algorithm.

( 4 x 2 = 8 Weightage )

**SECTION B** (Short ESSAY) Answer any **four** questions

Each question carries **3** Weightage

8. Difine Huffman algorithm for extended binary tree.
9. What is AVL tree .Explain its Rotations.
10. Summarize Tree traversals algorithm with example.
11. Define Hashing and Explain the collision resolution techniques.
12. Explain Binomial Heap and Binomial Queues.
13. Summarize Asymptotic notations.
14. Explain Recursion and its type.

( 4 x 3 = 12 Weightage )

P.T.O

**SECTION C** (ESSAY) Answer any **two** questions

Each question carries **5** Weightage

15. What is Threaded Binary Tree ? Explain its types.
16. Differentiate Stack and queue in data structure
17. What is an algorithm ? Explain the analysis, complexities and properties of algorithm with suitable examples
18. What is a Tree. Summarize BST with example

( 2 x 5 = 10 Weightage )

Name……...

Reg.No…….

# FIRST SEMESTER M.Sc. DEGREE (REGULAR) EXAMINATION, NOVEMBER 2024

(SHPG)

Computer Science

**CSS1C05 – COMPUTER ORGANIZATION & ARCHITECTURE**

Time : Three Hours Maximum : 30 Weightage

**SECTION A** (Short Answer) Answer any **four** questions
Each question carries **2** Weightage

1. Convert (952.756) with base 10 to binary number system.
2. Differentiate between cache memory and virtual memory.
3. Explain "microinstructions" with an example.
4. Describe IEEE format for double precision floating point representation.
5. What are the different types of 8086 instructions? Give one example each.
6. Draw full Adder circuit using logic gates.
7. Explain the steps in a memory READ operation.

( 4 x 2 = 8 Weightage )

**SECTION B** (Short ESSAY) Answer any **four** questions
Each question carries **3** Weightage

8. Explain fast multiplication techniques with example.
9. Outline 8086 register organization.
10. Summarize Booth's Algorithm.
11. With the help of a block diagram, explain the working of Serial-In, Serial-Out shift register.
12. Explain the working principle of cache memory. Illustrate any one cache mapping technique.
13. Outline the working of 4-to- I multiplexer with suitable diagram.
14. Explain the different arithmetic instructions of 8086 microprocessor.

( 4 x 3 = 12 Weightage )

**SECTION C** (ESSAY) Answer any **two** questions
Each question carries **5** Weightage

15. Simplify using K-map F (P. Q. R. 5) 5=∑(1. 2. 4. 7, 10, 12, 13, 15).
16. Explain in detail organization and working of a virtual memory system.
17. With the help of block diagrams, explain two bus and three bus organization of process.
18. Discuss the organization of hardwired control unit. Compare it with microprogrammed unit.

( 2 x 5 = 10 Weightage )