

**ANNAMALAI UNIVERSITY**



**FACULTY OF ENGINEERING AND TECHNOLOGY**

**B.E COMPUTER SCIENCE AND ENGINEERING  
Regulations & Curriculum – 2022**

**HAND BOOK**

**2022**

**ANNAMALAI UNIVERSITY****FACULTY OF ENGINEERING AND TECHNOLOGY****B. E. (Four - Year) Degree Programme (FULL - TIME)****Choice Based Credit System (CBCS)****REGULATIONS 2022****1. Condition for Admission**

Candidates for admission to the first year of the four year B.E. Degree programmes shall be required to have passed the final examination of the plus 2 Higher Secondary Course with Mathematics, Physics and Chemistry as courses of study and candidates who have passed the Higher Secondary Examination through vocational stream under Engineering, conducted by the Board of Secondary Education, Government of Tamil Nadu or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

Candidates who have passed the Diploma programme in Engineering of the State Board of Technical Education, Tamil Nadu will be eligible for admission to the second year of the four year degree programme in B.E. under the lateral entry scheme provided they satisfy other conditions.

**2. Branches of Study in B.E.**

BRANCH I	-	Civil Engineering
BRANCH II	-	Civil and Structural Engineering
BRANCH III	-	Mechanical Engineering
BRANCH IV	-	Mechanical Engineering (Manufacturing)
BRANCH V	-	Electrical and Electronics Engineering
BRANCH VI	-	Electronics and Instrumentation Engineering
BRANCH VII	-	Chemical Engineering
BRANCH VIII	-	Computer Science and Engineering
BRANCH IX	-	Information Technology
BRANCH X	-	Electronics and Communication Engineering
BRANCH XI	-	Computer Science and Engineering (Artificial Intelligence and Machine Learning)
BRANCH XII	-	Computer Science and Engineering (Data Science)

**3. Courses of Study and Scheme of Examinations**

The courses of study with respective syllabi and the scheme of Examinations are given separately.

**4. Choice Based Credit System (CBCS)**

The curriculum includes Humanities / Social Sciences /Management, Basic Sciences, Engineering Sciences, Professional Core, Professional/Programme Electives and Open Electives in addition to Seminar & Industrial Training and Project. Each semester curriculum shall normally have a blend of theory, practical and theory cum practical courses. The total credits for the entire degree Programme is **173 (132 for lateral entry students)**.

**5. Eligibility for the Degree**

A candidate shall be eligible for the degree of Bachelor of Engineering if the candidate has satisfactorily undergone the prescribed courses of study for a period of four academic years and has passed the prescribed examinations in all the four academic years. For the award of the degree, a student has to earn a minimum of 173 credits (132 for lateral entry students).

Serve in any one of the Co-curricular activities such as

- National Cadet Corps (NCC)
- National Service Scheme (NSS)
- National Sports Organization (NSO) and
- Youth Red Cross (YRC)

For at least one year. The students enrolled in any one of the co-curricular activities (NCC / NSS / NSO / YRC) will undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid. While the training activities will normally be during weekends, the camp will normally be during vacation period.

(or)

Enrol as a student member of a recognized professional society such as

- Student Chapters of Institution of Engineers (India)
- Student Chapters of other Professional bodies like ICI, ISA, IICChE, IEEE, SAE, ASHRAE, CSI and IWS

**5.1 B.E (Honours) Degree**

A student shall be eligible to get Under Graduate degree with Honours, if he/she completes an additional 20 credits. Thus the total credits are 193. Out of 193 credits (152 credits for lateral entry students), 20 credits must be earned by studying additional course offered by the same or allied Departments (listed in Annexure) in the fifth, sixth and seventh semesters.

**5.2 B.E Degree with Minor Engineering**

A student shall be eligible to get Under Graduate degree with additional Minor Engineering, if he/she completes an additional 20 credits. Out of the 193 credits, 20 credits must be earned from the courses offered by any one of the Departments (listed in Annexure) in the Faculty of Engineering and Technology in fifth, sixth and seventh semesters.

**6. Assignment of Credits for Courses**

Each course is normally assigned one credit per hour of lecture/tutorial per week and half credit for one hour for laboratory or practical or drawing course per week.

**7. Duration of the Programme**

A student is normally expected to complete the B.E. programme in four years but in any case not more than seven years from the time of admission.

**8. Registration for Courses**

A newly admitted student will automatically be registered for all the courses prescribed for the first, second and third semesters without any option.

Every other student shall enrol for the courses intended to be credited in the succeeding semester in the current semester itself by completing the registration form indicating the list of courses. This registration will be done a week before the last working day of the current semester.

A student is required to earn 173 (132 for lateral entry students) credits in order to be eligible for obtaining the degree. However the student is entitled to enjoy an option to earn either more or less than the total number of credits prescribed in the curriculum of a particular semester on the following guidelines:

### 8.1 Slow Learners

The **slow learners** may be allowed to withdraw certain courses with the approval by the Head of the Department and those courses may be completed by them in the fifth year of study and still they are eligible to be awarded with I Class. A student can withdraw a maximum of 2 courses per semester from IV semester to VII semester and take up those courses in the fifth year of study. However, courses withdrawn during odd semesters (V and VII) must be registered in the odd semester of fifth year and courses withdrawn during even semesters (IV and VI) must be registered in the even semester of fifth year.

### 8.2 Advanced Learners

The **advanced learners** may be allowed to take up the open elective courses of eighth semester in sixth and seventh semesters one in each to enable them to pursue industrial training/project work in the entire eighth semester period provided they should register those courses in the fifth semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

### 9. Project Work

The student typically registers for project at the end of seventh semester and completes it at the end of the eighth semester along with the courses prescribed for study in the eighth semester. However a student who has registered and successfully completed the courses of eighth semester by acquiring additional credits in the earlier semesters can attempt to spend his/her period of study in an industry and complete his/her project work, submit the project report and appear for viva-voce examination at the end of eighth semester.

### 10. Mandatory Induction Program

A 3-week long induction program for the UG students entering the institution, right at the start is proposed. Normal classes start only after the induction program is over. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

- Physical Activity
- Creative Arts
- Imparting Universal Human Values
- Literary Activities
- Conduct of crash courses on soft skills
- Lectures by Eminent People
- Visits to Local Area
- Familiarization to Dept./Branch & Innovative practices

### 11. Electives

The elective courses fall under two basic categories: Professional Electives and Open Electives.

#### 11.1 Professional Elective Courses

The Professional Elective courses are offered in the concerned branch of specialization and a student can choose the Professional Elective courses with the approval of the Head of the Department concerned.

### 11.2 Open Elective Courses

Apart from the various Professional elective courses, a student must study **five** open elective courses of which the student may opt to study either that offered by the Department concerned or from the open elective courses offered by any other Department in the Faculty of Engineering & Technology, with the approval of the Head of the concerned Department and the Head of the Department offering the course. In case the student opts to study an open elective offered by a neighbouring Department in the Faculty, it shall be handled by the faculty of that Department offering the chosen open elective.

A student may be required to choose Intellectual Property Rights (IPR) and Cyber Security as open electives anywhere between fifth and eighth semesters as part of the requirements of the study.

### 11.3 MOOC (SWAYAM) Courses

The student can be permitted to earn not more than 40 % of his/her total credits (that is 69 credits) by studying Massive Open Online Courses (MOOCs) offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned and the Dean of the Faculty. The courses will be considered as equivalent to elective courses from the fifth to the eighth semesters and the credits earned through MOOC courses may be transferred and considered for awarding Degree to the student concerned.

A student who earns 3 or more credits from a 12 week MOOC course through SWAYAM portal (Syndicate Resolution No.:14 dated 10.05.2019) shall be exempted from studying the elective course and permitted to transfer the credits. Besides the student may be permitted to claim for the conversion to the next higher grade in accordance with the Syndicate Resolution No.: 31 dated 09.09.2020

### 11.4 Value Added Courses

A student can study one or more value added courses being offered by the other Departments of Study either within the Faculty or any other Faculty in the University in any semester of the B.E degree programme except First Year, with the restriction that only one Value added Course can be registered at a time.

### 11.5 Extra One Credit Courses

One credit courses shall be offered by a Department with the prior approval from the Dean of the Faculty.

For one credit courses, a relevant potential topic may be selected by a committee consisting of the Head of the Department concerned and the Board of Studies member from the Department and a senior faculty member from the Department concerned. An expert from industry familiar with the topic chosen may be accordingly invited to handle classes for the students. The details of the syllabus, time table and the name of the industrial expert may be sent by the above committee to the Dean for approval. The credits earned through the extra one credit courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. Students can take a maximum of two extra one credit courses (one each in VI and VII semesters). They shall be allowed to take extra one credit courses offered in other Departments with the permission of Head of the Department offering the courses. A separate mark sheet shall be issued for extra one credit courses.

### 11.6 Skill Related /Naan Mudhalvan

A student is required to study **Three** open elective courses One each in the fifth, sixth and seventh semester of study as part of acquiring skills in the specified field. The student shall pursue the open electives listed in the Naan Mudhalvan portal against the respective semesters. However alternatively the student shall choose the open electives from the list tabled relating to the respective programmes with the approval of the Head of the Department concerned and Dean of the Faculty.

## 12. Assessment

### 12.1. Theory Courses

The break-up of Continuous Assessment for the theory courses relates to evaluating the performance under the five Course Outcomes uniformly with 5 Marks for each outcome spread over Two Mid-Semester tests and One Assignment, totalling to 25 Marks. Similarly the break-up mark for University End Semester exams involves evaluating the performance under the five Course Outcomes with 15 Marks for each Outcome, totalling to 75 Marks.

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I Covering Units I & II)	: 8 marks
Second assessment (Mid-Semester Test-II Covering Units III, IV & V)	: 12 marks
Third Assessment (Assignment Covering Units I, II, III, IV & V)	: 5 marks
End Semester Examination	: 75 marks

The break-up of Continuous Assessment for the theory course titled Basic Engineering in the II semester that involves two disciplines requires evaluating the performance under the five Course Outcomes, with 3 for one discipline and two for the other, uniformly with 5 Marks for each outcome spread over Two Mid-Semester tests and One Assignment, totalling to 25 Marks. Similarly the break-up mark for University End Semester exams involves evaluating the performance under the five Course Outcomes with 15 Marks for each Outcome, totalling to 75 Marks.

### 12.2 Practical Courses

The break-up of Continuous Assessment for the practical courses involves evaluating the performance under the five Course Outcomes uniformly with 8 Marks for each outcome spread over Two tests and Record work, totalling to 40 Marks. Similarly the break-up mark for University End Semester exams relates to evaluating the performance under the five Course Outcomes with 12 Marks for each Outcome, totalling to 60 Marks

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First Assessment (Test-I Relating to Cycle I)	: 15 marks
Second Assessment (Test-II Relating to Cycle II)	: 15 marks
Maintenance of Record book	: 10 marks
End Semester Examination	: 60 marks

### 12.3 Theory cum Practical Course

The break-up of Continuous Assessment for the theory cum practical courses necessitates to evaluating the performance as being followed for the theory and practical courses individually and requires the students to clear each component separately. The average of the marks secured by the student in the theory and practical courses and the appropriate grade relating to the average shall be assigned to the student.

### 12.4 Project Work

The continuous assessment marks for the project work will be 40 and to be assessed by a review committee consisting of the project guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the Chairman by the Head of the Department. The Head of the Department may be a member or the Chairman. At least two reviews should be conducted during the semester by the review committee. The student shall make presentation on the progress made before the committee. 60 marks are allotted for the project work and viva voce examination at the end of the semester.

### 12.5 Industrial Internship

After attending the internship during the semester vacation of II / III year for a period of 4 weeks duration in each year, the student has to submit a report and appear for the viva-voce exam along with the V/VII semester end semester examinations.

### 13. Substitute Assessment

A student, who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the final examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Dean / Head of the Department within a week from the date of the missed assessment.

### 14. Student Counsellors (Mentors)

To help the students in planning their course of study and for general advice on the academic programme, the Dean / Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Dean / Head of the Department.

### 15. Class Committee

For all the branches of study during the first two semesters, a common class committee will be constituted by the Dean of the faculty. From among the various teachers teaching the same common course to different classes during each semester of the first year, the Dean shall appoint one of them as course coordinator.

The composition of the class committee during first and second semesters will be as follows:

- Course coordinators of all courses.
- All the Heads of the Sections, among whom one may be nominated as Chairman by the Dean.
- The Dean may opt to be a member or the Chairman.

For each of the higher semesters, separate class committees will be constituted by the respective Head of the Departments.

The composition of the class committees from third to eighth semester will be as follows:

- Teachers of the individual courses.
- A seminar coordinator (for seventh semester only) shall be appointed by the Head of the Department
- A project coordinator (for eighth semester only) shall be appointed by the Head of the Department from among the project supervisors.

- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory/40 marks for seminar/ industrial training, practical and project work will be finalized for every student and tabulated and submitted to the Head of the Department (to the Dean in the case of I & II Semester) for approval and transmission to the Controller of Examinations.

### **16. Attendance Requirements**

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

### **17. Temporary Break of Study**

A student is permitted to go on break of study for a maximum period of one year either as two breaks of one semester each or a single break of one year.

If a student wishes to apply for break of study, the student shall apply to the Dean in advance, in any case, not later than the last date of the first assessment period. The application duly filled by the student shall be submitted through the Head of the Department. In the case of short term employment/ training/ internship, the application for break of study shall be approved and forwarded by the Head of the Department concerned to the Dean.

However, the student must complete the entire programme within the maximum period of seven years.

### **18. Procedure for Withdrawing from the Examinations**

A student can withdraw from all the examinations of the semester only once during the entire programme on valid grounds accepted by the University. Such withdrawal from the examinations of a semester will be permitted only if the candidate applies for withdrawal at least 24 hours before the commencement of the last examination. The letter grade 'W' will appear in the mark sheet for such candidates.

### **19. Passing and Declaration of Examination Results**

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the Controller of Examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA), and prepare the mark sheets.



90 to 100 marks	:	Grade 'S'
80 to 89 marks	:	Grade 'A'
70 to 79 marks	:	Grade 'B'
60 to 69 marks	:	Grade 'C'
55 to 59 marks	:	Grade 'D'
50 to 54 marks	:	Grade 'E'
Less than 50 marks	:	Grade 'RA'
Withdrawn from the examination	:	Grade 'W'

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course, is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who is detained for lack of attendance must re-register for and repeat the courses in the respective semester.

A student who obtains letter grade RA in the mark sheet must reappear for the examination of the courses except for Honours courses.

A student who obtains letter grade W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

**S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0**

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-evaluation of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

OGPA/CGPA is similarly calculated considering all the courses taken from the time of admission.

## 20. Awarding Degree

After successful completion of the programme, the degree will be awarded based on OGPA/CGPA.

The conversion of OGPA/CGPA (from I semester to VIII Semester) to the corresponding Percentage of marks may be calculated as per the following formula:

$$\text{Percentage of marks} = (\text{OGPA/CGPA} - 0.25) \times 10$$

$$\text{Where } \text{OGPA/CGPA} = \frac{\sum C_i GP_i}{\sum C_i}$$

$i$  - Credit hours of a course

$i$  - Grade Point of that course

### 20.1 Honours Degree

The student requires to earn a minimum of 193 credits within four years (152 credits within three years for lateral entry students) from the time of admission, pass all the courses in the first attempt from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students) and obtain a OGPA/CGPA of 8.25 or above to obtain the Honours Degree.

The student is required to complete 6 elective courses, 2 each in the V, VI and VII semesters with a stipulation that 2 of the 6 courses need to be of 4 credits each, while the remaining 4 has to be of 3 credits each, thus totalling to 20 credits, the choice being approved by the Head of the Department concerned and the Dean of the Faculty.

However, if the student either does not clear the extra course(s) relating to become eligible for the Honours Degree or discontinues it in any of the semesters, then the student may revert to the category of the First Class with Distinction or First class, provided the student is eligible for that respective category. The student may claim for revised mark sheet, paying the stipulated fee in order that the unsuccessful appearance or discontinuity of the course(s) is not reflected in the new mark sheet.

### 20.2 First Class with Distinction

To obtain B.E Degree First Class with Distinction, a student must earn a minimum of 173 Credits within four years (132 credits within three years for lateral entry students) from the time of admission, by passing all the courses in the first attempt from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students) and obtain a CGPA of 8.25 or above.

### 20.3 First Class

To obtain B.E Degree First Class, a student must earn a minimum of 173 credits within *five* years (132 credits within *four* years for lateral entry students) from the time of admission and obtain a OGPA/CGPA of 6.75 or above for all the courses from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

### 20.4 Second Class

For Second Class, the student must earn a minimum of 173 credits within *seven* years (132 credits within *six* years for lateral entry students) from the time of admission.

### 20.5 B.E Degree with Minor Engineering

The student shall be given an option to earn a Minor Engineering Degree in another discipline of Engineering not related to his/her branch of study at the end of the first year provided the student clears all the subjects in the first year in the first attempt and secures a OGPA/CGPA of not less than 7.5

The student is required to earn an additional 20 credits starting from the third semester in the sense he/she requires to complete 6 elective courses, 2 each in the V, VI and VII semesters with a stipulation that 2 of the 6 courses need to be of 4 credits each, while the remaining 4 has to be of 3 credits each, thus totalling to 20 credits, the choice being approved by the Head of the Department concerned and the Dean of the Faculty.

The rules for awarding the B.E degree in First Class with Distinction or in First Class or in Second Class apply in the same manner for B.E Degree with Minor Engineering.

However the student who opts for Honours Degree is not entitled to pursue B.E Degree with Minor Engineering and vice-versa

## 21. Ranking of Candidates

The candidates who are eligible to get the B.E. degree with Honours will be ranked together on the basis of OGPA/CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The candidates who are eligible to get the B.E. degree in First Class with Distinction will be ranked next after those with Honours on the basis of OGPA/CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The candidates passing with First Class will be ranked next after those with distinction on the basis of OGPA/CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The ranking of candidates will be done separately for each branch of study.

## **22. Transitory Regulations**

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

Wherever there had been change of syllabi, examinations based on the existing syllabi will be conducted for three consecutive times after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent courses, as per the new syllabi, on the recommendations of the Head of the Department concerned.

## ANNEXURE

S.No.	Branch of Study in B.E	Honours Elective Courses from Same and Allied Departments of	Minor Engineering Courses from Other Departments of
1	Civil Engineering	1. Civil Engineering 2. Civil and Structural Engineering.	1. Mechanical Engineering 2. Electrical Engineering 3. Chemical Engineering 4. Computer Science and Engineering 5. Computer Science and Engineering (Artificial Intelligence and Machine Learning) 6. Computer Science and Engineering(Data Science) 7. Mechanical (Manufacturing) Engineering. 8. Electronics and Instrumentation Engineering. 9. Information Technology 10. Electronics and Communication Engineering.
2	Civil and Structural Engineering		
3	Mechanical Engineering	1. Mechanical Engineering 2. Mechanical (Manufacturing) Engineering.	1. Civil Engineering 2. Civil and Structural Engineering. 3. Electrical Engineering 4. Chemical Engineering 5. Computer Science and Engineering 6. Computer Science and Engineering (Artificial Intelligence and Machine Learning) 7. Computer Science and Engineering (Data Science) 8. Electronics and Instrumentation Engineering. 9. Information Technology 10. Electronics and Communication Engineering.
4	Mechanical (Manufacturing) Engineering.		

5	Electrical and Electronics Engineering	1. Electrical Engineering 2. Electronics and Instrumentation Engineering	1. Civil Engineering 2. Civil and Structural Engineering.
6	Electronics and Instrumentation Engineering.	3. Electronics and Communication Engineering	3. Mechanical Engineering 4. Chemical Engineering 5. Mechanical (Manufacturing) Engineering.
7	Chemical Engineering	1. Chemical Engineering 2. Pharmacy 3. Electronics and Instrumentation Engineering	1. Civil Engineering 2. Mechanical Engineering 3. Electronics and Instrumentation Engineering. 4. Information Technology 5. Civil and Structural Engineering. 6. Electrical Engineering 7. Electronics and Communication Engineering. 8. Mechanical (Manufacturing) Engineering. 9. Computer Science and Engineering 10. Computer Science and Engineering (Artificial Intelligence and Machine Learning) 11. Computer Science and Engineering(Data Science)
8	Computer Science and Engineering	1. Computer Science and Engineering. 2. Information Technology 3. Electronics and Communication Engineering	1. Civil Engineering 2. Mechanical Engineering 3. Mechanical (Manufacturing) Engineering.
9	Information Technology	4. Computer Science and Engineering(Artificial Intelligence and Machine Learning) 5. Computer Science and Engineering(Data Science)	4. Civil and Structural Engineering. 5. Chemical Engineering

10	Electronics and Communication Engineering.	<ol style="list-style-type: none"> <li>1. Electrical Engineering</li> <li>2. Electronics and Instrumentation Engineering</li> <li>3. Electronics and Communication Engineering</li> </ol>	<ol style="list-style-type: none"> <li>1. Civil Engineering</li> <li>2. Civil and Structural Engineering.</li> <li>3. Mechanical Engineering</li> <li>4. Chemical Engineering</li> <li>5. Mechanical (Manufacturing) Engineering.</li> </ol>
11	Computer Science and Engineering (Artificial Intelligence and Machine Learning)	<ol style="list-style-type: none"> <li>1. Computer Science and Engineering.</li> <li>2. Information Technology</li> <li>3. Electronics and Communication Engineering</li> </ol>	<ol style="list-style-type: none"> <li>1. Civil Engineering</li> <li>2. Mechanical Engineering</li> <li>3. Mechanical (Manufacturing) Engineering.</li> <li>4. Civil and Structural Engineering.</li> <li>5. Chemical Engineering</li> </ol>
12	Computer Science and Engineering (Data Science)	<ol style="list-style-type: none"> <li>4. Computer Science and Engineering(Artificial Intelligence and Machine Learning)</li> <li>5. Computer Science and Engineering(Data Science)</li> </ol>	

## DETAILS OF COURSE CODE

S. No	Code (3 <sup>rd</sup> and 4 <sup>th</sup> Digits)	Details	Code (5 <sup>th</sup> and 6 <sup>th</sup> Digits)	Details
1	ET	Common Course for the faculty	HS	Humanities Theory
2	CE	Civil Engg. Course	HP	Humanities Practical
3	CZ	Civil and Structural Engg. course	BS	Basic Science Theory
4	ME	Mechanical Engg. Course	BP	Basic Science Practical
5	MM	Mechanical Engg (Manufacturing). Course	ES	Engineering Science Theory
6	EE	Electrical and Electronics Engg. Course	SP	Engineering Science Practical
7	EI	Electronics and Instrumentation Engg. course	PC	Professional Core Theory
8	CH	Chemical Engg. course	CP	Professional Core Practical
9	CS	Computer Science and Engg. course	PE	Professional Elective Theory
10	IT	Information Technology course	EP	Professional Elective Practical
11	EC	Electronics and Communication Engg. course	IT	Internship /Industrial Training
12	AI	Computer Science and Engineering (Artificial Intelligence and Machine Learning)	OE	Open Elective Theory
13	DS	Computer Science and Engineering (Data Science)	PV	Project and Viva-voce
14	YY	Code of the Program concerned (S.No 02 to S.No.13)		

The first two digits relate to the year from which the Regulations commence 7<sup>th</sup> digit represents the semester and 8<sup>th</sup> and 9<sup>th</sup> digits represent the serial number of courses.



## ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY  
B.E./B.Tech. (Four Year) Degree Program (FULL-TIME)

Choice Based Credit System (CBCS)

Curriculum for First Year B.E (2022-23 onwards)

COURSES OF STUDY AND SCHEME OF EXAMINATIONS (REGULATIONS 2022)

SEMESTER I									
Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits
22ETBS101	BS-I	Mathematics–I	3	1	-	25	75	100	4
22ETBS102	BS-II	Physics	3	1	-	25	75	100	4
22ETBS103	BS-III	Chemistry	3	1	-	25	75	100	4
22ETES104	ES-I	Programming for Problem Solving	2	1	-	25	75	100	3
22ETHS105	HS-I	Heritage of Tamils தமிழர் மரபு	1	-	-	25	75	100	1
22ETHP106	HSP-I	Communication Skills and Language Laboratory	-	-	3	40	60	100	1.5
22ETSP107	ESP-I	Engineering Workshop Practice	-	-	3	40	60	100	1.5
22ETSP108	ESP-II	Electrical Wiring and Earthing Practice Laboratory	-	-	3	40	60	100	1.5
<b>Total Credits</b>									<b>20.5</b>

SEMESTER II									
Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits
22ETHS201	HS-II	English	3	1	-	25	75	100	4
22ETBS202	BS-IV	Mathematics–II	3	1	-	25	75	100	4
22ETES203	ES-II	Basic Engineering*	4	-	-	25	75	100	4
22ETHS204	HS-III	Tamils And Technology தமிழரும் தொழில்நுட்பமும்	1	-	-	25	75	100	1
22ETBP205	BSP-I	Physics Laboratory	-	-	3	40	60	100	1.5
22ETBP206	BSP-II	Chemistry Laboratory	-	-	3	40	60	100	1.5
22ETSP207	ESP-III	Computer Programming Laboratory	-	-	3	40	60	100	1.5
22ETSP208	ESP-IV	Engineering Graphics	2	-	3	40	60	100	3
<b>Total Credits</b>									<b>20.5</b>

\* Civil (3 Units) & Mechanical (2 Units) for Circuit Branches

\*Mechanical (2 Units) & Electrical and Electronics (3 Units) for Civil, C&S and Chemical Engineering Branches

\* Civil (2 Units) & Electrical and Electronics (3 Units) for Mechanical & Mechanical (Manufacturing) Engineering Branches



SEMESTER III									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
22CSBS301	BS-V	Mathematics - III	3	1	-	25	75	100	4
22ETES302	ES-III	Environmental Studies	3	-	-	25	75	100	3
22CSES303	ES-IV	Analog Electronic Circuits	3	-	-	25	75	100	3
22CSES304	ES-V	Digital Electronics	2			25	75	100	2
22CSPC305	PC-I	Data Structures and Algorithms	3	1	-	25	75	100	4
22CSPC306	PC-II	Object Oriented Programming	3	1		25	75	100	4
22CSSP307	ESP-V	Digital Electronics Lab	-	-	3	40	60	100	1.5
22CSCP308	PCP-I	Data Structures and Algorithms Lab	-	-	3	40	60	100	1.5
22CSCP309	PCP-II	Object Oriented Programming Lab	-	-	3	40	60	100	1.5
								<b>Total Credits</b>	<b>24.5</b>

SEMESTER IV									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
22CSBS401	BS-VI	Discrete Mathematics	3	-	-	25	75	100	3
22CSES402	ES-VI	Computer Organization and Architecture	3	-	-	25	75	100	3
22CSPC403	PC-III	Operating Systems	3	-	-	25	75	100	3
22CSPC404	PC-IV	Database Management Systems	3	-	-	25	75	100	3
22CSPC405	PC-V	Python Programming	3	-	-	25	75	100	3
22CSPC406	PC-VI	Design and Analysis of Algorithms	3	-	-	25	75	100	3
22ETHS407	HS-IV	Universal Human Values	2	1	-	25	75	100	3
22CSCP408	PCP-III	Operating Systems Lab	-	-	3	40	60	100	1.5
22CSCP409	PCP-IV	Database Management Systems Lab	-	-	3	40	60	100	1.5
22CSCP410	PCP-V	Python Programming Lab	-	-	3	40	60	100	1.5
								<b>Total Credits</b>	<b>25.5</b>
<b>Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming V Semester.</b>									

SEMESTER V											
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits		
22CSPC501	PC-VII	Theory of Computation	3	-	-	25	75	100	3		
22CSPC502	PC-VIII	Computer Graphics and Multimedia	3	-	-	25	75	100	3		
22CSPC503	PC-IX	Computer Networks	3	-	-	25	75	100	3		
22CSPC504	PC-X	Microprocessors	3			25	75	100	3		
22CSPE505	PE-I	Professional Elective I	3	-	-	25	75	100	3		
22CSPE506	PE-II	Professional Elective II	3	-		25	75	100	3		
22YYOE507	OE-I	Open Elective - I	3	-	-	25	75	100	3		
22CSCP508	PCP-VI	Computer Graphics and Multimedia Lab	-	-	3	40	60	100	1.5		
22CSCP509	PCP-VII	Computer Networks Lab	-	-	3	40	60	100	1.5		
22CSCP510	PCP-VIII	Microprocessors Lab	-	-	3	40	60	100	1.5		
22ETIT511	IT-I	Industrial Training / Rural Internship/Innovation / Entrepreneurship	Four weeks during the summer vacation at the end of IV Semester					100	100	4.0	
							<b>Total Credits</b>		<b>29.5</b>		

SEMESTER VI										
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	
22CSPC601	PC-XI	Compiler Design	3	-	-	25	75	100	3	
22CSPC602	PC-XII	Software Engineering	3	-	-	25	75	100	3	
22CSPE603	PE-III	Professional Elective - III	3	-	-	25	75	100	3	
22CSPE604	PE-IV	Professional Elective - IV	3	-	-	25	75	100	3	
22CSPE605	PE-V	Professional Elective -V	3	-	-	25	75	100	3	
22YYOE606	OE-II	Open Elective - II	3	-	-	25	75	100	3	
22CSCP607	PCP-IX	Compiler Design Lab	-	-	3	40	60	100	1.5	
22CSCP608	PCP-X	Software Engineering Lab	-	-	3	40	60	100	1.5	
							<b>Total Credits</b>		<b>21.0</b>	
<b>Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming VII Semester.</b>										

SEMESTER VII										
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	
22ETHS701	HS-V	Engineering Ethics	2	-	-	25	75	100	2	
22CSPC702	PC-XIII	Embedded Systems and Internet of Things (IoT)	3	-	-	25	75	100	3	
22CSPE703	PE-VI	Professional Elective- VI	3	-	-	25	75	100	3	
22CSPE704	PE-VII	Professional Elective- VII	3	-	-	25	75	100	3	
22YYOE705	OE-III	Open Elective - III	3	-	-	25	75	100	3	
22CSCP706	PCP-XI	Embedded Systems and Internet of Things (IoT) Lab	-	-	3	40	60	100	1.5	
22ETIT707	IT-II	Industrial Training / Rural Internship/Innovation / Entrepreneurship	<i>Four weeks during the summer vacation at the end of VI Semester</i>				100	100	4.0	
							<b>Total Credits</b>		<b>19.5</b>	

SEMESTER VIII										
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	
22YYOE801	OE-IV	Open Elective – IV	3	-	-	25	75	100	3	
22YYOE802	OE-V	Open Elective – V	3	-	-	25	75	100	3	
22CSPV803	PV-I	Project Work and Viva-Voce	-	PR 10	S 2	40	60	100	6	
							<b>Total Credits</b>		<b>12</b>	

<b>L</b>	No. of Lecture Hours	<b>TR</b>	No. of Hours for Discussion on Industrial Training
<b>T</b>	No. of Tutorial Hours	<b>S</b>	No. of Seminar Hours on Industrial Training / Project
<b>P</b>	No. of Practical Hours	<b>PR</b>	No. of Hours for Discussion on Project work
<b>CA</b>	Continuous Assessment Marks	<b>FE</b>	Final Examination Marks
<b>Credits</b>	Credit points allotted to that course	<b>Total</b>	Total Marks

**PE – PROFESSIONAL ELECTIVES**

1. Perl Programming
2. Distributed Systems
3. Web Technology
4. Real Time Systems
5. Advanced Java Programming
6. Mobile App Development
7. Software Testing and Quality Assurance
8. Mobile Computing
9. Cryptography and Network Security
10. Pervasive Computing
11. Adhoc and sensor Networks
12. Digital Image Processing
13. Machine Learning
14. Digital Signal Processing
15. Cloud Computing
16. Speech Processing and Synthesis
17. Information Retrieval Techniques
18. Data Mining
19. Web Application Framework
20. Open Source Programming
21. Soft Computing Techniques

**OE - OPEN ELECTIVES**

1. Internet of Things
2. Enterprise Resource Planning
3. E-Commerce
4. Supply Chain Management
5. Cyber Forensics
6. System Modeling and Simulation
7. Social Network Analysis
8. Java Full Stack Development
9. Big Data Analytics
10. Machine Learning with Application to Objects Recognition [Naan Mudhalvan]

11. Full Stack [Naan Mudhalvan]
12. Augmented & Virtual Reality (AR & VR) Development [Naan Mudhalvan]
13. Block Chain [Naan Mudhalvan]
14. Cloud Essentials [Naan Mudhalvan]
15. Intellectual Property Rights
16. NCC (Army Wing)

#### LIST OF HONOURS ELECTIVE COURSES

S. No	Course Code	Course Name	Credits
1	22CSHESCN	Software Project Management (or) Nano Computing	4
2	22CSHESCN	Artificial Intelligence	4
3	22CSHESCN	Graph Theory	3
4	22CSHESCN	Deep Learning (or) Operation Research	3
5	22CSHESCN	Parallel and Distributed Algorithms	3
6	22CSHESCN	Digital Watermarking and Steganography	3

#### LIST OF MINOR ENGINEERING ELECTIVE COURSES

S. No	Course Code	Course Name	Credits
1	22CSMISCN	Object Oriented Programming	4
2	22CSMISCN	Database Management Systems (or) Software Engineering	4
3	22CSMISCN	Computer Networks	3
4	22CSMISCN	Mobile App Development	3
5	22CSMISCN	Internet of Things	3
6	22CSMISCN	Big Data Analytics (or) Social Network Analysis	3

**ONE CREDIT COURSES**

1. Deep Learning Tools Lab
2. Image and Speech Processing Lab
3. Data Visualization Lab
4. Mobile Application Development Laboratory
5. Professional Communications

**SEMESTER I**

22ETBS101	MATHEMATICS -I	L	T	P/D	C
		3	1	0	4

**COURSE OBJECTIVES**

- To familiarize definite integrals and its application in finding area and volume.
- To introduce the fundamentals of functions of several variables.
- To make the student to learn infinite series and its nature.
- To impart knowledge about Vector calculus.
- To provide the concept of eigen values and eigen vectors of a real matrix and its properties of great utility in many branches of engineering.

**UNIT I: INTEGRAL CALCULUS**

Evaluation of definite integrals and their properties - Applications of definite integrals to evaluate surface areas and volumes of revolutions. Improper integral - Beta and Gamma functions and their properties.

**UNIT II: FUNCTIONS OF SEVERAL VARIABLES**

Rolle's theorem-Mean value theorem. Indeterminate forms - L'Hospital's rule, Functions of two variables: Taylor's and Maclaurin's series expansions - Maxima and minima for functions of two variables.

**UNIT III: SEQUENCES AND SERIES**

Convergence of sequence and series - Tests for convergence: Comparison test (only for series with positive terms) - D'Alembert's ratio test-Cauchy's root test-Integral test - Leibnitz's test (Alternating series).

**UNIT IV: VECTOR CALCULUS (DIFFERENTIATION)**

Gradient, divergence and curl - Directional derivative - Unit normal vector - Irrotational and solenoidal vectors - Expansion formulae for operators involving.

**UNIT V: MATRICES**

Rank of a matrix - Symmetric, skew - Symmetric and orthogonal matrices - Characteristic equation - Eigen values and Eigen vectors - Cayley-Hamilton Theorem - Diagonalization of symmetric matrices by Orthogonal transformation.

**TEXT BOOKS**

1. Veerarajan T., "Engineering Mathematics for First Year", Tata McGraw-Hill, New Delhi, 2008.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 36<sup>th</sup> Edition, 2010

**REFERENCE BOOKS**

1. G.B. Thomas and R.L. Finney, “Calculus and Analytic geometry”, 9<sup>th</sup> publishers, Reprint,2002.
2. Erwin kreyszig,“Advanced Engineering Mathematics”,9<sup>th</sup> Edition, JohnWiley &Sons,2006.
3. Ramana B.V., “Higher Engineering Mathematics”,Tata McGraw Hill New Delhi,11<sup>th</sup> Reprint, 2010.
4. N.P. Bali and Manish Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, Reprint,2008.

**COURSE OUTCOMES**

At the end of this course, Students will able to

1. Solve improper integrals using Beta and Gamma functions.
2. Evaluate the extreme values for functions of two variables.
3. Analyze the convergence of infinite series.
4. Understand vector differentiation and Recognize solenoidal and irrotational fields.
5. Solve eigen values and eigen vectors of a real matrix and Orthogonal transformation of a matrix.

Mapping of Course Outcomes with Program Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2									
CO2	3	3	2	2								
CO3	3	3	2									
CO4	3	3										
CO5	3	3	3	2	2							

22ETBS102	PHYSICS	L	T	P/D	C
		3	1	0	4

**COURSE OBJECTIVES**

- To understand the ray of light to undergo the phenomenon of interference diffraction and polarization.
- To understand the principle and various application of laser.
- To develop knowledge in crystal structure and its properties.
- To understand the energy quantization of subatomic particles like electron.
- Rationalize the law of conservation of energy in solar water heater and solar cells.



**UNIT I: WAVE OPTICS**

Huygens' Principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer and Mach-Zehnder interferometer. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; diffraction gratings and their resolving power.

**UNIT II: LASERS**

Introduction - Principles of Laser - Stimulated emission, Properties of laser beams: monochromaticity, coherence, directionality and brightness Einstein's theory of, stimulated emission A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO<sub>2</sub>), solid - State lasers (ruby, Neodymium), dye lasers, laser speckles, applications of lasers in science, engineering and medicine.

**UNIT III: CRYSTAL PHYSICS**

Introduction to solid Materials - Crystal structure - Geometry of lattice unit cell - Bravais' lattice - Crystal systems, Crystal structures of Materials - (Cordination number, Atomicradius, packing factor and packing density) - Types of crystal Lattice (Simple Cubic, Body Centered Cubic, Face Centered Cubic and Hexagonal Closed Packed) Miller Indices and their calculations - Finding Miller indices of crystal planes.

**UNIT IV: QUANTUM MECHANICS**

Heisenberg uncertainty Principle - CDual nature of Matter and radiation - De Broglie's Wave length - Wave Velocity and group velocity. The wave Equation, Schrödinger's time dependent and independent wave equations - The Wave function and its physical significance - The particle in a box Problem (one dimensional box) - Energy quantization - Eigen values and Eigen functions.

**UNIT V: ENERGY PHYSICS**

Introduction to energy sources - Energy sources and their availability (Conventional and Non-conventional energy sources) solar energy - Methods of Harvesting solar energy - Solar heat collector, solar water heater and solar cells. Wind energy - Basic principle and components of wind energy Conversion system (WECS) - Application of wind energy. Biomass - Biogas Generation - Classification of Biogas plants - Properties and application of Biogas.

**TEXT BOOKS**

1. Arumugam.M. "Engineering Physics", Anuradha agencies, 2<sup>nd</sup> Edition, 1997.
2. John Twidell& Tony Weir, "Renewable Energy Resources", Taylor & Francis, 2005.
3. Avadhanulu. M.N. and Kshirsagar P.G., "A Text Book of Engineering Physics", S. Chand & Company Ltd., 7<sup>th</sup> Enlarged Revised Ed., 2005
4. Gaur R.K. and Gupta S.L., "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2003.

- Rai.G.D, “Solar Energy Utilization” Volume-1 & 2 by - Khanna Publishers, New Delhi
- Pajput. R. K. Non -Conventional energy sources and Utilization - S. Chand Publication -2013.

### REFERENCE BOOKS

- Rajendran.V , “Engineering Physics”, Tata McGraw Hill publishers, 2009.
- Rai G.D., “Non-conventional Energy sources”, Khauna Publications, 1993.
- Mani. P. “Engineering Physics”, Dhanam Publication, Chennai, 2011.
- Agarwal.M.P, “Solar Energy”, S.Chand& Co., I Edn, New Delhi, 1983.

### COURSE OUTCOMES

At the end of this course, student will be able to

- Gain knowledge on the construction of different types of interferometer.
- Description on different types of laser and its application.
- Analyze the importance of packing factor in different crystal system.
- Evaluate the quantum mechanical concept of wave velocity and group velocity.
- Compared the different energy resource and their availability.

Mapping of Course Outcomes with Program Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		3	2						1
CO2	3	2			2	1	1					
CO3	3	1	1			1						
CO4	2	1	2	2	1	1						
CO5	3	2			1	2	1			1		1

22ETBS103	CHEMISTRY	L	T	P/D	C
		3	1	0	4

### COURSE OBJECTIVES

- To understand water treatment techniques and basic knowledge on surface chemistry.
- To provide knowledge on electrochemical cells and chemistry involved in corrosion.
- To learn various processes involved in fuel refining and mechanism involved in energy storage devices.
- To develop knowledge about synthesis of various types of polymers and nano materials.
- To get basic knowledge on refractories, lubricants and spectroscopical techniques.

**UNIT I: WATER CHEMISTRY AND SURFACE CHEMISTRY**

Hardness of water - Softening of hard water by ion exchange method - Boiler feed water - Boiler troubles - Internal treatment methods - Estimation of hardness by EDTA method - Desalination of brackish water - Reverse Osmosis. Disinfection of water - Break point chlorination - Adsorption - Types of Adsorption - Freundlich and Langmuir adsorption isotherms - Applications of adsorption.

**UNIT II: ELECTROCHEMISTRY AND CORROSION**

Electrode potential - Electrochemical cell - Measurement of EMF - Nernst equation for cell EMF - Concentration cells - Electrochemical series - Conductometry - Conductance, Cell constant - Types of conductometric titrations. Potentiometry - Principle of acid base titration. Corrosion - Dry and wet corrosion - Galvanic, concentration cell and pitting corrosion - Control of corrosion by Cathodic protection method.

**UNIT III: FUELS AND STORAGE DEVICES**

Fuels - Classification - Calorific values - HCV and LCV - Analysis of coal - Proximate and ultimate analysis - Refining of petroleum. Cracking - Fixed bed - Synthetic petrol - Fischer - Tropsch process - Flue gas analysis by Orsat apparatus. Batteries - Primary and secondary - Dry cell - Lead acid storage battery - Ni-Cd battery - Lithium battery - H<sub>2</sub>-O<sub>2</sub> fuel cell.

**UNIT IV: POLYMERS AND NANO MATERIALS**

Polymers -Types of polymerization - Addition, condensation and copolymerisation - Mechanism of addition polymerization (Free radical). Plastics - Thermoplastics and thermosetting plastics -Preparation, properties and uses of polyethylene, polyvinyl chloride, polystyrene, Nylon and bakelite. Nano chemistry -Introduction to nano materials. Synthesis - Precipitation, sol- Gel process, electro deposition and chemical vapour deposition methods. Carbon nano tubes, fullerenes, nano wires and nano rods.

**UNIT V: ENGINEERING MATERIALS AND SPECTROSCOPIC TECHNIQUES**

Refractories - Classification, characteristics (Refractoriness, RUL, Thermal spalling, porosity) and uses, Lubricants - Classification, properties (cloud and pour point, flash and fire point, viscosity index) and applications. Principles of spectroscopy - Beer - Lambert's Law - UV - Visible and IR spectroscopy -Basic principles and instrumentation (block diagram) - Fluorescence and its applications in medicine.

**TEXT BOOKS**

1. Jain, P.C. and Monica Jain (2010) "Engineering Chemistry" DhanpatRai& Sons, New Delhi.
2. Dara, S.S. and Umare, S.S. (2014) "Text Book of Engineering Chemistry" S. Chand & Co. Ltd., New Delhi.
3. Gopalan, R., Venkappaya, D. and Nagarajan, S. (2008) "Engineering Chemistry" Tata McGraw Publications Ltd., New Delhi.

4. Puri, B.R., Sharma, L.R. and Pathania, M.S. (2013) “Principles of Physical Chemistry” Vishal Publication Company, New Delhi.
5. Sharma, Y.R. (2010) “Elementary Organic Spectroscopy, Principle and Chemical Applications” , S. Chand Publishers, New Delhi.
6. Asim K Das and Mahua Das (2017) “An Introduction to Nanomaterials and Nanoscience” CBS Publishers & Distributors Pvt. Ltd., New Delhi.

### COURSE OUTCOMES

At the end of this course work, student will be able to

1. Develop innovative methods in soft water production for industrial uses and about adsorption analysis.
2. Describe the concept of electrochemistry and its applications; corrosion and its controlling methods.
3. Understand the properties of fuels and applications of energy storage devices.
4. Synthesis various polymers and understand about nanomaterials.
5. Gain knowledge on refractories, lubricants and understand the concepts of certain spectroscopical techniques

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2					2			
CO2				2	1							
CO3	3		3									
CO4	3				1							
CO5		2	3	2					2			

22ETES104	PROGRAMMING FOR PROBLEM SOLVING	L	T	P/D	C
		2	1	0	3

### COURSE OBJECTIVES

- To understand the fundamentals of C programming
- To provide students with understanding of code organization and functional hierarchical decomposition using complex data types.
- To understand how to break a large problem into smaller parts, writing each part as a module or function
- To effectively utilize structures and pointers in problem solving
- To enable students to take up Systems programming or Advanced C programming course.

**UNIT I: FUNDAMENTALS OF PROGRAMMING**

Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

**UNIT II: EXPRESSIONS AND CONTROL STRUCTURES**

Arithmetic Expressions and Precedence, Conditional Branching and Loops, Writing and evaluation of Conditionals and consequent Branching, Iteration and Loops.

**UNIT III: ARRAYS**

Arrays: Arrays (1-D, 2-D), Character arrays and Strings, Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

**UNIT IV: FUNCTIONS**

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

**UNIT V: FILES AND STRUCTURES**

Structure: Structures, Defining structures and Array of Structures, Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation). File handling (only if time is available, otherwise should be done as part of the lab).

**TEXT BOOKS**

1. Byron Gottfried, "Schaum's Outline of Programming with C", McGraw-Hill.
2. E. Balaguruswamy, "Programming in ANSI C", TataMcGraw-Hill.

**REFERENCE BOOKS**

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Prentice Hall of India.

**COURSE OUTCOMES**

At the end of this course, the students will be able to

1. Formulate algorithms, draw flowcharts and write pseudocode for solving arithmetic and logical problems.
2. Develop C programs using branching and looping statements.
3. Implement searching and sorting algorithms and analyze the order of complexities.

4. Define and call simple functions by value and by reference and also to write recursive functions.
5. Utilize structures, pointers and files in C programming.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2										
CO2	2	2	3	2								
CO3	2	2	3	2								
CO4	1	1										
CO5	2	1	1									

22ETHS105	HERITAGE OF TAMILS தமிழர் மரபு			
	L	T	P/D	C
	1	0	0	1

**அலகு I: மொழி மற்றும் இலக்கியம்: 3**  
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமணப் பெளத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

**அலகு II: மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை: 3**  
நடுகல் முதல் நவீன சிற்பங்கள் வரை V ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாடல்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

**அலகு III: நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3**  
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

**அலகு IV: தமிழர்களின் திணைக் கோட்பாடுகள்: 3**  
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

**அலகு V: இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3**  
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

1. Language and Literature: Language Families in India - Dravidian Languages -Tamil as a Classical Language - Classical Literature in Tamil -Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature –Management Principles inThirukural –Tamil Epics andImpact of Buddhism&Jainismin TamilLand –Bakthi Literature Azhwars and Nayanmars.- Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.
2. Heritage - Rock art paintings to modern art - Sculpture: Hero stone to modern sculpture – Bronzeicons –Tribes and their handicrafts-Art of templecar making –Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.
3. Folk and Martial arts - Therukoothu, Karagattam, VilluPattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.
4. Thina concept of Tamils -Flora and Fauna of Tamils &Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.
5. Contribution of Tamils to Indian National Movement and Indian Culture: Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India -Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine -Inscriptions & Manuscripts -Print History of TamilBooks.

#### TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
- 4.. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL -(in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of TamilStudies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of TamilStudies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of TamilStudies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, TamilNadu)
10. StudiesintheHistoryofIndiawithSpecialReferencetoTamilNadu(Dr.K.K.Pillay)(Publishe dby: The Author)
11. PorunaiCivilization(JointlyPublishedbyDepartmentofArchaeology&TamilNaduText

Bookand Educational Services Corporation, TamilNadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

22ETHP106	COMMUNICATION SKILLS AND LANGUAGE LABORATORY	L	T	P/D	C
		0	0	3	1.5

### COURSE OBJECTIVES

- To facilitate computer assisted multimedia instruction enabling individualized and independent language learning.
- To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm.
- To bring about a consistent accent and intelligibility in student pronunciation of English by providing an opportunity for practice in speaking.
- To improve the fluency of students in spoken English
- To train students to use Language appropriately for public speaking, group discussion and interviews.

### LIST OF TOPICS

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

Suggested Software Package: Globarena Package for communicative English The Globarena Package consists of the following exercises

1. Reading comprehension
2. Listening comprehension
3. Vocabulary exercises
4. Phonetics
5. Role Play in dialogues
6. Auto Speak

### TEXT BOOKS

1. Daniel Jones Current," English Pronouncing Dictionary", Edition with CD.
2. R. K. Bansal and J. B. Harrison, "Spoken English ",Orient Longman 2006 Edn.
3. J. Sethi, Kamlesh Sadanand& D.V. Jindal, "A Practical course in English Pronunciation, (with two Audio cassettes)", Prentice-Hall of India Pvt. Ltd., New Delhi.
4. T.Balasubramanian," A text book of English Phonetics for Indian Students", (Macmillan).



5. “English Skills for Technical Students”, WBSCTE with British Council, OL.

### COURSE OUTCOMES

At the end of this course work, Students will be able to

1. Student will heighten their awareness of correct usage of English Grammar in writing and speaking.
2. Acquire speaking ability in English both in terms of fluency and comprehensibility.
3. Enhance competence in the four modes of literacy; Writing, Speaking, Reading and Listening.
4. Ensure student to improve their accuracy and fluency in producing and understanding spoken and written English
5. Exposure of the grammatical forms of English and the use of these forms in specific communicative contexts.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3								3		3
CO2		3								3		3
CO3			2							3		3
CO4		2								3		3
CO5			3							3		3

22ETSP107	ENGINEERING WORKSHOP PRACTICE	L	T	P/D	C
		0	0	3	1.5

### COURSE OBJECTIVES

- To provide the students simple hands-on-experience in the basic aspects of production engineering in fitting, carpentry and sheet metal.
- To familiarize the students in the various hand forging operations

**CARPENTRY:** Use of hand tools - exercises in planning and making joints namely, Lap joint, Lenthhening joint, half lap joint, dovetail joint, mortising and tenoning etc.

**FITTING:** Use of bench tools, vice, hammers, chisels, files, hacksaw, centre punch, twist drill, taps and dies - Simple exercises in making T, V joint and dovetail joints.

**SHEET METAL WORK:** Use of hand tools - Simple exercises in making objects like cone, funnel, tray, cylinder.

**SMITHY:** Demonstration of hand forging and drop forging.

**COURSE OUTCOMES**

At end of this course work, students will be able to

1. Use basic tools of fitting, carpentry and sheet metal fabrication.
2. Fabricate simple carpentry joints.
3. Develop skill to make simple fitting joints.
4. Create simple shapes of sheet material.
5. Distinguish hand forging and drop forging operation.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		2		2		3					3
CO2	3		2		2		3					3
CO3	3		2		2		3					3
CO4	3		2		2		3					3
CO5	3		2		2		3					3

22ETSP108	ELECTRICAL WIRING AND EARTHING PRACTICE LABORATORY	L	T	P/D	C
		0	0	3	1.5

**COURSE OBJECTIVES**

- To create an awareness on the electrical safety in industrial and commercial environment.
- To enable the understanding on the principles of different types of electrical wiring.
- To offer exposure on the need for earthing and earthing practices.
- To provide practical knowledge on the various types of lighting circuits.
- To introduce methods for measuring the variables in electric circuits.

**LIST OF EXPERIMENTS**

1. Residential Wiring
2. Fluorescent lamp wiring
3. Stair case Wiring
4. Godown Wiring
5. Ceiling fan wiring
6. Industrial Wiring
7. Series and Parallel Lamp Circuits
8. Measurement of Earth Resistance
9. Measurement of Parameters in a Single-Phase AC Circuit
10. Measurement of Voltage, Current, Power and Power factor in a Resistive Circuit
11. Soldering Practice -Components devices and circuits -using general purpose PCB
12. Corridor Wiring

13. Test the operation and control circuit for LED Fluorescent Lamp (18W)
14. Study of various categories of Fuses and Insulators
15. Study and test the operation of Automatic Iron Box
16. Testing the buck/boost functions of the domestic stabilizer

### COURSE OUTCOMES

At the end of this course work, Students will be able to

1. Familiarize with the electrical safety measures.
2. Identify the different types of electrical wiring.
3. Know the necessity of Earthing.
4. Gain knowledge on the different types of lighting circuits.
5. Understand the methods for measuring electrical variables.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2			2					3
CO2	3			2			2		2			3
CO3	3			2			2		2			3
CO4	3			2			2		2			3
CO5	3			2			2		2			3

**SEMESTER II**

22ETHS201	ENGLISH	L	T	P/D	C
		3	1	0	4

**COURSE OBJECTIVES**

- To ensure the students with good vocabulary
- To make the students participate actively in writing activities
- To practice the unique qualities of professional writing style
- To develop the students the proficiency in communicative skills
- To ensure the students to face the demand of their profession

**UNIT I: VOCABULARY BUILDING**

The concept of Word Formation

Root words from foreign languages and their use in English

Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Count and uncount nouns.

Synonyms, antonyms, and standard abbreviations.

Language development - Wh questions asking and answering yes or no questions.

**UNIT II: BASIC WRITING SKILLS**

Sentence Structures

Use of phrases and clauses in sentences

Importance of proper punctuation

Creating coherence and Techniques for writing precisely

Organizing principles of paragraphs in writing

**UNIT III: NATURE AND STYLE OF SENSIBLE WRITING**

Describing and Defining

Classifying and Providing examples or evidence

Writing introduction and conclusion

Comprehension

Precise Writing

**UNIT IV: WRITING PRACTICES & ORAL COMMUNICATION**

Listening to lectures and making notes

Mechanics of presentation, asking and giving instruction

Essay Writing -Writing analytical essays and issue based essays

Dialogue writing and conversation

Letter writing -Formal and informal

**UNIT V: GROUP DISCUSSION AND JOB APPLICATION**

Characteristics and practices of group discussion

Job application

Resume preparation

Writing reports -minutes of a meeting, accident, survey E-mail -etiquette

**TEXT /REFERENCE BOOKS**

1. Michael Swan,“Practical English Usage”, OUP, 1995.
2. F.T. Wood,“Remedial English Grammar”,Macmillan,2007.
3. William Zinsser,“On Writing Well”, Harper Resource Book, 2001,
4. Liz Hamp - Lyons and Ben Heasley,“Study Writing”, Cambridge University Press, 2006.
5. Sanjay Kumar and PushpLata, “Communication Skills” Oxford University Press, 2011.
6. “Exercises in Spoken English. Parts. I-III”, CIEFL, Hyderabad, Oxford University Press.
7. Raman, Meenakshi and Shama, Sangeetha, “Technical Communication Principles and Practice”, Oxford University Press, New Delhi,2014.

**COURSE OUTCOMES**

At the end of this course work, students will able to

1. Comprehension, writing and speaking skills. Get an exposure of vocabulary and gain a good glossary.
2. Get knowledge regarding use of Grammar in speech and writing.
3. Acquire a knowledge of remembering, understanding, applying, analyzing, evaluating & creating.
4. Determine how to articulate their ideas effectively to a variety of listeners.
5. Acquire ability to speak and write effectively in English.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2		2						3		3
CO2		2		2						3		3
CO3			3							3		3
CO4			2	3						3		3
CO5			3	2						3		3

22ETBS202	MATHEMATICS -II	L	T	P/D	C
		3	1	0	4

**COURSE OBJECTIVES**

- To familiarize multiple integrals and its application in finding area and volume.
- To make the student to learn line, surface and volume integrals.
- To solve Second order linear differential equations with constant coefficients.
- To acquaint the student with the techniques in the theory of analytic functions.
- To introduce the fundamentals of complex integrations.

**UNIT I: MULTIVARIABLE CALCULUS (INTEGRATION)**

Double integrals (Cartesian) - change of order of integration in double integrals - Change of variables (Cartesian to polar) - Applications: Area as a double integral. Triple integrals (Cartesian) - Applications: Volume as a triple integral.

**UNIT II: VECTOR CALCULUS (INTEGRATION)**

Line, Surface and Volume integrals - Gauss divergence theorem (without proof) - Green's theorem in the plane (without proof) - Stokes theorem (without proof). Verification of the above theorems and evaluation of integrals using them.

**UNIT III: ORDINARY DIFFERENTIAL EQUATIONS**

First order ordinary differential equations (Linear and Bernoulli's differential equations, exact differential equations). Solution of Second order ordinary linear differential equations with constant co-efficient (method of variation of parameters only). Solution of Second order ordinary linear differential equations with variable co-efficient (Euler and Legendre's linear equations).

**UNIT IV: COMPLEX VARIABLE (DIFFERENTIATION)**

Analytic functions and their properties - Cauchy-Riemann equations - Harmonic functions - harmonic conjugate of elementary analytic functions - Construction of an analytic function. Mobius transformations.

**UNIT V: COMPLEX VARIABLE (INTEGRATION)**

Cauchy theorem (without proof) - Cauchy Integral formula (without proof) - Cauchy Integral formula for higher derivatives (without proof) - zeros and poles of an analytic functions - singularities. Residues - Cauchy Residue theorem (without proof) - Evaluation of definite integral using them. Taylor's series and Laurent's series.

**TEXT BOOKS**

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 36<sup>th</sup> Edition, 2010.
2. Erwin kreyszig, "Advanced Engineering Mathematics", 9<sup>th</sup> Edition, John Wiley & Sons, 2006.

**REFERENCE BOOKS**

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9<sup>th</sup> Edition, Pearson, Reprint, 2002.
2. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", 9<sup>th</sup> Edn., Wiley India, 2009.
3. S. L. Ross, "Differential Equations", 3<sup>rd</sup> Ed., Wiley India, 1984.
4. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7<sup>th</sup> Ed., McGraw Hill, 2004.
5. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

**COURSE OUTCOMES**

At the end of this course, students will be able to

1. Solve double and triple integrals in finding area and volumes.
2. Apply line, surface and volume integrals in Gauss, Greens and Stoke's theorems.
3. Solve Second order linear differential equations with constant coefficients.
4. Construct analytic function and analyze conformal mappings.
5. Evaluate the complex integrals and contour integration.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2								
CO2	3	3	2									
CO3	3	3	3	3	3							
CO4	3	3	2									
CO5	3	3	3	2								

22ETES203	BASIC ENGINEERING {Civil (2 Units), Civil (3 Units), Mechanical (2 Units), Electrical and Electronics (3 Units)}	L	T	P/D	C
		4	0	0	4

**BASIC CIVIL ENGINEERING (2 Units)****COURSE OBJECTIVES**

- To inculcate a knowledge on essentials of Civil Engineering and to expose on the role of significance and contributions
- To satisfying societal needs and illustrate the concepts of various construction techniques

**UNIT I**

Introduction to Civil Engineering - Various disciplines of Civil Engineering - Introduction to various building materials Stone, Bricks, Steel, Cement, Concrete – its characteristics, types and uses. Surveying - Principles and objectives of surveying; Types, Classifications of surveying, measurement of areas and distances – chain – compass: Introduction to Leveling, Total station, Remote sensing.

**UNIT II**

Building construction – foundations; Bearing capacity of soil, functions of foundations, Types - Shallow and Deep. Brick masonry – Header, Stretcher, Flemish and English Bond. Columns, Lintels, Roofs – functions, types, roofing materials. Bridges – necessity - selection of site – components of a bridge: Dams – types – selection site - forces acting on a dam – Roads – uses - classification of roads – components of a road.

**TEXT BOOKS**

1. Ramesh babu. V, A text book of Basic Civil Engineering, Anuradha Agencies, Kumbakonam, 1995.
2. Palanichamy M.S., Basic Civil Engineering, Tata McGraw Hill Publishing Company ltd, 2000.

**REFERENCE BOOKS**

1. Ramamrutham V, Basic Civil Engineering, DhanpatRai Publishing Co. (P) Ltd., 1999.
2. Natarajan K V, Basic Civil Engineering, Dhanalakshmi Publications, Chennai, 2005.
3. SatheeshGopi, Basic Civil Engineering, Pearson Publications, 2010.

**COURSE OUTCOMES**

1. Understand the basic knowledge on civil engineering materials
2. Develops the skill to satisfy the social needs and suitable method of construction technique

Mapping of Course Outcomes with Programme Outcomes															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	2									2	3	2	2
<b>CO2</b>	3	2	2									2	2	3	2
<b>CO3</b>															
<b>CO4</b>															
<b>CO5</b>															

**BASIC CIVIL ENGINEERING (3 Units)****COURSE OBJECTIVES**

- To inculcate a knowledge on essentials of Civil Engineering
- To expose the students on the role, significance and contributions of Civil Engineering in satisfying societal needs
- To illustrate the concepts of various construction techniques

**UNIT I**

Introduction to Civil Engineering - Relevance of Civil Engineering in the overall infrastructural development of the country. Introduction to various building materials -Stone, Bricks, Steel, Cement, Concrete, Timber -its characteristics, types and uses. Various types of buildings as per NBC; Selection of suitable site for buildings, Components of a residential building -its functions, Orientation of a building, simple definitions - Plinth area / built up area, floor area / carpet area -floor space index.



**UNIT II**

Surveying - Principles and objectives of surveying; Types, Classifications of surveying, measurement of areas and distances - Chain - Compass: Introduction to Leveling, Total station, Remote sensing - Fundamental principles and applications.

Building construction - Foundations; Bearing capacity of soil, functions of foundations, Types - Shallow and Deep. Brick masonry - Header, Stretcher, Flemish and English Bond. Columns, Lintels, Roofs - Functions, types, roofing materials, Floors -functions, types, flooring materials. Decorative finishes - Plastering, interior design.

**UNIT III**

Bridges - Necessity - Selection of site - Components of a bridge: Dams -Types - Selection of site - Forces acting on a dam - Roads - Uses - Classification of roads - Components of a road; Railways - Basic components of permanent way -Water supply - Per capita requirement - Sources - Need for conservation of water - Rain water harvesting - Basic water treatment - Sewage and its disposal - Basic definitions - Septic tank - Components and functions.

**TEXT BOOKS**

1. Ramesh babu. V, A text book of Basic Civil Engineering, Anuradha Agencies, Kumbakonam, 1995.
2. Palanichamy M.S., Basic Civil Engineering, Tata McGraw Hill Publishing Company ltd, 2000.

**REFERENCE BOOKS**

1. Ramamrutham V, Basic Civil Engineering, DhanpatRai Publishing Co. (P) Ltd., 1999.
2. Natarajan K V, Basic Civil Engineering, Dhanalakshmi Publications, Chennai, 2005.
3. SatheeshGopi, Basic Civil Engineering, Pearson Publications, 2010.

**COURSE OUTCOMES**

1. Understand the basic knowledge on Civil engineering materials
2. Develops the skill to satisfy the social needs
3. Describe the suitable method of construction technique

Mapping of Course Outcomes with Programme Outcomes															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	2									2	3	2	2
<b>CO2</b>	3	2	2									2	2	3	2
<b>CO3</b>	3	2	2			2						2	2	2	3
<b>CO4</b>															
<b>CO5</b>															

**BASIC MECHANICAL ENGINEERING (2 Units)****COURSE OBJECTIVES**

- To familiarize the students the functioning of boilers, turbines and internal combustion engines.
- To provide knowledge about the use of various machine tools and manufacturing processes

**UNIT I**

Energy Conversion Devices: Boilers - Classification - Description and working of Cochran boiler - Babcock and Wilcox boiler. Steam turbines: Principles and working of Impulse and Reaction turbines. Gas turbines: Principles and working of Open cycle and Closed cycle gas turbines. Internal Combustion Engines: Classification - Principal parts - Two stroke and four stroke cycle engines - Working principle of petrol and diesel engines - Concept of CRDI and MPFI fuel injection systems - Hybrid engines. Battery electric vehicles (BEV) - key components

**UNIT II**

Formative Manufacturing Processes: Forging - Principle and operations; Rolling - Principle, rolling mill configurations; Extrusion - Direct versus indirect extrusion. Metal Casting: Principle - Green sand moulding - Injection moulding. Subtractive Manufacturing: Description of parts and operations performed: Lathe, Shaper, Universal Drilling machine, Universal Milling Machine - CNC Machining Centers. Additive Manufacturing Processes: 3 D Printing: Classification - Steps - Advantages - Disadvantages - Stereo lithography process - Gas welding -principle, Oxy-acetylene welding - Equipment, Arc welding - Principle - Equipment - Brazing: Types - Soldering - Comparison of brazing and soldering.

**TEXT BOOKS**

1. Prabhu T J, Jaiganesh V and Jebaraj S, Basic Mechanical Engineering, Scitech Publications Pvt. Ltd., Chennai, 2016.
2. Venugopal and Prabhuraj T J, Basic Mechanical Engineering, ARS publishers, Sirkali, 1996.

**REFERENCE BOOKS**

1. Hajra Choudhury S. K., Nirjhar Roy, Hajra Choudhury A. K., Elements of Workshop Technology,(Vol 1 and Vol II,) , Media Promoters, Pvt Ltd. (2008)
2. Rao P. N., Manufacturing Technology : Foundry, Forming and Welding - Vol 1,Mc Graw Hill Education, (2013)
3. Steven R. Schmid, Serope Kalpakjian, Manufacturing Processes for Engineering Materials (English) 5th Edition, Pearson India, (2009)

**COURSE OUTCOMES**

At end of this course work, Students will be able to

1. Demonstrate the working of various energy conversion devices such as boilers, turbines and internal combustion engines
2. Appraise the fundamental concepts of manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (3 Units)****COURSE OBJECTIVES**

- To understand the basics of Electrical circuit laws and fundamentals of AC circuits
- To understand the working of DC Machines, transformers and AC machines
- To learn the basics of electronic devices and Communication Systems

**UNIT-I BASIC CIRCUITS**

Definition of current and voltage - Electrical circuit elements (R, L and C) - Ohm's Law- Kirchhoff's laws - solution for currents and voltages - AC circuits - RMS -Average values - Introduction to 3 phase systems - Advantages

**UNIT-II ELECTRICAL MACHINES**

Laws of Electromagnetism - Construction of DC Machines - DC Generator - EMF Equation - DC Motor - Principle of operation - Types – Characteristics

Single-phase Transformer: Construction and Working principle - EMF equation - Three-phase transformer - Working principle.

Three-phase induction motor – Construction and working principle - Single-phase induction motor - Alternators - Working principle

**UNIT-III BASIC ELECTRONICS**

P-N junction - VI Characteristics of PN junction diode, Zener diode - Rectifier circuits- Voltage Regulator using Zener diode - Elements of Communication Systems - Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

**TEXTBOOKS**

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 2014.
2. A K Theraja & B L Theraja, A Textbook of Electrical Technology, Vol.2, S. Chand Publishing, 2014.

**REFERENCE BOOKS**

1. Del Toro, "Electrical Engineering Fundamentals", Second edition, Pearson Education, New Delhi, 1989.
2. V.K. Mehta, Rohit Mehta, "Basic Electrical Engineering", S.Chand Publications, 2012.

**COURSE OUTCOMES**

At the end of the course, the students will be able to

- Understand the concepts related with electrical circuits and AC fundamentals.
- Acquire knowledge on the concepts of DC machines, Transformers and AC machines
- Enhance the knowledge about the basic electronic devices and their applications.  
Gain insight on the various elements of Communication systems.

Mapping of Course Outcomes with Programme Outcomes															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1									2			
CO2	3	2	1									2			
CO3	3	2	1									2			
CO4															
CO5															

22ETHS204	TAMILS AND TECHNOLOGY தமிழ்நாட்டுத் தொழில்நுட்பம்	L	T	P/D	C
		1	0	0	1

**அலகு I:** நெசவு மற்றும் பாணைத் தொழில்நுட்பம்: 3  
சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் - கரும்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

**அலகு II:** வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3  
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரம் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

**அலகு III:** உற்பத்தித் தொழில் நுட்பம்: 3  
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

**அலகு IV:** வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3  
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுவித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

அலகு V: அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3  
 அறிவியல் தமிழின் வளர்ச்சி -கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் 3 தமிழ்  
 மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் V தமிழ் மின் நூலகம் 3  
 இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

1. **Weaving and Ceramic Technology:**Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW) - Graffiti on Potteries.
2. **Design and Construction Technology:**Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age - Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) -Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.
3. **Manufacturing Technology:**Art of Ship Building - Metallurgical studies - Iron industry-Iron smelting, steel - Copper and gold - Coinsassource of history - Minting of Coins - Beads making - Industries Stone beads - Glass beads - Terracotta beads - Shell beads/bone beats - Archeological evidences - Gem stone types described in Silappathikaram.
4. **Agriculture and Irrigation Technology:**Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoomp of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries - Pearl - Conchediving - Ancient Knowledge of Ocean - Knowledge Specific Society.
5. **Scientific Tamil & Tamil Computing:** Development of ScientificTamil - Tamil computing - Digitalization of Tamil Books - Development of Tamil Software - Tamil Virtual Academy -Tamil Digital Library - Online Tamil Dictionaries - Sorkuvai Project.

#### TEXT-CUM-REFERENCEBOOKS:

1. தமிழக வரலாறு - மக்களுக்கும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL -(in print)
6. Social Life of the Tamils The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies).
7. Historical Heritage of theTamils (Dr.S.V.Subatamanian,Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of theTamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - ‘Sangam City Civilization on the bank so friver Vaigai’(Jointly Published by:Department of Archaeology&TamilNadu TextBook and Educational Service Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22ETBP205	PHYSICS LABORATORY	L	T	P/D	C
		0	0	3	1.5

### COURSE OBJECTIVES

- To access the Rigidity modulus of wire.
- To assess the various properties of light.
- To assess the characterization of Metals.
- To analyses the thickness of microsized objects.

### LIST OF EXPERIMENTS

1. Air Wedge
2. Newtons’s Rings
3. Simple Pendulum
4. Dispersive power of the Prism
5. Diffraction Grating
6. Acoustic diffraction Grating
7. Compound Pendulum
8. Kunt’s tube experiment
9. Young’s double slit experiment
10. Laser Grating
11. Torsional Pendulum
12. Young’s Modulus -Non-uniform Bending
13. Young’s Modulus –Uniform Bending.

### COURSE OUTCOMES

At the end of this course work, Students will be able to

1. Acquired the knowledge of torsional properties of metals wire
2. Determine the radius of curvature of the plano-convex lens.
3. Determine the dispersion power of the prism.
4. Evaluate the important characteristics of simple and compound pendulum
5. Determine the Young’s Modulus of uniform and non-uniform bending.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3						2		2	3		3
CO2	3						2		2	3		3
CO3	3						2		2	3		3
CO4	3						2		2	3		3
CO5	3						2		2	3		3

22ETBP206	CHEMISTRY LABORATORY	L	T	P/D	C
		0	0	3	1.5

### COURSE OBJECTIVES

- To list the water quality standards.
- To assess the composition of an alloy.
- To appreciate the practical significance of acidimetry, alkalimetry, permanganometry, conductometry and potentiometry.
- To analyse quantitatively the amount of a substance present in a given sample.

### LIST OF EXPERIMENTS

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Determination of the rate constant of a reaction
6. Determination of cell constant and conductance of solutions
7. Potentiometry - determination of redox potentials and emfs
8. Saponification/acid value of an oil
9. Determination of the partition coefficient of a substance between two immiscible liquids
10. Adsorption of acetic acid by charcoal
11. Volumetric analysis

### COURSE OUTCOMES

At the end of this course work, Students will be able to

1. Determine the physical properties like surface tension and viscosity.
2. Determine rate of reactions and saponification of oil.
3. Calculate the quantity of adsorbate adsorbed by charcoal.
4. Determine the impurity from Pharmaceutical products and hardness of water.
5. Determine exact concentration of acid and bases present in the industrial wastes.

Mapping of Course Outcomes with Program Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1		1			1					
CO2	2	1				1						
CO3	3	2		1			2					
CO4	3		1									
CO5	2	2										

22ETSP207	COMPUTER PROGRAMMING LABORATORY	L	T	P/D	C
		0	0	3	1.5

### COURSE OBJECTIVES

- To enable students to code, compile and test C programs.
- To enable students to design algorithms using appropriate programming constructs for problem solving.
- Identify tasks in which the numerical techniques learned are applicable and apply them to write programs.
- To enable students to segregate large problems into functions using modular programming concepts.
- To enable students to apply pointer and structures in programs effectively.

**[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given]**

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 & 9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems



Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

### COURSE OUTCOMES

At the end of this course work, Students will be able to

1. Analyze program requirements and develop programs using conditional and looping statements.
2. Write programs for handling arrays and strings.
3. Create C programs with user defined functions and recursive function calls.
4. Utilize pointers and structures for dynamic memory allocation in C programming.
5. Develop C programs for handling files.

Mapping of Course Outcomes with Programme Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1		2							
CO2	2	1	1		2							
CO3	2	1	1		2							
CO4	1	1	1		2							
CO5	1	1	1		2							

22ETSP208	ENGINEERING GRAPHICS	L	T	P/D	C
		2	0	3	3

### TRADITIONAL ENGINEERING GRAPHICS

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Reading a Drawing; Sectional Views; Dimensioning, True Length, Angle.

### COMPUTER GRAPHICS

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM). (Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

**COURSE OBJECTIVES**

- To develop the ability to produce simple engineering drawing and sketches based on current practice
- To develop the means for communication of ideas, thoughts and design of objects, related to engineering applications, to others through drawing
- To develop the skills to read manufacturing and construction drawings used in industry
- To develop a working knowledge of the layout of plant and equipment
- To develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricators

**UNIT I: INTRODUCTION TO ENGINEERING DRAWING**

Introduction to Engineering Drawing: Lettering, Dimensioning and use of drawing instruments. Conic sections: Eccentricity method of/for drawing ellipse, parabola and hyperbola- Tangent and Normal from a point on the curve.

**UNIT II: ORTHOGRAPHIC PROJECTIONS**

Orthographic projections: Introduction -Projections of points Projections of Straight lines: Determination of true length and true angle of inclinations using half cone and trapezoidal methods -drawing the projections of straight lines using half cone method from true length and true angle of inclinations.

**UNIT III: PROJECTIONS OF REGULAR SOLIDS**

Projections of solids in simple position: Projections of cube, Tetrahedron, prisms, Pyramids, cone and cylinder. Projections of solids: Auxiliary projections -projections of prisms, pyramids, cylinder and cone when the axis is inclined to only one plane.

**UNIT IV: SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS,**

Sections of solids: Sections of prisms, pyramids, cylinder and cones -true shape of section. Developments of solids: Developments of lateral surfaces of solids using parallel and radial line methods.

**UNIT V: ISOMETRIC PROJECTIONS**

Isometric projections: Projections of simple solids. Conversion of pictorial view of simple objects into orthographic projections (only elevation and plan)

**OVERVIEW OF COMPUTER GRAPHICS COVERING**

Introduction to CAD software: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars). The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.

**CUSTOMIZATION & CAD DRAWING**

Consisting of setup of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines and other basic geometric entities.

**ANNOTATIONS, LAYERING & OTHER FUNCTIONS**

Applying dimensions to objects and annotations to drawings; Setting up and use of Layers, Printing document stop a per using the print command; orthographic projection techniques Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation;

**TEXT/REFERENCE BOOKS**

1. BhattN.D.,Panchal V.M.& Ingle P.R.,(2014), Engineering Drawing, Charotar Publishing House.
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
3. Agrawal B. &Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
5. (Corresponding set of) CAD Software Theory and User Manuals.

**COURSE OUTCOMES**

At the end of this course work, Students will be able to

1. Utilize drawing instruments effectively and able to present engineering drawings and sketches.
2. Describe the concept of orthographic, isometric projections of points, lines and regular solids.
3. Visualize the images and drawings in engineering perspective.
4. Practice sectioning of bodies like machines and equipment's.
5. Develop their technical communication skills and promote life-long learning.

Mapping of Course Outcomes with Programme Outcomes												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			2		2					2		2
CO2	3	3	3	2	2				2	2		2
CO3	2		2									
CO4	3	2	2	2								
CO5										3		3

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**B.E. COMPUTER SCIENCE AND ENGINEERING**  
**(Students Admitted From the Academic Year 2022)**

**VISION**

To provide a congenial ambience for individuals to develop and blossom as academically superior, socially conscious and nationally responsible citizens.

**MISSION**

- **M1:** Impart high quality computer knowledge to the students through a dynamic scholastic environment wherein they learn to develop technical, communication and leadership skills to bloom as a versatile professional.
- **M2:** Develop life-long learning ability that allows them to be adaptive and responsive to the changes in career, society, technology, and environment.
- **M3:** Build student community with high ethical standards to undertake innovative research and development in thrust areas of national and international needs.
- **M4:** Expose the students to the emerging technological advancements for meeting the demands of the industry.

**B.E. (CSE) – PROGRAMME OUTCOMES (PO)**

After the successful completion of the B.E(CSE) degree programme the students will be able to :

Sl. No.	Programme Outcomes
<b>PO1</b>	<b>Engineering Knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO2</b>	<b>Problem Analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
<b>PO3</b>	<b>Design/Development of Solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

<b>PO4</b>	<b>Conduct Investigations of Complex Problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
<b>PO5</b>	<b>Modern Tool Usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
<b>PO6</b>	<b>The Engineer and Society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
<b>PO7</b>	<b>Environment and Sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO8</b>	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO9</b>	<b>Individual and Team Work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO10</b>	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>PO11</b>	<b>Project Management and Finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
<b>PO12</b>	<b>Life-long Learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

**B. E. (CSE) - PROGRAMME EDUCATIONAL OBJECTIVES  
(PEO)**

<b>PEO</b>	<b>PEO Statements</b>
<b>PEO1</b>	To prepare graduates with potential to get employed in the right role and/or become entrepreneurs to contribute to the society.
<b>PEO2</b>	To provide the graduates with the requisite knowledge to pursue higher education and carry out research in the field of Computer Science and Engineering.
<b>PEO3</b>	To equip the graduates with the skills required to stay motivated and adapt to the dynamically changing world so as to remain successful in their career.
<b>PEO4</b>	To train the graduates to communicate effectively, work collaboratively and exhibit high levels of professionalism and ethical responsibility.

**B. E. (CSE) - PROGRAMME SPECIFIC OUTCOMES (PSOs)**

<b>PSOs</b>	<b>Programme Specific Outcome</b>
<b>PSO1</b>	Acquire the ability to understand <b>basic sciences, humanity sciences, basic engineering sciences and fundamental core courses</b> in Computer Science and Engineering to realize and appreciate real life problems in diverse fields for proficient design of computer based systems of varying complexity.
<b>PSO2</b>	Learn <b>specialized courses</b> in Computer Science and Engineering to build up the aptitude for applying typical practices and approaches to deliver quality products intended for business and industry requirements.
<b>PSO3</b>	Apply <b>technical and programming skills</b> in Computer Science and Engineering essential for employing current techniques in software development crucial in industries, to create pioneering career paths for pursuing higher studies, research and to be an entrepreneur.

**B.E (CSE) - CONSISTENCY OF PEOS WITH MISSION OF THE DEPARTMENT**

PEO Statements	Mission Statements			
	M1	M2	M3	M4
<b>PEO1:</b> To prepare the graduates with the potential to get employed in the right role and/or become entrepreneurs to contribute to the society.	2	3	2	3
<b>PEO2:</b> To provide the graduates with the requisite knowledge to pursue higher education and carry out research in the field of Computer Science.	2	2	3	2
<b>PEO3:</b> To equip the graduates with the skills required to stay motivated and adapt to the dynamically changing world so as to remain successful in their career.	2	3	2	3
<b>PEO4:</b> To train the graduates to communicate effectively, work collaboratively and exhibit high levels of professionalism and ethical responsibility.	3	3	2	3

3-Strong Correlation    2-Moderate Correlation    1-Weak Correlation

**B.E. (CSE) MAPPING OF PEOs WITH POs**

Mapping of PEOs with POs												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>PEO1</b>	3	2	3	2	3	1	1	1	2	2	1	2
<b>PEO2</b>	3	2	3	2	2	-	-	-	-	1	-	2
<b>PEO3</b>	2	2	2	1	3	1	1	1	2	2	-	3
<b>PEO4</b>	2	1	2	1	2	1	1	2	2	3	2	1

3- Strong Correlation    2-Moderate Correlation    1-Weak Correlation

22CSBS301	MATHEMATICS - III	L	T	P	C
		3	1	0	4

**Course Objectives :**

- To familiarize the basic concepts of partial differential equation which is helpful in solving real world problems.
- To introduce Fourier series which is very useful in the study of computing.
- To solve boundary value problems which is helpful in investigation of the important features of electromagnetic theory.
- To provide basics of Fourier transform which is useful in solving problems in frequency response of a filter and signal analysis.
- To impart knowledge about z-transform which can played important role in the development of communication engineering.

**UNIT - I Partial Differential Equations**

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions - Solution of standard type of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second order with constant coefficients.

**UNIT – II Fourier Series**

Dirichle's conditions - General Fourier series - Odd and Even functions - Half range sine series - Half range cosine series - Complex form of Fourier series – Parseval's identity.

**UNIT – III Boundary Value Problems**

Solutions of one dimensional wave equation – One dimensional heat equation (without derivation) – Fourier series solutions in Cartesian co-ordinates.

**UNIT – IV Fourier Transform**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem - Parseval's identity.

**UNIT – V Z - Transform**

Elementary properties – Inverse Z – Transform - Convolution theorem –Solution of difference equations using Z – Transform.

**Text Books :**

1. Kandasamy P, Tilagavathy K and Gunavathy K, "Engineering Mathematics", 6<sup>th</sup> edition, (Vol I & II) S.Chand & Co Ltd. New Delhi, 2006.
2. Ventakaraman M K, "Engineering Mathematics", The National Publishing Co., Chennai, 2003.



**References :**

1. Ramana B V., Higher Engineering Mathematics.,2007, Tata McGraw Hill Pub.
2. Veerarajan, T., Engineering Mathematics, 3<sup>rd</sup> edition, 2005, Tata McGraw Hill Pub.
3. Vairamanickam.k., Nirmala.p., Tamilselvan.S., Transforms and Partial Differential Equations., 2014,Scitech Publications(India) Pvt.Ltd
4. Singaravelu, A., Engineering Mathematics, Meenakshi Publications, Chennai,2004.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Acquire basic understanding of the most common partial differential equations.
2. Understand the concepts of Fourier series.
3. Ability to solve boundary value problems.
4. Able to investigate signals problems using Fourier transform
5. Familiarize Z-transform that play important roles in many discrete engineering problems.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-

22ETES302	ENVIRONMENTAL STUDIES	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To provide basic knowledge on natural resources.
- To describe the types, characteristic features, structure and function of an ecosystem.
- To expose information about biodiversity richness and the political angers to the species of plants, animals and microorganisms.
- To educate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To teach problem of over population, health and hygiene and also the role of technology in eliminating or minimizing above factors.

**UNIT – I Introduction**

Multidisciplinary nature of environmental studies - Definition, scope and importance - Need for public awareness. Natural resources - Forest resources: use and over-

exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of an individual in conservation of natural resources- Equitable use of resources for sustainable lifestyles.

### **UNIT – II Concept of an Ecosystem**

Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological - pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

### **UNIT – III Bio Diversity**

Definition: genetic, species and ecosystem diversity - Bio geographical classification of India - Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

### **UNIT – IV Types of Pollution**

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soil pollution - Marine pollution- Noise pollution - Thermal pollution - Nuclear hazards- Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution – Disaster management: floods, earthquake, cyclone and landslides. Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, and watershed management - Resettlement and rehabilitation of people; its problems and concerns. - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation - Consumerism and waste products - Environment Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation.

### **UNIT – V Environment and Human Health**

Population growth, variation among nations - Population explosion – Family Welfare Programme - Environment and human health - Human Rights - Value Education -

HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health -Case Studies.

#### Text Books :

1. Textbook of Environmental Studies, Erach Bharucha, University Press,2005.
2. Environmental Studies, MP Poonia & SC Sharma, Khanna Publishing House,2017.

#### References :

1. Environmental Studies, Rajagopalan, Oxford University Press, 2005.
2. Brunner R.C., Hazardous Waste Incineration, McGraw Hill Inc., 1989.
3. Cunningham, W.P.Cooper, T.H. Gorhani, E& Hepworth, M.T., Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 2001.
4. De A.K., Environmental Chemistry, Wiley Easter Ltd.New Age International Limited, 3rd Edition, 2003.
5. Jadhav, H & Bhosale, V.M. Environmental Protection and Laws. Himalaya Pub. House, Delhi, 1995 .
6. Wanger K.D., Environmental Management. W.B. Saunders Co. Philadelphia, USA, 1998.

#### Course Outcomes :

At the end of this course, the students will be able to

1. Understand renewable and non-renewable resources of our ecosystem.
2. Compare ecological system, causes and their relationship.
3. Explain political angers to the species of plants, animals and microorganisms in the environment and the threats to biodiversity
4. Analyse the causes and consequences of natural and man induced disasters (flood, earthquake, landslides, cyclones) and measure pollutions and minimize their effects.
5. Design modes with the help of information technology for eliminating or minimizing the problems of Environment and human health.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	1	3	-	-	-	-	-
CO2	1	-	-	-	-	1	3	-	-	-	-	-
CO3	1	-	-	-	-	2	3	-	-	-	-	-
CO4	2	1	-	-	-	2	3	-	-	-	-	-
CO5	1	-	2	1	-	3	3	-	-	-	-	-

22CSES303	ANALOG ELECTRONIC CIRCUITS	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To impart the knowledge on the qualitative and quantitative exposition of fundamental concepts of silicon and germanium semiconductor devices.
- To understand the principle, operation and characteristics of diode, bipolar junction transistor and metal oxide field effect transistor.
- To educate the characteristics of common gate and circuits.
- To demonstrate the working of operational amplifiers and its applications.
- To describe the simulation of amplifiers, controllers and oscillators.

**UNIT - I**

Diode P-N junction diode, I-V characteristics of a diode-review of half-wave and full-wave rectifiers- Zener diodes-clamping and clipping circuits.

**UNIT – II**

BJT Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model-biasing circuits- current mirror-common-emitter- common-base and common collector amplifiers-Small signal equivalent circuits, high-frequency equivalent circuits.

**UNIT - III**

MOSFET Structure I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small- signal model and biasing circuits, common-source, common-gate and common-drain amplifiers - small signal equivalent circuits - gain, input and output impedances-transconductance - high frequency equivalent circuit.

**UNIT – IV**

Amplifiers Differential amplifier; power amplifier-direct coupled multi-stage amplifier; internal structure of an operational amplifier-ideal op-amp- non-idealities in an op- amp (Output offset voltage-input bias current-input offset current-slew rate- gain bandwidth product).

**UNIT - V**

Analysis of op-amp Circuits Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier- differential amplifier- instrumentation amplifier- integrator-active filter- P, PI and PID controllers and lead/lag compensator using an op-amp-voltage regulator- oscillators (Wein bridge and phase shift). Analog to Digital Conversion- Hysteretic Comparator-Zero Crossing Detector-Square-wave and triangular-wave generators- Precision rectifier-peak detector- Astable Multivibrator.

**Text Books :**

1. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
2. Theodore F Bogart, Jeffrey S. Beasley, Guillermo Rico, "Electronic Devices and Circuits", 6<sup>th</sup> Edition, Pearson Education India, 2004.

**References :**

1. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
3. M.K. Achuthan and K.N. Bhat, "Fundamentals of Semiconductor Devices", Tata McGraw-Hill Publishing Company Limited, 2007.
4. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.
5. J.V.Wait, L.P.Huelsman and G.A.Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
6. Behzad Razavi, Design of Analog CMOS Integrated Circuits, McGraw Hill International Edition, 2001.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand the characteristics of transistors.
2. Design and analyze various rectifiers.
3. Acquire knowledge about amplifier circuits.
4. Infer the fundamental concepts of MOSFETs and their applications for analog electronics circuits.
5. Derive the functioning of OP-AMP and design OP-AMP based circuits.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	1	-	-	-	-	-	-	-	-
CO3	1	1	-	-	-	-	-	-	-	-	-	-
CO4	1	1	-	-	-	-	-	-	-	-	-	-
CO5	2	1	1	-	-	-	-	-	-	-	-	-

22CSES304	DIGITAL ELECTRONICS	L	T	P	C
		2	0	0	2

**Course Objectives :**

- To familiarize with Digital signals, Logic operations, Boolean algebra, number systems, codes and digital ICs with TTL and CMOS logic,
- To describe the simplification of logic functions using K-map & Q-M method and also design the logic circuits such as Multiplexer, De-multiplexer/Decoders, Adders, Subtractor, digital comparator and parity checker/generator,
- To demonstrate operations of flip-flops including clocked SR, J-K, T and D-type, shift registers and Synchronous /Asynchronous counters.
- To educate the concepts of ADC and DAC convertors.
- To explain the classification and characteristics of memory organization and illustrate the design of PLD, CPLDS & FPGA.

**UNIT-I Digital Circuits - Introduction**

Digital signals - digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations - Boolean algebra - examples of IC gates - number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes - error detecting and correcting codes - characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

**UNIT - II Standard Representation for Logic Functions**

K-map representation - Simplification of logic functions using K-map - minimization of logical functions, Don't care conditions - Multiplexer, De- Multiplexer/Decoders, Adders-Subtractors- BCD arithmetic- carry look ahead adder- serial adder- ALU- elementary ALU design- popular MSI chips- digital comparator- parity checker/generator-code converters- priority encoders- decoders/drivers for display devices- Q-M method of function realization.

**UNIT- III Flip Flops and Counters**

A 1-bit memory, the circuit properties of Bi stable latch, the clocked SR flip flop, J-K-T and D-type flip flops- applications of flip flops- shift registers- applications of shift registers-serial to parallel converter- parallel to serial converter- ring counter- sequence generator- ripple (Asynchronous) counters- synchronous counters- counters design using flip flops-special counter IC's- asynchronous sequential counters- applications of counters.

**UNIT - IV ADC and DAC Converters**

Digital to analog converters: weighted resistor/converter- R-2R Ladder D/A converter- specifications for D/A converters- examples of D/A converter ICs- sample and hold circuit- analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter- counting A/D converter- dual slope

A/D converter-A/D converter using voltage to frequency and voltage to time conversion- specifications of A/D converters-example of A/D converter ICs.

### UNIT - V Memory Organization

Memory organization and operation-expanding memory size-classification and characteristics of memories- sequential memory- read only memory (ROM)-read and write memory(RAM)- content addressable memory (CAM)- charge de coupled device memory (CCD)- commonly used memory chips- ROM as a PLD- Programmable logic array- Programmable array logic- complex Programmable logic devices (CPLDS)- Field Programmable Gate Array (FPGA).

#### Text Books :

1. P. Jain, "Modern Digital Electronics", McGraw Hill Education,2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India,2016.

#### References :

1. Floyd, "Electron Devices", Pearson Asia, 5<sup>th</sup> Edition,2013.
2. Donald P Leach<sup>th</sup>, Albert Paul Malvino, Goutan Saha, "Digital Principles and Applications", 7 Edition,2010.
3. V.K. Mehta, Rohit Mehta, "Principles of Electronics", S.Chand Publications,2005.
4. Digital Electronics, Rishabh Anand, Khanna Publishing House,2<sup>nd</sup> edition,2014.
5. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India,2016.
6. Rashid, "Microelectronic circuits", Thomson Publications,2010.

#### Course Outcomes :

At the end of this course, the students will be able to

1. Acquire knowledge on Digital signals, Logic operations, Boolean algebra, number systems, codes and TTL / CMOS logic based digital ICs,
2. Apply the K-map & Q-M method to simplify logic and evaluate the design of logic circuits including Multiplexer, De-multiplexer/Decoders, Adders, Subtractor, digital comparator and parity checker/generator,
3. Demonstrate the operations of flip-flops including clocked SR, J-K, T and D-type, shift registers and Synchronous /Asynchronous counters.
4. Compare and contrast the design of weighted resistor & R-2R Ladder DAC and ADC such as successive approximation ADC, counting ADC and dual slope ADC.
5. Analyze the classification and characteristics of memories and to explain the design of PLD, CPLDS & FPGA.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	3	1	1	-	-	-	-	-	-	-	-
CO3	1	1	1	-	-	-	-	-	-	-	-	-
CO4	1	1	1	-	-	-	-	-	-	-	-	-
CO5	2	1	2	1	-	-	-	-	-	-	-	-

22CSPC305	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	1	0	4

### Course Objectives :

- To impart the basic concepts of data structures and algorithms.
- To demonstrate the usage of stacks and queues
- To teach about lists
- To familiarize the concepts of Trees and graphs in detail.
- To provide understanding on the implementation of searching and sorting techniques.

### UNIT - I Basic Terminologies

Elementary Data Organizations - Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm - Asymptotic Notations - Time- Space trade off. Searching- Linear Search and Binary Search Techniques- their complexity analysis.

### UNIT – II ADT Stack and its operations

Algorithms and their complexity analysis- Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue- Types of Queue: Simple Queue, Circular Queue, Priority Queue- Operations on each types of Queues- Algorithms and their analysis.

### UNIT - III Linked Lists

Singly linked lists-Representation in memory-Algorithms of several operation- Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue- Header nodes-Doubly linked list: operations on it and algorithmic analysis-Circular Linked Lists- all operations their algorithms and the complexity analysis.



**UNIT – IV Trees**

Basic Tree Terminologies- Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree- Tree operations on each of the trees and their algorithms with complexity analysis- Applications of Binary Trees-B Tree, B+ Tree: definitions- algorithms and analysis.

**UNIT - V Sorting and Hashing**

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort- Performance and Comparison among all the methods- Hashing- Graph: Basic Terminologies and Representations- Graph search and traversal algorithms and complexity analysis.

**Text Books :**

1. Ellis Horowitz, Sartaj Sahni, “Fundamentals of Data Structures”, Illustrated Edition, Computer Science Press, 1983.
2. Mark Allen Weiss, “Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition, Addison-Wesley Publishing Company, 4<sup>th</sup> Edition, 2014.

**References :**

1. RS Salaria, “Data Structures”, Khanna Publishing House, 5<sup>th</sup> edition, 2017.
2. Yashwant Kanetkar, “Data Structures through C”, BPB Publications, 2<sup>nd</sup> edition, 2009.
3. RB Patel, “Expert Data Structures with C++”, Khanna Publications, 2<sup>nd</sup> edition, 2012.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand the basic data structure operations and analyze the time and space complexity of searching algorithms.
2. Develop algorithms using the basic operations of stacks and queues and analyze their complexity.
3. Implement the basic operations of linked lists and analyze their algorithm complexity.
4. Identify the basic terminologies and operations on binary trees, binary search trees, AVL trees and B+ trees.
5. Compare the performance of selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort algorithms in term of Space and Time complexity.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-
CO4	1	1	1	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-

22CSPC306	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	1	0	4

**Course Objectives:**

- To understand the basics of programming constructs of C++
- To impart knowledge about the object oriented programming concepts in C++
- To know the basics concepts of the Java programming
- To familiarize object oriented concepts in Java programming
- To build Java applications with threads and generics classes

**UNIT - I Basics of C++ Programming**

Introduction to Programming Paradigms, Characteristics of Object Oriented Programming Languages, Structure of C++ Program, Tokens – Comments, Keywords, Data types, Identifiers, Variables, Constants, Operators and Seperators, Control Structure – Decision Making Statements, Looping and Jumping Statements, Types of Functions, Arguments.

**UNIT - II OOPs in C++ Programming**

Classes and Objects, Constructors and Destructors, Array of Objects, Nested Classes, Inheritance and Types, Polymorphism and Types – Function and Operator Overloading, Virtual and Pure Virtual Function, Abstract Class, Run time Polymorphism using Pointers, Exception Handling, File Management.

**UNIT - III Basics of Java Programming**

Characteristics of Java, Java Environment – API, JSL, JDK, JRE, JVM, JCL, Structure of Java Program, Tokens – Comments, Keywords, Data Types, Identifiers, Variables, Constants, Operators and Seperators, Control Structures – Decision Making Statements and Looping and Jumping Statements, Classes and Objects, Constructors, Finalize Method, Command Line Arguments.

**UNIT - IV OOPs in Java Programming**

Inheritance and Types, Method Overloading and Overriding, Definition and Implementation of Interfaces, Access Control, Packages – System Packages, User Defined Packages, Java Class Libraries - String, Math, Util, Enumeration, Vector, Hashtable and Collection.

**UNIT - V Intermediate Java Programming**

Exception Handling, Input/Output Basics, Streams – Reading and Writing Files, Multitasking, Multithreading, Thread Life Cycle, Creating Threads, Daemon Threads, Thread Groups. Generic Programming – Generic Classes, Generic Methods, Bounded Types, Restrictions and Limitations.

**Text Books**

1. Balaguruswamy E, “Object Oriented Programming with C++”, Tata McGraw-Hill Publication, 8<sup>th</sup> Edition, September 2020.
2. Balaguruswamy E, “Programming with Java”, Tata Mc Graw - Hill Publication, 6<sup>th</sup> Edition, March 2019.

**References**

1. Bjarne Stroustrup, “C++ Programming Language”, 4<sup>th</sup> Edition, May 2022.
2. Herbert Schildt, “Java The Complete Reference”, 11<sup>th</sup> Edition, December 2020
3. Nick Samoylov, “Learn Java Programming”, 2<sup>nd</sup> Edition July 2022
4. Cay S. Horstmann, Gary Cornell, “Core Java Fundamentals”, 9<sup>th</sup> Edition, Prentice Hall, 2013.

**Course Outcomes:**

Upon completion of the course, students will be able to:

1. Write simple applications in C++.
2. Implement the concepts of object oriented programming in C++.
3. Develop simple programs using Java programming constructs.
4. Build Java applications using inheritance, interface and packages.
5. Develop Java applications with multithreading and generics programming.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	1	1	3	-	-	-	-	-	-	-	-	-
<b>CO2</b>	2	2	2	2	-	-	-	-	-	-	-	-
<b>CO3</b>	1	1	3	-	-	-	-	-	-	-	-	-
<b>CO4</b>	2	2	2	2	1	-	-	-	-	-	-	1
<b>CO5</b>	2	2	2	2	1	-	-	-	-	-	-	1

<b>22CSSP307</b>	<b>DIGITAL ELECTRONICS LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**Course Objectives :**

- To train the students to experiment and analyze the characteristics of diode, Rectifiers, transistors, Oscillators and Multi vibrators.
- To develop the skills required to implement the concepts of Digital Logic design such as logic gates, RS/JK Flip-flops, Multiplexer and De-multiplexer.

**LIST OF EXERCISES**

1. Characteristics of semi conductor diode.
2. Characteristics of Zener diode and Zener diode as a voltage regulator.
3. Estimation of ripple factor and efficiency in a full wave / Bridge rectifier with and without filter.
4. Characteristics of CE PNP and NPN transistor.
5. Frequency response of RC coupled amplifier.
6. Estimation of gain and efficiency in a class B power amplifier.
7. Measurement of frequency of the output voltage in a RC phase shift oscillator.
8. Estimation of the frequency of the output voltage of a Bistable Multivibrator.
9. Verification of Truth table of AND / OR / NOT / NAND/ NOR / XOR gates.
- 10.Reduction of variables using K-Map.
- 11.Study of multiplexer and Demultiplexer.
- 12.Verification of state table of RS / JK flipflop.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Analyze the characteristics of diode, Rectifiers, transistors, Oscillators and Multivibrators.
2. Implement Digital logic circuits using logic gates, RS/JK Flip-flops, Multiplexer and De-multiplexer.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	-	-	-	-	-	-	-	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22CSCP308	DATA STRUCTURES AND ALGORITHMS LAB	L	T	P	C
		0	0	3	1.5

**Course Objectives:**

- To impart knowledge on basic linear and non-linear data structures and their major operations.
- To prepare the students to write programs to solve searching and sorting algorithms.

**LIST OF EXERCISES**

1. Write a program to create a Stack and perform insertion and deletion operations on it.
2. Write a program to create a List and perform operations such as insert, delete, update and reverse.

3. Write a program to create a Queue and perform operations such as insertion and deletion.
4. Write a program to Implement Linear Search Algorithm.
5. Using iteration and recursion concepts write programs for finding the element in the array using the Binary Search method.
6. Write a program and simulate various graph traversing techniques.
7. Write a program and simulate various tree traversing techniques.
8. Write a program to Implement Binary Search Tree.
9. Write a program to simulate Bubble sort, quick sort and Merge sort algorithms.

### Course Outcomes :

At the end of this course, the students will be able to

1. Develop a C++ program to build the basic data structures like stack, queue and list.
2. Develop a C++ program for searching and sorting algorithms using iteration and recursion concept.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	2	-	-	-	-	-	-	-	-
CO2	1	2	3	2	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22CSCP309	OBJECT ORIENTED PROGRAMMING LAB	L	T	P	C
		0	0	3	1.5

### Course Objectives :

- To teach programs to implement data abstraction, encapsulation, data hiding, Inheritance, dynamic programming using C++.
- To educate the concepts of interfaces, multithreads and exceptions to develop programs in Java SDK environment.

### LIST OF EXERCISES C++ PROGRAM

1. Write a C++ program to design a class having static function names showcount() which has the property of displaying the number of objects created of the class.
2. Write a C++ program to find maximum of two numbers using friend function.
3. Write a C++ program using copy constructor to copy data of an object to another object.

4. Write a C++ program to design a class representing complex numbers and having functionality of performing addition and multiplication of two complex numbers using operator overloading.
5. Write a C++ program to design a student class representing student roll no. and a tests class (derived class of student) representing the scores of the student in various subjects and sports class representing the score in sports. The sport and test class should be inherited by the result class having the functionality to add the scores and display the final result for the student.
6. Write a C++ program to maintain the records of the person with details (Name and Age) and find the eldest among them. The program must use this pointer to return the result.
7. Write a C++ program to illustrate the use of virtual function in a class.
8. Write a C++ program showing data conversion between objects of different classes.

### JAVA PROGRAM

1. Simple Java Applications
  - a. Understanding References to an Instant of a Class
  - b. Handling Strings
2. Simple Package Creation
  - a. Creating User Defined Packages
  - b. Creating User Defined Packages - Array of Objects
3. Interfaces
  - a. Implementing User Defined Interfaces
  - b. Implementing Pre Defined Exceptions
4. Threading
  - a. Creation of Threading
  - b. Multi Threading
5. Exception Handling Mechanism in Java
  - a. Implementing Predefined Exceptions
  - b. Implementing User Defined Exceptions

#### Course Outcomes :

At the end of this course, the students will be able to

1. Design algorithms to implement data abstraction, encapsulation, data hiding, Inheritance, dynamic programming using C++.
2. Apply the concepts of interfaces, multithreads and exceptions to develop programs in Java SDK environment.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	-	-	-	-	-	-	-	-
CO2	2	2	3	1	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22CSBS401	DISCRETE MATHEMATICS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To introduce the basic concepts of Mathematical Logic that deals with the method of reasoning.
- To impart knowledge about sets and relations.
- To provide basic understanding of Boolean Algebra.
- To familiarize the basic properties and concepts of general algebraic systems.
- To illustrate graph theory and its application to Computer Science.

**UNIT - I Mathematical Logic**

Propositions – Connectives – Tautology and contradiction – Equivalence of prepositions – Tautological Implication – Normal Forms – Theory of Inference – Rules of Inference.

**UNIT - II Set Theory and Relations**

Set operations – Ordered pairs and Cartesian product – Relations – Type of relations – Operations on relations – Properties of relations – Equivalence classes – Partition of set – Matrix and Graphical representation of relation.

**UNIT - III Lattice and Boolean Algebra**

Partial ordered set – Hasse diagram – Lattices – Properties of Lattices – Boolean Algebra – Karnaugh map method.

**UNIT - IV Group and Group code**

Algebraic systems – Semi groups and Monoids – Groups – Permutation Group – Subgroups – Coding Theory – Group codes – Hamming codes – Procedure for Encoding and Decoding Group codes.

**UNIT - V Graph Theory**

Graphs – Special simple graphs – Matrix representation of graphs – Path cycles and connectives – Eulerian and Hamiltonian graphs – Shortest path algorithms.

**Text Book :**

1. Veerarajan T, “Discrete Mathematics with Graph Theory and Combinatorics”, Tata McGraw Hill Publishing Company Ltd, 2014.
2. Discrete Mathematics and Its Applications, S. K. Chakraborty and B. K. Sarkar, Oxford, 2011.

**References :**

1. Venkataraman M K, “Discrete Mathematics”, The National Publishing Company, 2008.
2. Kolman Busby Ross, “Discrete Mathematical Structures”, Pearson Education Pvt Ltd, 2000.
3. Trembley J P and Manohar R P, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw Hill Publishing Company Ltd, 2005.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Acquire the basic concepts in Mathematical Logic and theory of inferences.
2. Understand the concepts of Set theory, Relations and equivalence classes with matrix representation.
3. Implement Lattice theory and Boolean Algebra in circuit design.
4. Design coding and encoding group codes.
5. Understand the basic concepts of Graph theory, Eulerian and Hamiltonian graphs.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	-	-	-	2	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	2	-	-	-	-	-	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-
CO5	3	3	1	-	-	-	-	-	2	-	-	-

22CSES402	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To introduce the concepts of Bus structure and functional units of a Computer.
- To familiarize the working of ALU with its structure and functions.
- To impart the knowledge on hierarchical memory system including cache memories and virtual memory.
- To describe the significance of Semiconductor RAM and ROM memories on Computer.
- To teach the concept of parallel processing on Computer.

**UNIT – I Introduction**

Functional Units – Basic operational concepts – Bus structures – Performance and metrics – Instructions and instruction sequencing – Instruction set architecture – Addressing modes – RISC – CISC.

**UNIT – II Fundamental Concepts**

ALU design – Execution of a complete instruction – Multiple bus organization Hard wired control – Micro programmed control – Nano programming.



**UNIT – III Memory**

Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – Improving cache performance – Virtual memory – Memory management requirements – Associative memories – Secondary storage devices.

**UNIT – IV I/O Devices**

Accessing I/O devices – Programmed I/O – Interrupts – Direct memory access– Buses – Interface Circuits – Standard I/O interfaces (PCI, SCSI, and USB) – I/O Devices and processors.

**UNIT - V Parallel Processing**

Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network - Data hazards – Instruction hazards – Influence on instruction sets – Data path and control considerations – Performance considerations – Exception handling.

**Text Books :**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, McGraw-Hill, 5<sup>th</sup> edition, Reprint2012.
2. David A. Patterson and John L. Hennessy, “Computer Architecture-A Quantitative Approach”, Elsevier, a division of reed India Private Limited, 5<sup>th</sup> edition,2012.

**References :**

1. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 6th Edition, Pearson Education, 2003.
2. Hayes,J.P.,“ComputerArchitectureandOrganization”,3rdEdition,TataMc-Graw Hill, 1998.
3. Ghosh T. K., “Computer Organization and Architecture”, Tata McGraw-Hill, 3<sup>rd</sup> edition,2011.
4. Behrooz Parahami, “Computer Architecture”, Oxford University Press,8<sup>th</sup> Impression, 2011.
5. Heuring, V.P.and Jordan, H.F., “Computer Systems Design And Architecture”, 2<sup>nd</sup> edition, Pearson Education,2004.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand the functional Units of a computer, bus organizations and addressing modes.
2. Compare and Contrast the Hardwired control and Micro programmed control.
3. Analyze RAM, ROM, Cache memory and virtual memory concepts.
4. Identify the various I/O interfaces that are communicated with computers.
5. Recognize the concept of parallel processing and Pipelining on Computers.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	1	-	-	-	-	-	-	-	-	-
CO3	1	1	1	-	-	-	-	-	-	-	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-

22CSPC403	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

### Course Objectives:

- To explain the basic concepts of operating system and perform Case study on UNIX and WINDOWS Operating System.
- To introduce the concepts of process, Threads and process scheduling.
- To teach the concepts of Critical Section, semaphores, IPC and deadlocks.
- To describe memory management techniques.
- To provide an overview of I/O hardware, I/O software, file managements and directories management.

### UNIT - I Introduction

Concept of Operating Systems- Generations of Operating systems-Types of Operating Systems-OS Services-System Calls-Structure of an OS - Layered, Monolithic, Microkernel Operating Systems-Concept of Virtual Machine-Case study on UNIX and WINDOWS Operating System.

### UNIT - II Processes and Scheduling

Definition - Process Relationship - Different states of a Process - Process State transitions, Process Control Block (PCB), Context switching-Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads- Process Scheduling- Foundation and Scheduling objectives - Types of Schedulers, Scheduling criteria-CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time-Scheduling algorithms- Pre-emptive and Non pre-emptive, FCFS, SJF, RR-Multiprocessor scheduling-Real Time scheduling-RM and EDF.

### UNIT - III Inter- Process Communications

Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution- The Producer Consumer Problem- Semaphores, Event Counters, Monitors, Message Passing-Classical IPC Problems- Reader's & Writer Problem, Dining Philosopher Problem etc. Deadlocks-Definition, Necessary and

sufficient conditions for Deadlock- Deadlock Prevention, Deadlock Avoidance-Banker's algorithm-Deadlock detection and Recovery.

#### UNIT – IV Memory Management

Basic concept - Logical and Physical address map, memory allocation- contiguous Memory allocation – Fixed and variable partition – Internal and External fragmentation Compaction; Paging-Principle of operation – Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging -Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).

#### UNIT – V File and Directories

I/O Hardware - I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure:-Disk structure, Disk scheduling algorithms-File Management:-Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

#### Text Books :

1. Silberschatz, Galvin, and Gagne, “Operating System Concepts”, Wiley India Pvt Ltd, 9<sup>th</sup> Edition 2013.
2. William Stallings, “Operating Systems – internals and design principles”, Prentice Hall, 7<sup>th</sup> Edition, 2011.

#### References :

1. Charles Crowley, “Operating System: A Design-oriented Approach”, 1<sup>st</sup> Edition Irwin Publishing, 1996.
2. Maurice Bach, “Design of the Unix Operating Systems”, 8<sup>th</sup> Edition Prentice - Hall of India, 2011.
3. Ekta Walia, “Operating Systems”, Khanna Publishing House, Delhi, 2<sup>nd</sup> edition, 2010.
4. Dhananjay M. Dhamdhere, “Operating Systems A Concept - Based Approach”, McGraw Hill, 1<sup>st</sup> edition, 2008.

#### Course Outcomes:

At the end of this course, the students will be able to

1. Explain the types of operating systems, operating system services and to perform a case study on UNIX and WINDOWS operating system.

2. Explain the concepts of process state, Threads and compare the process scheduling algorithms.
3. Illustrate the concepts of Critical Section, semaphores, IPC and develop Bankers algorithm to detect deadlock.
4. Summarize page management techniques and select suitable page replacement algorithm.
5. Discuss the I/O hardware, I/O software, file and directories management and able to develop disk scheduling algorithms.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	1	-	-	-	-	-	-	-	-
CO4	1	1	1	-	-	-	-	-	-	-	-	-
CO5	2	1	1	-	-	-	-	-	-	-	-	-

22CSPC404	DATABASE MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

### Course Objectives :

- To understand the fundamentals of DBMS and E-R Diagrams.
- To impart the concepts of the Relational model and SQL.
- To disseminate the knowledge on various Normal Forms.
- To inculcate the fundamentals of transaction management and Query processing.
- To familiarize on the current trends in data base technologies.

### UNIT – I Introduction

File System vs. DBMS – Views of data – Data Models – Database Languages – Database Management System Services – Overall System Architecture – Data Dictionary – Entity – Relationship (E-R) – Enhanced Entity Relationship Model.

### UNIT – II Relational Approach

Relational Model – Relational Data Structure – Relational Data Integrity – Domain Constraints – Entity Integrity – Referential Integrity – Operational Constraints – Keys – Relational Algebra – Fundamental operations – Additional Operations – Relational Calculus - Tuple Relational Calculus – Domain Relational Calculus - SQL – Basic Structure – Set operations – Aggregate Functions – Null values – Nested Sub queries – Derived Relations – Views – Modification of the database – Joined Relations – Data Definition Language – Triggers.

**UNIT – III Database Design**

Functional Dependencies – Pitfalls in Relational Database Design – Decomposition – Normalization using Functional Dependencies – Normalization using Multi-valued Dependencies – Normalization using Join Dependencies – Domain - Key Normal form.

**UNIT – IV Query Processing and Transaction Management**

Query Processing Overview – Estimation of Query Processing Cost - Join strategies – Transaction Processing – Concepts and States – Implementation of Atomicity and Durability – Concurrent Executions – Serializability – Implementation of Isolation – Testing for Serializability – Concurrency control – Lock Based Protocols – Timestamp Based Protocols.

**UNIT – V Trends in Data Base Technologies**

Distributed Databases - Homogeneous and Heterogeneous Databases - Distributed Data Storage - Distributed Transactions - Commit Protocols - Concurrency Control in Distributed Databases - Availability - Distributed Query Processing - Heterogeneous Distributed Databases- Cloud-Based Databases - Directory Systems.

**Text Books :**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Tata McGraw Hill, Sixth Edition,2010.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Addison Wesley, Sixth Edition,2010.

**References :**

1. Raghu Ramakrishnan, Johannes Gehrke “Database Management Systems”, McGraw Hill, Third Edition, 2002.
2. Peter Rob and Carlos Coronel, “Database Systems – Design, Implementation and Management”, Thompson Learning, Course Technology, Seventh Edition,2006.
3. C. J. Date, A.Kannan, S.Swamynathan , “An Introduction to Database Systems”, Addison Wesley, 8th Edition,2012.
4. Database Management Systems, R.P. Mahapatra & Govind Verma, Khanna Publishing House,2013.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Understand the fundamental concepts of Database Management Systems and Entity Relationship Model and develop ER Models.
2. Build SQL Queries to perform data creation and data manipulation operations on databases.
3. Understand the concepts of functional dependencies, normalization and apply such knowledge to the normalization of a database.
4. Identify the issues related to Query processing and Transaction management in database management systems.

5. Analyze the trends in data storage, query processing and concurrency control of modern database technologies.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	-	-	-	-	-	-	-	-
CO2	2	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	1	-	-	-	-	-	-	-	-	-
CO4	-	1	-	-	1	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-

22CSPC405	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

### Course Objectives:

- To familiarize with data types, variable, Operators, conditionals and looping.
- To provide in-depth Knowledge and understanding about the Functions.
- To make the students to understand the fundamentals of Classes and Objects.
- To impart the knowledge about File handling and networking.
- To educate the student in Database Management and GUI Programming in Python.

### UNIT – I Introduction

Elementary Programming, Selections and Loops: History of Python – Getting Started with Python – Programming Style – Writing a Simple Program – Reading Input from the Console – Identifiers – Variables, Assignment Statements, and Expressions – Simultaneous Assignments – Named Constants – Numeric Data Types and Operators – Type Conversions and Rounding–Introduction – Boolean Types, Values, and Expressions – if Statements – Two-Way if-else Statements – Nested if and Multi-Way if-elif-else Statements – Logical Operators – Conditional Expressions – Operator Precedence and Associativity – Detecting the Location of an Object Case Study: Computing Body Mass Index – The while Loop – The for Loop – Nested Loops – Keywords break and continue – Case Studies: Displaying Prime Numbers and Random Walk.

### UNIT - II Python Function

Mathematical Functions, Strings and User Defined Functions: Simple and Mathematical Python Built-in Functions – Strings and Characters – Introduction to Objects and Methods – Formatting Numbers and Strings – Drawing Various Shapes Drawing with Colors and Fonts – Defining a Function – Calling a Function – Functions with/without

Return Values – Positional and Keyword Arguments – Passing Arguments by Reference Values – Modularizing Code – The Scope of Variables – Default Arguments – Returning Multiple Values –Function Abstraction and Stepwise Refinement – Case Study: Generating Random ASCII Characters.

### UNIT - III Class and Object

Introduction to Object – Oriented Programming – Basic principles of Object – Oriented Programming in Python – Class definition, Inheritance, Composition, Operator Overloading and Object creation – Python special Unit – Python Object System – Object representation, Attribute binding, Memory Management, and Special properties of classes including properties, Slots and Private attributes.

### UNIT - IV Files and Exception Handling

Files, Exception Handling and Network Programming: Introduction –Text Input and Output – File Dialogs – –Exception Handling – Raising Exceptions – Processing Exceptions Using Exception Objects – Defining Custom Exception Classes – Binary IO Using Pickling – Case Studies: Counting Each Letter in a File and Retrieving Data from the Web–Client Server Architecture–sockets – Creating and executing TCP and UDP Client Server Unit – Twisted Framework – FTP – Usenets – News group Emails – SMTP – POP3.

### UNIT - V Database and GUI

Database and GUI Programming: DBM database – SQL database – GUI Programming using Tkinter: Introduction – Getting Started with Tkinter – Processing Events – The Widget Classes – Canvas – The Geometry Managers – Displaying Images – Menus – Popup Menus – Mouse, Key Events, and Bindings – List boxes – Animations – Scrollbars – Standard Dialog Boxes–Grids.

### Text Books :

1. Mark Lutz, “Learning Python, Powerful OOPs”, O’Reilly,2011.
2. Guttag, John, “Introduction to Computation and Programming Using Python”, MIT Press,2013.

### References :

1. Jennifer Campbell, Paul Gries, Jason montajo, Greg Wilson, “Practical Programming An Introduction To Computer Science Using Python” The Pragmatic Bookshelf ,2009.
2. Wesley J Chun “Core Python Applications Programming”, PrenticeHall,2012.
3. JeevaJose, “TamingPythonbyProgramming”,KhannaPublishingHouse,1st edition,2017.
4. J.Jose, “IntroductiontoComputingandProblemSolvingwithPython”,Khanna Publications,1st edition,2015.
5. Reema Thareja, “Python Programming”, Pearson,1<sup>st</sup>edition,2017.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand basic concepts of Conditional and Looping Statements in python programming.
2. Solve large program in a easy way using Modules concepts.
3. Apply the concepts of Object Oriented programming including encapsulation, inheritance and polymorphism as used in Python.
4. Simulate the commonly used operations in file system and able to develop application program to communicate from one end system to another end.
5. Develop menu driven program using GUI interface and to gain knowledge about how to store and retrieve data.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	1	-	-	-	-	-	-	-
CO3	1	2	-	-	1	-	-	-	-	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	-	-
CO5	1	2	3	1	2	-	-	-	1	-	-	2

22CSPC406	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To explain algorithm analysis performance measurements of algorithms and their application domains.
- To provide knowledge on major algorithmic strategies.
- To make the students understand the various graph and tree algorithms.
- To introduce the notation of computational complexity of problems.
- To teach the advanced algorithm on computational complexity theory.

**UNIT – I Introduction**

Overview of algorithm- Classification of algorithm-Characteristics of algorithm - Analysis of algorithms: step count-operation count-Asymptotic analysis of complexity bounds – best, average and worst-case behavior-Space complexity analysis- Analysis of recursive algorithms through recurrence relations: Substitution method - Recursion tree method and Masters' theorem- Introduction to time and space trade-off.

**UNIT – II Fundamental Algorithmic Strategies**

Brute-Force Approach – Greedy Algorithms - Dynamic Programming- Branch- and-Bound technique and Backtracking method for the design of algorithms - Illustrations of these



techniques for Problem-Solving - Knap Sack ,TSP and N-Queen problem.

### UNIT – III Graph and Tree Algorithms

Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS) Shortest path algorithms - Transitive closure - Minimum Spanning Tree - Topological sorting, Network Flow Algorithm.

### UNIT – IV Tractable and Intractable Problems

Computability of Algorithms – Decision problems and Turing machine-Complexity classes: P, NP, NP complete and NP hard -Theory of NP-complete problems.- Satisfiability problem and Cook’s theorem - Reduction techniques.

### UNIT – V Advanced Topics

Introduction to Approximation algorithms – Types of Approximation algorithms –Vertex cover problem- Introduction to Randomized algorithms- Types of Randomized algorithms- Randomized Quick sort-Class of problems beyond NP : P SPACE.

### Text Books :

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, “Introduction to Algorithms”, MIT Press/McGraw-Hill, 4th Edition, 2014.
2. Gajendra Sharma, “Design & Analysis of Algorithms”, Khanna Publishing House, New Delhi, 4th edition, 2016.

### References :

1. Jon Kleinberg and Éva Tardos, Pearson, “Algorithm Design”, 1st Edition, 2012.
2. Michael T Goodrich and Roberto Tamassia, “Algorithm Design: Foundations, Analysis, and Internet Examples”, Wiley, 3rd Edition, 2009.
3. S. Sridhar, “Design & Analysis of Algorithms”, Oxford, 1st edition, 2014.

### Course Outcomes:

At the end of this course, the students will be able to

1. Analyze the complexity of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Develop algorithms using design paradigms including divide-and- conquer, dynamic programming, greedy and backtracking algorithms.
3. Design algorithms using graphs and trees for engineering problems.
4. Compare and contrast tractable and untractable problems.
5. Describe the advanced algorithms on computational complexity theory

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	-	-	-	-	-	-	-	-
CO2	2	2	3	2	-	-	-	-	-	-	-	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-
CO4	1	2	1	1	-	-	-	-	-	-	-	-
CO5	1	2	1	1	-	-	-	-	-	-	-	-

22ETHS407	UNIVERSAL HUMAN VALUES	L	T	P	C
		2	1	0	3

### Course Objectives:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
- Strengthening of self-reflection.
- Development of commitment and courage to act.

### UNIT-I Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- 1.1 Purpose and motivation for the course, recapitulation from Universal Human Values-I.
- 1.2 Self – Exploration – what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the process for self-exploration.
- 1.3 Continuous Happiness and Prosperity- A look at basic Human Aspirations.
- 1.4 Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority.
- 1.5 Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario.
- 1.6 Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

### UNIT-II Understanding Harmony in the Human Being - Harmony in Myself!

- 2.1 Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’.
- 2.2 Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility.

- 2.3 Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).
- 2.4 Understanding the characteristics and activities of 'I' and harmony in 'I'.
- 2.5 Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

2.6 Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with disease

### **UNIT-III Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**

- 3.1 Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
- 3.2 Understanding the meaning of Trust; Difference between intention and competence.
- 3.3 Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- 3.4 Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.
- 3.5 Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

### **UNIT-IV Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

- 4.1 Understanding the harmony in the Nature.
- 4.2 Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self- regulation in nature.
- 4.3 Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.
- 4.4 Holistic perception of harmony at all levels of existence.  
Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

### **UNIT-V Implications of the above Holistic Understanding of Harmony on Professional Ethics**

- 5.1 Natural acceptance of human values.
- 5.2 Definitiveness of Ethical Human Conduct.
- 5.3 Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.

- 5.4 Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- 5.5 Case studies of typical holistic technologies, management models and production systems.
- 5.6 Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.
- 5.7 Sum up.
- Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

### Text Book :

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

### References :

- 1 Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- 2 Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- 3 The Story of Stuff (Book).
- 4 The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
- 5 Small is Beautiful - E. F Schumacher.
- 6 Slow is Beautiful - Cecile Andrews
- 7 Economy of Permanence - J CKumarappa
- 8 Bharat Mein Angreji Raj - PanditSunderlal
- 9 Rediscovering India - by Dharampal
- 10 Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
- 11 India Wins Freedom - Maulana Abdul Kalam Azad
- 12 Vivekananda - Romain Rolland (English)
- 13 Gandhi - Romain Rolland (English)

### Course Outcomes :

By the end of the course, Students are expected to become more aware of themselves, and their surroundings (family, society, nature);

1. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
2. They would have better critical ability.
3. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
4. They would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.
5. This is only an introductory foundational input. It would be desirable to follow it up by
  - a) faculty-student or mentor-mentee programs throughout their time with the institution

- b) Higher level courses on human values in every aspect of living. E.g. as a professional.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	3	3	-	-	-	-	-	-	-	-	-
CO3	-	-	-	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	3	-	-	2		-	-
CO5	-	-	-	-	-	-	-	-	2	2	-	2

22CSCP408	OPERATING SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

#### Course Objectives :

- To prepare the students to write the C programs to understand the concepts of operating system.
- To impart programming skills in shell programming.

#### LIST OF EXERCISES

- Job scheduling techniques.
- Disk scheduling techniques.
- Memory allocation techniques.
- Memory management techniques.
- Page replacement techniques.
- Producer consumer problem.
- Bankers algorithm.
- Dining Philosophers problem.
- Write a shell script to perform the file operations using UNIX commands.
- Write a shell script to perform the operations of basic UNIX utilities.
- Write a shell script for arrange 'n' numbers using awk'.
- Write a shell script to perform  $nCr$  calculation using recursion.
- Write a shell script to sort numbers and alphabetic from a text file using single 'awk' command.
- Write a Shell script to display all the files which are accessed in the last 10 days and to list all the files in a directory having size less than 3 blocks, greater than 3 blocks and equal to 3 blocks.
- Write a Shell script to display the numbers between 1 and 9999 in words.
- Write a Shell script for Palindrome Checking.

#### Course Outcomes :

At the end of this course, the students will be able to

- Develop C programs for Job scheduling techniques, Disk scheduling techniques, Memory management techniques and for synchronization problems.

2. Develop Shell script to practice Unix commands and utilities.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	-	-	-	-	-	-	-	-
CO2	1	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22CSCP409	DATABASE MANAGEMENT SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

### Course Objectives :

- To Build and populate a sample database using DDL and DML commands of Structured Query Language(SQL)
- To develop PL/SQL functions, procedures and packages that can be applied on a sample database.

### LIST OF EXERCISES

1. Implementation of queries for student database.
2. Data Definition Language – with constraint and without constraint.
3. Data Manipulation language – Insert, Delete, Update, Select and truncate.
4. Transaction Control Statement – Commit, Save point, Rollback.
5. Data Control Statement – Grant, Revoke.
6. Data Projection Statement – Multi column, alias name, arithmetic operations, Distinct records, concatenation, where clause.
7. Data Selection Statement – Between, and, not in, like, relational operators and logical operators.
8. Aggregate functions – count, maximum, minimum, sum, average, order by, group by, having.
9. Joint queries – inner join, outer join, self join, Cartesian join, or cross join.
10. Sub queries – in, not in, some, any, all, exist, notexist.
11. Set operations – union, union all, intersect, minus.
12. Database objects – synonym, sequences, views and index.
13. Cursor.
14. Functions and procedures.
15. Trigger.
16. Exceptions.
17. Packages.
18. Factorial of a number.
19. Checking whether a number is prime or not.
20. Fibonacci series.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Create a sample database using Structed Query Language (SQL) DDL commands and develop simple and advanced SQL Queries to manipulate the database.
2. Develop PL/SQL Functions, Procedures, Packages to perform database specific operations on a database.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	3	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	2

2CSPC410	PYTHON PROGRAMMING LAB	L	T	P	C
		0	0	3	1.5

**Course Objectives :**

- To develop the python program to do variety of programming tasks.
- To impart programming skills for various application using python.

**LIST OF EXERCISES**

**Write a Python program for the following:**

1. To check if a Number is Positive, Negative or Zero.
2. To check prime numbers.
3. To check Armstrong Number.
4. To Solve Quadratic Equation.
5. To Transpose a Matrix.
6. To Find the Size (Resolution) of Image.
7. To Display the Multiplication Table using FOR loop.
8. To Find ASCII Value of Character.
9. To Convert Decimal to Binary, Octal and Hexadecimal.
10. To Swap Two Variables Using Function.
11. To Display Fibonacci sequence Using Recursion.
12. To Shuffle Deck of Cards.
13. To Merge Mails.
14. To Find Hash of File.
15. To Root search.
16. To Solving initial value problem using 4<sup>th</sup> order Runge-Kuttamethod.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Solve simple python Programs and understand Object Oriented programming concepts using Python programming.
2. Develop real time applications using Python programming.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	1	-	-	-	-	-	-	1
CO2	-	-	2	2	1	-	-	-	1	-	-	2
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22CSPC501	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

**Course objectives:**

- To introduce and explain the method of constructing Regular Expression, NBA, DFA and Minimal DFA.
- To learn types of grammars and eliminate useless symbols, unit and null productions.
- To introduce the concepts of pushdown automata.
- To provide in-depth understanding of Turing machine and its applications.
- To impart knowledge about decidable and undecidable problems.

**UNIT- I Finite Automata**

Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA and NFA – Finite Automaton with  $\epsilon$ - moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NFA's with and without  $\epsilon$ -moves – Equivalence of finite Automaton and regular expressions –Minimization of DFA- - Pumping Lemma for Regular sets – Problems based on Pumping Lemma.

**UNIT- II Grammars**

Grammar Introduction– Types of Grammar - Context Free Grammars and Languages– Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG – Elimination of Useless symbols - Unit productions – Null productions – Greibach Normal form – Chomsky normal form – Problems related to CNF and GNF.



**UNIT - III Pushdown Automata**

Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL - pumping lemma for CFL problems based on pumping Lemma.

**UNIT – IV Turing Machines**

Definitions of Turing machines – Models – Computable languages and functions – Techniques for Turing machine construction – Multi head and Multi tape Turing Machines - The Halting problem – Partial Solvability – Problems about Turing machine- Chomskian hierarchy of languages.

**UNIT – V Unsolvable Problems and Computable Functions**

Primitive recursive functions – Recursive and recursively enumerable languages Universal Turing machine. Measuring and Classifying Complexity: Tractable and Intractable problems- Tractable and possibly intractable problems – P and NP completeness - Polynomial time reductions.

**Text Books :**

1. Hopcroft J.E., Motwani R. and Ullman J.D, “Introduction to Automata Theory, Languages and Computations”, Pearson Education, 2<sup>nd</sup> edition, 2008 (UNIT 1, 2,3).
2. John C Martin, “Introduction to Languages and the Theory of Computation”, Tata McGraw Hill Publishing Company, 3<sup>rd</sup> edition, New Delhi, 2007 (UNIT 4,5).

**References :**

1. Mishra K L P and Chandrasekaran N, “Theory of Computer Science - Automata, Languages and Computation”, Prentice Hall of India, 3<sup>rd</sup> edition, 2004.
2. Harry R Lewis and Christos H Papadimitriou, “Elements of the Theory of Computation”, Pearson Education, 2<sup>nd</sup> edition, New Delhi, 2003.
3. Peter Linz, “An Introduction to Formal Language and Automata”, Narosa Publishers, 3<sup>rd</sup> edition, New Delhi, 2002.
4. Kamala Krithivasan and Rama. R, “Introduction to Formal Languages, Automata Theory and Computation”, Pearson Education, 2009.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Construct NFA, DFA and Minimal DFA.
2. Derive a grammar without useless symbols and obtain CNF and GNF.
3. Construct pushdown automata for a given context free grammar and language.
4. Design a Turing Machine for a given recursively enumerable language.
5. Acquire the knowledge on decidable and undecidable problems.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	-
CO3	3	1	3	1	-	-	-	-	-	-	-	-
CO4	3	2	3	1	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-

22CSPC502	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
		3	0	0	3

### Course Objectives:

- To educate the basics of graphics system and algorithms to implement graphics primitives.
- To provide knowledge about 2D transformations and clipping techniques.
- To impart knowledge about 3D transformations and Open GL programming.
- To make the students to understand various aspects of multimedia.
- To impart knowledge on concept of sound, images and videos.

### UNIT- I Introduction

Overview of Graphics System – Coordinate Representation – Graphics Output Primitives – Attributes of Graphics Primitives – Implementation Algorithms for Graphics Primitives – Introduction to OpenGL – OpenGL functions for Graphics Primitives.

### UNIT- II 2D Concepts

2D Transformations – 2D Viewing – Window Viewport Transformation – Line, Polygon, Curve and Text Clipping Algorithms – OpenGL Functions for 2D Transformations and 2D Viewing.

### UNIT- III 3D Concepts

3D Concepts: 3D Transformations – 3D Viewing – 3D Object Representations – Spline Representation – Visible Surface Detection Methods – Color Models – OpenGL Functions for 3D Transformations and 3D Viewing.

### UNIT- IV Multimedia Systems Design

Multimedia Basics – Multimedia Applications – Multimedia System Architecture – Evolving Technologies for Multimedia – Defining Objects for Multimedia Systems – Multimedia Data Interface Standards – Multimedia Databases.

**UNIT- V Multimedia File Handling and Hypermedia**

Compression and Decompression – Data and File Format Standards – Multimedia I/O Technologies – Digital Voice and Audio – Video Image and Animation – Full Motion Video – Storage and Retrieval Technologies – Multimedia Authoring and User Interface – Hypermedia Messaging.

**Text Books :**

1. Donald D. Hearn, M. Pauline Baker and Warren Carithers, “Computer Graphics with OpenGL”, Fourth Edition, Pearson Education,2010.
2. Andleigh, P. K and Kiran Thakrar, “Multimedia Systems and Design”PHI, 2003.

**References :**

1. Francis S Hill Jr.and Stephen M Kelley, “Computer Graphics Using OpenGL”,3 Edition, Prentice Hall,2007.
2. Foley, Vandam, Feiner and Huges,“Computer Graphics: Principles an Practice”, 2nd Edition, Pearson Education, 2003.
3. Ralf Steinmetz and Klara Steinmetz, "Multimedia Computing, communications and Applications", Pearson Education,2004.
4. Judith Jeffcoate,“Multimedia in practice: Technology and Applications”PHI, 1998.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Understand and capable of using OpenGL functions to create interactive Computer graphics structures.
2. Design and apply OpenGL functions to two dimensional graphics, transformations and clipping algorithms.
3. Design and apply OpenGL functions to three dimensional graphics, transformation and apply color models to graph systems.
4. Analyze and apply design strategiesto multimedia systems and multimedia databases.
5. Develop the animation projects from concepts of audio, image, video and hypermedia messaging.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	2	1	1	-	-	-	-	-	-	-
CO3	1	2	2	1	1	-	-	-	-	-	-	-
CO4	1	-	1	-	-	-	-	-	-	-	-	-
CO5	1	2	1	1	1	-	-	-	-	-	-	1

22CSCP503	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

**Course objectives:**

- To impart knowledge on layered approach that makes design, implementation and operation of extensive networks possible.
- To teach the components required to build networks.
- To provide basic concepts related to network addressing and routing.
- To make the students to understand the concepts of end-to-end flow of Information and congestion control.
- To familiarize with the concepts of electronic mail, HTTP, DNS and SNMP.

**UNIT-I Data communication Components**

Data Communications, Networks, Networks Types, Protocols Layering, TCP/IP Protocol Suite, OSI model, Performance, Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum, Transmission Media, Switching.

**UNIT-II Data Link Layer and Medium Access Sub Layer**

Introduction of Data Link Layer, Link Layer Addressing, Error Detection and Error Correction - DLC Services, Data Link Layer Protocols, HDLC, PPP- Media Access Control, wired LANs,- Ethernet, Wireless LANs:- Introduction, IEEE 802.11, Bluetooth – Connecting Devices.

**UNIT-III Network Layer**

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

**UNIT-IV Transport Layer**

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

**UNIT-V Application Layer**

WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.

**Text books:**

1. Data Communications and Networking, Fifth Edition, Behrouz A. Forouzan, TMH, 2013.

**References :**

1. Computer Networks: A Systems Approach, Larry L. Peterson, Bruce S. Davie, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. Data and Computer Communications, William Stallings, Tenth Edition, Pearson Education, 2013.
3. Computer and Communication Networks, Nader F. Mir, Second Edition, Prentice Hall, 2014.
4. Computer Networks: An Open Source Approach, Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, McGraw Hill Publisher, 2011.
5. Computer Networking, A Top-Down Approach Featuring the Internet, James F. Kurose, Keith W. Ross, Sixth Edition, Pearson Education, 2013.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand the functions of layering and protocols.
2. Summarize the devices, protocols and standards to design a network.
3. Construct and implement the concept of switching and routing.
4. Select appropriate protocol and techniques related to transport layer in order to maintain consistent flow of information.
5. Illustrate the functions of electronic mail, HTTP, DNS and SNMP.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	1	3	2	-	-	-	-	-	-	-	-
CO4	3	1	3	2	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-

22CSPC504	MICROPROCESSORS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To familiarize with the architecture of 8086 microprocessor including stacks, procedures, interrupts and instruction set.
- To impart knowledge on 8086, 80186, 80286, 80386, 80486 and Pentium processors.
- To demonstrate the Memory interfacing and I/O interfacing with the case studies.

- To explain the architecture of 8031/ 8051 and 16 bit controller.
- To analyze the role of 8051 microcontroller in ADC, DAC, Stepper Motor and Waveform generation.

### UNIT-I Introduction to 8086

Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

### UNIT-II 8086 Processor

8086 Architecture – Basic Configuration – 8086 Minimum and Maximum mode configurations – Addressing modes – Basic Instructions – System bus timing – System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure – 8086 Interrupts – Assembly level programming – Introduction to 80186 – 80286 – 80386 – 80486 and Pentium processors.

### UNIT-III Interfacing

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard/display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller.

### UNIT-IV Microcontroller

Architecture of 8031/ 8051 – Special Function Registers (SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming - Introduction to 16 bit Microcontroller.

### UNIT-V Advanced Topics

Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation.

### Text Books :

1. Yu-Cheng Liu, Glenn A. Gibson, “Microcomputer Systems: The 8086 / 8088 Family –Architecture, Programming and Design”, Prentice Hall of India, 2<sup>nd</sup> Edition, 2007.
2. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Pearson Education, 2<sup>nd</sup> Edition, 2011.

### References :

1. Douglas V. Hall, “Microprocessors and Interfacing, Programming and Hardware”, TMH, 2012.

- Ramesh S. Gaonkar, “Microprocessor Architecture Programming and Applications with 8085”, Penram International Publishing, 4<sup>th</sup> Edition, 2000.
- Kenneth J. Ayala., “The 8051 Microcontroller Architecture Programming and Applications”, Penram International Publishing (India), 1996.

**Course Outcomes :**

At the end of this course, the students will be able to

- Acquire the basic knowledge on the architecture of 8086 microprocessor including Addressing modes, Instruction set. Assembly language programming, Stacks, Macros, Interrupts and interrupt service routines.
- Develop the programming skills on 8086 and comprehend the other microprocessors such as 80186, 80286, 80386, 80486 and Pentium processors
- Design and develop the Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller through memory and I/O interfacing.
- Derive programming knowledge on 8031/ 8051 microcontroller covering Special Function Registers, I/O Pins Ports and Circuits and also acquire familiarity on 16 bit Microcontroller.
- Implement Programs for 8051 Timer, ADC, DAC, Stepper Motor and for Waveform generation.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	1	1	-	-	-	-	-	-	-	-	-	-
<b>CO2</b>	2	1	1	-	-	-	-	-	-	-	-	-
<b>CO3</b>	2	2	2	1	-	-	-	-	-	-	-	-
<b>CO4</b>	2	1	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	1	1	2	1	-	-	-	-	-	-	-	-

<b>22CSCP508</b>	<b>COMPUTER GRAPHICS AND MULTIMEDIA</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>LAB</b>				<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**Course Objectives :**

- To provide knowledge on implementation of 2D and 3D shape drawing algorithms, transformations and its applications.
- To demonstrate various aspects of image, sound and video editing tools such as GIMP, Audacity, Windows Movie Maker, Swish, Flash, etc.

**LIST OF EXERCISES**

1. Implementation of Bresenham's Algorithm – Line and Circle.
2. Implementation of Bresenham's Algorithm – Ellipse.
3. Implementation of Line, Circle and Ellipse attributes.
4. Two Dimensional transformations - Translation, Rotation, Scaling, Reflection, Shear.
5. Cohen Sutherland 2D line clipping and Windowing.
6. Sutherland – Hodgeman Polygon clipping Algorithm.
7. Three dimensional transformations - Translation, Rotation, Scaling.
8. Drawing three dimensional objects and Scenes.
9. Line DDA, chain of diamonds, chessboard.
10. Generating Fractal images.

**GIMP:**

1. Creating Logos.
2. Simple Text Animation.

**Audacity**

1. Silencing, Trimming and Duplicating the Audio Signal.
2. Giving the Advanced Effect to the Audio Signal.

**Windows Movie Maker**

1. Applying Effect to Video.
2. Creating Titles in Video

**Swish**

1. Text Effects.
2. Pre-Loader.

**Flash**

1. Changing the shape of the Object.
2. Imaging Viewing using Mask.

**Photo Impact**

1. Text Effects.
2. Image Slicing.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Implement 2D and 3D shape drawing algorithms, transformations and its applications.
2. Develop applications on image, sound and video using editing tools such as GIMP, Audacity, Windows Movie Maker, Swish, Flash, etc.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

**Mapping of Course Outcomes with Programme Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	2	1	-	1	-	-	-	-	-	-	-
<b>CO2</b>	1	1	3	1	3	-	-	-	-	-	-	1
<b>CO3</b>	2	2	-	-	-	-	-	-	-	2	-	2



22CSCP509	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	3	1.5

**Course objectives :**

- To understand the basic networking command, client/server concept and network programming using TCP/IP.
- To provide an opportunity to do To acquire knowledge of protocol, techniques used for data transmission from client to server and to identify methods for creating distributed applications.

**LIST OF EXERCISES**

1. Networking Commands.
2. Implementation of Socket program for Echo.
3. Implementation of client and server for chat using TCP.
4. File transfer between client and server using TCP/IP.
5. Implementation of Remote command execution.
6. Client and Server application using UDP.
7. Implementation of Address Resolution Protocol.
8. Socket Program to download a webpage.
9. Implementation of Remote method Invocation.
10. Implementation of server in C and Client in Java.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Make use of network administration commands and demonstrate their use in different network scenarios
2. Implement the Socket programming for Client Server Architecture, Analyze the Packet Contents of different Protocols and Implementation of the routing Protocols.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer science and Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	-	-	-	-
CO2	3	3	2	2	3	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22CSCP510	MICROPROCESSORS LAB	L	T	P	C
		0	0	3	1.5

**Course Objectives :**

- To prepare the students to write assembly language programs on 8085 and 8086 microprocessor.
- To impart design/programming skills on microprocessor interfacing applications.

**LIST OF EXERCISES**

1. Study of 8085 and study of 8086 microprocessor.
2. 8-bit Arithmetic Operation.
3. 16-bit Arithmetic Operation.
4. Find the number of even and odd number in a block of data.
5. Fibonacci series.
6. Hexadecimal to binary conversion.
7. Matrix Addition.
8. Sorting an array of numbers.
9. Searching a string.
10. Digital clock.
11. Square wave generation using 8253IC.
12. Stepper motor interface using 8255IC.
13. Data transfer using USART.
14. Keyboard status.
15. Message display 8279IC.
16. Simulation of traffic light control signal.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Develop Assembly language programs for solving simple mathematical problems.
2. Design and experiment microprocessor interfacing applications using 8253IC, 8255IC, USART, 8279IC and traffic light control system.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	-	-	-	-	-	-	-	-	-
CO2	2	2	2	1	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22CSPC601	COMPILER DESIGN	L	T	P	C
		3	0	0	3

**Course objectives:**

- To understand and list the different stages in the process of compilation.
- To Identify different methods of lexical analysis.
- To design top-down and bottom-up parsers.
- To identify synthesized and inherited attributes.
- To develop algorithms to generate code for a target machine.

**UNIT – I Introduction to Compilers**

Programming Language basics-Language processors – Analysis of the source program – Translators-Compilation and Interpretation- The Phases of Compiler- Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools – Applications of Compiler Technology.

**UNIT – II Lexical analysis**

Lexical Analysis – Role of the lexical analysis – Input Buffering – Specification of tokens- Recognition of tokens – Lexical analyzer generator- LEX- Finite Automata Regular Expression to an NFA – Conversion of an NFA to a DFA –Optimization of DFA based pattern matchers.

**UNIT – III Syntax analysis**

Need and Role of the Parser – Context-Free Grammars – Writing a Grammar – Top-Down Parsing- Recursive-Descent Parsing FIRST and FOLLOW – LL(1) Grammars- Non recursive Predictive Parsing- Error Recovery in Predictive Parsing Bottom-Up Parsing – Shift-Reduce Parsing –Introduction to LR parsing – SLR Parser Canonical LR Parser – LALR- Parser Generators- YACC.

**UNIT – IV Syntax-directed translation & Run time environment**

Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute-Definitions- Design of predictive translator – Type Systems- Specification of a simple type checker-Equivalence of Type Expressions-Type Conversions. Runtime environments –Storage organizations-stack allocation of space –Access to nonlocal data on the stack- Heap Management- Introduction to Garbage Collection.

**UNIT-V Code Generation**

Intermediate-code generation - Variants of Syntax Trees – Three-Address Code– Types and Declarations – Translation of Expressions – Type Checking – Control Flow – Back patching – Switch-Statements –Intermediate Code for Procedures. Code generation: Issues in the Design of a Code Generator The Target Language – Addresses in the target Code– Basic Blocks and Flow Graphs – Principal Sources of Optimization- Optimization

of Basic Blocks – Loops in flow graphs – A Simple Code Generator –Peephole Optimization.

#### Text Books :

1. Compilers: Principles, Techniques and Tools by Alfred V.Aho, Monica S. Lam,
2. Ravi Sethi, Jeffrey D.Ullman, Pearson Publishers,2008.
3. Allen I. Holub, “Compiler Design in C”, Prentice Hall of India,2003.
4. Bennet J.P., Introduction to Compiler Techniques, Tata McGraw-Hill, 2<sup>nd</sup> edition,2003.

#### References :

1. Henk Alblas and Albert Nymeyer,, Practice and Principles of Compiler Building with C, PHI,2001.
2. Kenneth C. Louden, Compiler Construction: Principles and Practice, Thompson Learning,2003.
3. Charles N. Fischer, Richard. J. LeBlanc, “Crafting a Compiler with C”, Pearson Education, 2008.
4. Compilers: Principles, Techniques, and Tools by Alfred V.Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson Publishers,2008.

#### Course Outcomes:

At the end of this course, the students will be able to

1. Illustrate the different phases of compiler.
2. Explain the process of lexical analysis.
3. Understand the need of parser and compare the principle of top down and bottom up parser.
4. Construct syntax trees and able to explain storage organization.
5. Develop algorithms for generating intermediate code.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	-	-	-	-	-	-	-	-
CO3	2	2	-	3	-	-	-	-	-	-	-	-
CO4	1	1-	2	-	1	-	-	-	-	-	-	-
CO5	1	1	1	-	1	-	-	-	-	-	-	-

22CSPC602	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To understand the basics phases of development of a Software Project.
- To understand the major considerations for enterprise integration and deployment concepts of requirements engineering and Analysis Modeling.
- To understand the various testing and basics of Quality Management.
- To explain about Software Configuration Management.
- To describe about the Risk Management.

**UNIT- I Introduction to Software Process**

The Software process- A Generic Process Model- Perspective Process Models- Specialized Process Models- The Unified Process- Personal and team process models- Agile Development- Extreme Programming (XP)- Requirements Engineering- Requirements Analysis- Establishing the Groundwork- Eliciting Requirements- Developing Use Cases- Negotiating Requirements- Validating Requirements- Requirements Analysis- Scenario-Based Modeling.

**UNIT- II Design Concepts**

The Design Process- Design Concepts- The Design Model- Architectural Design- Assessing Alternative Architectural Designs- Architectural Mapping Using Data Flow- Component-level design- Designing Class-Based Components- Conducting Component-Level Design- User Interface design- User Interface Analysis and Design- Interface Analysis- Pattern based Design- WebApp design- WebApp Design Quality- WebApp Interface design.

**UNIT- III Quality Management**

Software Quality- The Software Quality Dilemma- Achieving Software Quality- Review techniques- Cost Impact of Software Defects- Defect Amplification and Removal- Review Metrics and Their Use- Informal Reviews- Formal Technical Reviews- Software Quality Assurance- Test Strategies for Conventional Software- Test Strategies for Object-Oriented Software- SQA Tasks, Goals, and Metrics- Statistical Software Quality Assurance- A Strategic Approach to Software Testing- System Testing- The Art of Debugging.

**UNIT- IV Configuration Management**

The SCM Repository- The SCM Process- Configuration Management for Web Apps- A Framework for Product Metrics- Metrics for the Requirements Model- Metrics for the Design Model- Project Management concepts- The management spectrum- People- The Product- The Process- Metrics in the Process and Project Domains.

**UNIT- V Software Project Estimation**

Decomposition Techniques-Empirical Estimation Models-The Make/Buy Decision-Project Scheduling-Defining a Task Set for the Software Project-Defining a Task Network-Reactive versus Proactive Risk Strategies-Risk Identification-Risk Projection-Risk Refinement-The RMMM Plan-Business Process Reengineering- Software Reengineering-Reverse Engineering-Restructuring-Forward Engineering- The SPI Process-The CMMI-The People CMM-SPI Return on Investment-SPI Trends.

**Text Books :**

1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Software Engineering, K.K. Aggarwal & Yogesh Singh, New Age International, 2nd edition,2006.

**References :**

1. Ian Sommerville, “Software Engineering”, 9th Edition, Pearson Education Asia, 2011.
2. Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning Private Limited, 2009.
3. Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.
4. Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd, 2007.
5. Stephen R.Schach, “Software Engineering”, Tata McGraw-Hill Publishing Company Limited, 2007.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Comprehend the basic elements of Software Project Models.
2. Analyze the strategies in Software Designing.
3. Visualize the significance of the different kind of Software Testing methods.
4. Explore the various Management methods in Software Development Projects.
5. Acquire knowledge about Risk Management in Software Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	-	-	-	1	-	1	-
CO2	1	1	2	-	-	-	-	-	-	-	-	-
CO3	1	2	2	-	-	-	-	-	-	-	-	-
CO4	1	1	-	-	-	-	-	-	-	-	-	-
CO5	1	1	-	-	1	1	-	-	-	-	-	-

22CSCP607	COMPILER DESIGN LAB	L	T	P	C
		0	0	3	1.5

**Course Objectives :**

- To make the students to understand the different stages of compiler.
- To impart programming skills needed to develop a compiler.

**LIST OF EXERCISES**

1. Implementation of Lexical Analyser for IF Statement.
2. Implementation of Lexical Analyser for Arithmetic Expression.
3. Construction of NFA from Regular Expression.
4. Construction of DFA from NFA.
5. Implementation of Shift Reduce Parsing Algorithm.
6. Implementation of Operator Precedence Parser.
7. Implementation of Recursive descent Parser.
8. Implementation of Code Optimization Techniques.
9. Implementation of CodeGenerator.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Apply the programming knowledge skill to design and develop a compiler.
2. Understand and implement lexical analyzer, syntax analyser, code optimizer and code generator.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	3	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22CSCP608	SOFTWARE ENGINEERING LAB	L	T	P	C
		0	0	3	1.5

**Course Objectives:**

- To provide the students with simple experiments to understand the basic aspects about the behavior of the testing techniques to detect the errors in the software.
- To understand standard principles to check the occurrence of defects and its removal.

**LIST OF EXERCISES**

1. Write a C program for matrix multiplication to understand the causes of failures.
2. Write a C program for Binary Search – Path Testing.
3. Write a C program to derive test cases based on boundary value analysis
4. Write a C program for cause effect graph to check whether defect is found in the program.
5. Write a C program to perform data flow testing for the given code and find out all d-use Pairs.
6. Write a C program to demonstrate the working of the looping constructs.
7. Write and test a program to count number of check boxes on the page checked and unchecked count using selenium tool.
8. Write and test a program to provide total number of objects available on the page using selenium tool.
9. Write and test a program to login a specific web page using selenium tool.
10. Write and test a program to select the number of students who have scored more than 60 in any one subject ( or all subjects).
11. Write a Java script to develop a web page which calculates the GCD of 2 numbers using Selenium tool.
12. Write and test a program to update 10 student records into table into Excel file using selenium tool.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Investigate the Reasons for Bugs and Analyze the principles in Software Testing.
2. Implement various Test Processes for Quality Improvement.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

**Mapping of Course Outcomes with Programme Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	-	1	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22ETHS701	ENGINEERING ETHICS	L	T	P	C
		2	0	0	2

**Course Objectives:**

- To provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues.
- To familiarize about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards,
- To educate the Safety and Risk, Risk Benefit Analysis.



- To teach about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights.
- To impart knowledge about MNC's, Business, Environmental, Computer Ethics, Honesty, Moral Leadership, sample Code of Conduct.

**UNIT-I Introduction**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

**UNIT-II Challenges**

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

**UNIT – III Risk Analysis**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal.

**UNIT – IV Loyalty**

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

**UNIT – V Business Ethics**

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

**Text Books :**

1. Govindarajan M, Natarajan S and Senthilkumar V S, "Professional Ethics and Human values", PHI Learning, New Delhi,2013.
2. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York,2005.

**References :**

1. Charles E Harris, Michael S Pritchard and Michael J Rabins,"Engineering Ethics – Concepts and Cases", Thompson Learning, 2000.
2. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999. John R Boatright, "Ethics and the Conduct of Business", Pearson Education,2003.

3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press,2001.
4. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press,2003.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Understand the basic concepts of engineering Ethics.
2. Analyze the importance of codes in engineering practice.
3. Comprehend the Risk analysis in Ethics.
4. Describe about Collegiality and Loyalty
5. Acquire knowledge on Business Ethics.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	1	1	3	-	-	-	-
CO2	2	-	-	-	-	2	-	3	-	-	-	-
CO3	1	-	-	-	-	2	-	3	-	-	-	-
CO4	1	-	-	-	-	2	-	3	-	-	-	-
CO5	1	-	-	-	-	1	2	3	-	-	-	-

22CSPEC702	EMBEDDED SYSTEMS AND INTERNET OF THINGS (IOT)	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To introduce the basics, features and attributes, challenges, recent trends, design and development languages, development life cycle of embedded systems.
- To educate the students on real time operating system based embedded system design, an overview of ARM architecture and development tools.
- To teach the students the characteristics, physical/logical design, and functional blocks of IoT.
- To explain network and communication aspects and applications of IoT.
- To impart knowledge on building IoT with Raspberry Pi, Arduino using Python.

**UNIT – I Introduction to Embedded Systems**

Introduction, Applications of embedded system, Features and Attributes of Embedded System, Challenges in Embedded System, Selection of Processors, Recent trends in embedded system, Embedded Firmware design approaches and development languages, embedded development life cycle.

**UNIT – II Real Time Operating Systems**

Prime Movers: Real time without RTOS, Task states, Task table and data– Multitasking operating systems–Context switches–Kernels–Task swapping methods–Scheduler algorithms –Inter process communication mechanism-memory communication, Message passing, Signals. Overview of ARM Architecture, Programmer’s model and Development Tools.

**UNIT – III Introduction to IoT**

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, Machine to Machine, Difference between IoT and M2M, Software defined Network (SDN).

**UNIT - IV Network and Communication Aspect**

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination. Applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT applications.

**UNIT - V Raspberry PI with Python and Arduino**

Building IOT with RASBERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi - Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms – Arduino - Evolution of IOE and its benefits.

**Text Books :**

1. Marilyn Wolf, “Computers as Components-Principles of Embedded Computing System Design”, Morgan Kaufmann Publishers, 3<sup>rd</sup> edition, 2012.
2. Vijay Madiseti, Arshdeep Bahga, “Internet of Things: AHands-OnApproach” Orient Blackswan Pvt. Ltd., New Delhi, 2015.

**References :**

1. Shibu K.V, “Introduction to Embedded System”, Tata McGraw-Hill,2009.
2. David E. Simon, “An Embedded Software Primer”, Pearson Education Asia, Addison Wesley, 2001.
3. Raj kamal, “Embedded Systems”, Architecture, Programming and Design”, Tata McGraw Hill,2003.
4. Steve Heath, “Embedded Systems Design”, Newnes /An imprint of Elsevier, 2<sup>nd</sup> edition,2005.
5. Internet of Things, Jeeva Jose, (ISBN: 978-93-86173-591) KBP House,1<sup>st</sup>edition,2018.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand the features and design/development of embedded system.
2. Design an embedded system using RTOS, ARM architecture.
3. Understand the building blocks of IoT, IoT enabling technologies, characteristics of IoT systems , IoT levels and the difference between IoT and M2M.
4. Build domain specific IoTs by analyzing the MAC protocols and survey routing protocols.
5. Design IoT physical devices using Raspberry Pi and Arduino with interfacing sensors and actuators through programming with Python.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	2
CO5	3	1	1	-	2	1	-	-	-	-	-	-

22CSCP706	EMBEDDED SYSTEM AND INTERNET OF THINGS (IOT) LAB	L	T	P	C
		0	0	3	1.5

**Course Objectives :**

- To understand the working principle of Embedded System.
- To make use various sensors in IoT.
- To know how to use various tools in IoT for designing applications.

**LIST OF EXERCISES****Embedded System**

1. Alphanumeric LCD interface using 8051.
2. Study of ARM evaluation system.
3. Flashing of LEDs using ARM(LPC2148).
4. Interfacing keyboard and LCD using ARM(LPC2148).
5. Temperature sensor interface using ARM(LPC2148)

**IoT**

1. Distance Measurement.
2. Identifying Moisture content in Agricultural Land.
3. Fire Alarm Indicator.
4. Basic Home Automation.
5. Identifying Room Temperature.
6. How to Control PWM Signals.
7. Designing a Calculator using NumPi.
8. Designing Game using PyGame.
9. Designing frontend GUI using TKinter.
10. Identification of Earthquake.
11. Implementation of sorting mechanism.
12. Accessing GPIO using Google Assistance.
13. How to create a video player.
14. Uploading data to cloud and monitoring in cloud.
15. Connecting social media (twitter).

**Course Outcomes:**

At the end of this course, the students will be able to

1. Develop a real time projects using embedded systems including 8051 and Advanced RISC Machines (ARM).
2. Design IoT based products that can be used in all real time applications.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	-	-	2	-	2	-	-	-	-	-	-	-
<b>CO2</b>	-	3	3	1	3	1	-	-	-	-	-	2
<b>CO3</b>	2	2	-	-	-	-	-	-	-	2	-	2

22ETIT707	INDUSTRIAL TRAINING/RURAL INTERNSHIP/ INNOVATION/ENTREPRENEURSHIP	L	TR	S	C
		0	1	2	4

Note:\*- Four weeks during the summer vacation before the end of sixth semester

### COURSE OBJECTIVES :

- To expose the students to understand technical and professional skill requirements in IT industries.
- To impart professional skills for solving problems in industries.
- To train the students to design innovative solutions for a problem.
- To motivate the students to become an Entrepreneur.
- To develop communication and technical report writing skill.

The students will work for two periods per week guided by student counselor. They will be asked to present a seminar of not less than 15 minutes and not more than 30 minutes on any technical topic of student's choice related to Computer Science and Engineering and to engage in discussion with audience. They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the student counselor based on the technical presentation, the report and also on the interaction shown during the seminar.

The students will individually undertake a training program in reputed concerns in the field of Computer Science and Engineering during summer vacation (at the end of sixth semester) for a minimum stipulated period of four weeks. At the end of training the student has to submit the detailed report on the training undertaken within ten days from the commencement of the seventh semester. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

### Course Outcomes :

At the end of this course, the students will be able to

1. Understand the day-to-day job in IT industries, and technical and professional skills needed for an industry.
2. Develop and refine technical and professional skills through hands-on work experience.
3. Design an innovative solution for an Industry requirement by applying the knowledge learned from industry and in academics.
4. Develop a startup for product or services based on the people or industry requirements.
5. Communicate effectively the knowledge learned in internship through document and PowerPoint presentation.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	2	2	-	-	-	-	-	-	-	-	3
CO3	1	-	2	1	2	-	-	-	-	-	-	-
CO4	1	-	-	-	-	-	-	-	2	-	2	1
CO5	1	-	-	-	2	-	-	-	-	3	-	-

22CSPV803	PROJECT WORK AND VIVA VOCE	L	PR	S	C
		0	10	2	6

**Course objectives :**

- To inculcate the ability of the student to solve specific problems right from its identification.
- To review literatures based on the problem statement.
- To label methodology for solving the problem.
- To solve problems using modern tools if required.
- To impart the students in preparing project reports and to defend their reports during evaluation.

**Course outcomes :**

At the end of this course, the students will be able to

1. Understand and articulate problem statement and identify the objectives of the project.
2. Review the state-of-the-art literature on the topic of the proposed work.
3. Design the methodology of the work in terms of block diagram.
4. Design experiments and conduct investigations of the work using modern IT tools and infer the results in graph, table and charts.
5. Communicate effectively through technical report and PowerPoint presentation.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	-	-	-	-	-	-	3	-	3	-
CO2	1	2	-	-	-	-	-	-	3	-	3	3
CO3	1	-	2	-	-	-	-	-	3	-	3	-
CO4	1	-	2	2	2	-	-	-	3	-	3	-
CO5	1	-	-	-	-	-	-	-	3	3	3	3

**PE – PROFESSIONAL ELECTIVES**

22CSPE SCN	PERL PROGRAMMING	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To provide the basic features of Perl language.
- To explain the concept of lists, arrays and hashes.
- To impart programming skills for handling files.
- To demonstrate the usage of subroutines and units.
- To introduce regular expression for processing text.

**UNIT - I An overview of Perl**

Getting started, Scalar data – Numbers – Strings – Built-in warnings - Operators – Variables – Output with print – Control structures – Getting user input - More control structures.

**UNIT - II Lists and Hashes**

Introduction to lists, Simple lists, Complex lists, Accessing list values, List slices, Ranges, Combining ranges and Slices. Arrays – Accessing single and Multiple elements from an array – Interpolating Arrays into Strings – For Control Structure – Array functions (pop, push, shift, unshift, and sort) – Array manipulations; Introduction to Hashes – Hash element access – Hash functions – Typical use of hash.

**UNIT - III Files and Data**

Input from standard input – Diamond operator – Invocation Arguments – Standard Output – Formatted Output using printf – File Handles – Opening a file handle – Fatal errors – Using file handle – Reopening a standard file handle – Output with say – File handles in a scalar.

**UNIT - IV Subroutines and Unit**

Introduction to subroutines – Defining – Invoking – Return Values – Arguments – Private variables – Variable length parameter list – Lexical variables – Use strict pragma – Return operator – Non-scalar return values – Perl Unit – Finding and Installing Unit – Using simple Unit- CGI.

**UNIT - V Regular Expressions**

Introduction to regular expressions- Simple patterns – Character classes – Matching with regular expression – Processing text with regular expression – Substitutions – Split operator – Join function.



**Text Books :**

1. Stephen Spainhour, Ellen Siever, Nathan Patwardhan, "Perl in a Nutshell", O'Reilly Media Publications, 1998.
2. Simon Cozens, Peter Wain Wriarth, "Beginning Perl", Wrox press, 1<sup>st</sup> edition, 2000.

**References :**

1. Tom Christiansen, Brian D Foy, Larry Wall, Jon Orwant, "Programming Perl", O'Reilly Media, 4<sup>th</sup> Edition, 2012.
2. Randal L. Schwartz, Brian D Foy, Tom Phoenix, "Learning Perl", O'Reilly Media, 6<sup>th</sup> Edition, 2011.
3. Ellie Quigley, "Perl by Example", Prentice Hall, 5<sup>th</sup> Edition, 2014.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Apply basic programming concepts of Perl language.
2. Develop Perl programs using arrays, lists and hashes.
3. Create Perl programs that make use of directories and files.
4. Define and call subroutines with return values, arguments, private variables and variable length parameter list.
5. Illustrate matching, replacing and splitting operations in text using regular expressions.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	1	-	-	-	-	-	-	-	-
CO3	1	2	1	1	-	-	-	-	-	-	-	-
CO4	1	2	-	-	-	-	-	-	-	-	-	-
CO5	2	2	1	-	-	-	-	-	-	-	-	-

22CSPESC�	DISTRIBUTED SYSTEMS	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To understand the foundations of Distributed System
- To introduce the idea of peer to peer services and file system
- To describe the components and support required for distributed system
- To instruct the remote method invocation and objects
- To enable the design process and resource management systems

**UNIT – I Introduction**

Examples of Distributed System – Trends in Distributed System – Focus on resource sharing – Challenges – Case study: World Wide Web – System Model – Physical models – Architectural models – Fundamental models.

**UNIT - II System Model**

Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation and Objects: Remote Invocation – Introduction – Request – reply protocols - Remote procedure call – Remote method invocation. Case study: Java RMI – Group communication – Publish – subscribe systems – Message queues – Shared memory approaches – Distributed objects – Case study: Enterprise Java Beans – from objects to components.

**UNIT - III Peer to peer Systems**

Introduction – Napster and its legacy – Peer to peer – Middleware –Routing overlays. Overlay case studies: Pastry, Tapestry – Distributed File Systems – Introduction – File service architecture – Andrew File system. File System: Features  
File model – File accessing models – File sharing semantics naming: Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP.

**UNIT – IV Clocks, events and process states**

Synchronizing physical clocks – Logical time and logical clocks – Global states - Coordination and Agreement – Introduction – Distributed mutual exclusion – Elections Transactions and Concurrency Control – Transactions – Nested transactions – Locks – Optimistic concurrency control – Timestamp ordering – Atomic Commit protocols - Distributed deadlocks – Replication – Case study – Coda.

**UNIT – V Process Management**

Process Migration: Features, Mechanism – Threads: Models, Issues, Implementation. Resource Management: Introduction – Features of Scheduling Algorithms – Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

**Text Books :**

1. George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, 5<sup>th</sup> Edition, Pearson Education,2012.
2. Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.

**References :**

1. TanenbaumA.S.,VanSteen M.,“Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.

2. Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education, 2004.
3. Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, USA,2003.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Acquire the knowledge on foundations of distributed System
2. Predict the remote method invocation and objects in the distributed file system
3. Formulate the idea of peer-to-peer services and file system
4. Identify the components and support required for distributed system
5. Apply the experienced skills on design process and resource management systems.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	1	-	-	-	-	-	-	-	-
CO3	2	1	1	1	-	-	-	-	-	-	-	-
CO4	2	-	-	1	-	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	1	-	-	-	-	-

22CSPESCEN	WEB TECHNOLOGY	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To introduce the basics of static web designing using HTML.
- To prepare the students to write simple scripts using Extensible Markup Language.
- To prepare the students to use PERL for CGI programming.
- To understand the concept of server-side web designing using PHP.
- To impart skills in designing web pages including PERL and Ajax with Rails.

**UNIT - I XHTML**

Evolution of HTML and XHTML- Standard XHTML Document Structure- Basic Text Markup- Images-Hypertext Links-Lists- Tables- Forms- Frames. Cascading Style Sheets Introduction to CSS – Levels of Style Sheets- Style Specification Formats- Selector Forms- Property Value Forms – Font Properties- List Properties – Color- Alignment of Text – Background Images- Span and Div Tags.

**UNIT – II Introduction to SGML**

Features of XML - XML as a subset of SGML – XML Vs HTML – Views of an XML document - Syntax of XML- XML Document Structure – Namespaces- XML Schemas-

simple XML documents – Different forms of markup that can occur in XML documents - Document Type declarations – Creating XML DTDs – Displaying XML Data in HTML browser – Converting XML to HTML with XSL minimalist XSL style sheets – XML applications.

### UNIT - III Overview of PERL

Origin and Use of Perl- Scalars and their Operations – Assignment Statements and Simple Input and Output – Control Statements- Fundamentals of Arrays – Hashes References- Functions- Pattern Matching – File Input and Output – Simple programs in Perl -Using Perl for CGI Programming.

### UNIT - IV Overview of PHP

Origin and Use of PHP - PHP- General Syntactic Characteristics Operations and Expressions- Control Statements- Arrays- Functions-Pattern Matching- Form Handling- Files-Cookies-Session Tracking - Database Connectivity, Simple programs in PHP and MySQL.

### UNIT - V RAILS

Overview of Rails- Document Requests- Processing Forms- Rails Application with Databases – Layouts -AJAX - Ajax Overview of Ajax – Basics of Ajax – Rails with Ajax.

### Text Books :

1. Deitel & Deitel, Nieto, Lin, Sadhu, XML How to Program, Pearson Education, New Delhi,2016.
2. Kogent Learning Solutions Inc, Web Technologies Black Book, Dreamtech Press, New Delhi,2013.

### References :

1. Chris Bates, Web Programming Building Internet Applications 3rd ed., Wiley India Edition, New Delhi,2012.
2. Bankim Patel, Lal Bihari Barik, Introduction to Web Technology & Internet, Acme Learning Private Limited, New Delhi,2015.
3. Pankaj Sharma, Introduction to Web Technology, Katson Books, New Delhi,2014.
4. Phil Ballard, Michael Moncur, Sams Teach Yourself Ajax, JavaScript and PHP, Pearson Education,New Delhi,2012.
5. Achyut S Godbole, Atul Kahate, Web Technologies TCP/IP Architecture and Java Programming, 2nd ed., Tata McGraw Hill Education Private Limited, NewDelhi,2015.

### Course Outcomes :

At the end of this course, the students will be able to

1. Understand the basic concepts of Hyper Text Markup Language to develop simple web pages.
2. design stylish web pages with the features of Extensible Markup Language

3. Develop projects in system administration, web development, network programming and GUI development using PERL.
4. Understand PHP and can write simple programs in PHP and My SQL
5. inspect how to manage databases using Rails and implements AJAX operations using rails

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	-	1	-	-	-	-	-	-	-
CO2	-	1	1	-	1	-	-	-	-	-	-	-
CO3	-	1	1	-	1	-	-	-	-	-	-	-
CO4	-	1	1	-	1	-	-	-	-	-	-	-
CO5	1	1	1	-	1	-	-	-	-	-	-	-

22CSPESCEN	REAL TIME SYSTEMS	L	T	P	C
		3	0	0	3

### Course Objectives:

- To introduce the fundamental problems, concepts, and approaches in the design and analysis of real-time systems.
- To emphasize the issues related to the design and analysis of systems with real-time constraints.
- To study the real time applications and their functional semantics.
- To provide a comprehensive idea about real time system, task assignment, scheduling, memory management, and related fault tolerance issues.
- To acquire the basic knowledge on real time system programming and programming tools.

### UNIT – I Introduction

Issues in Real-Time computing - structure of a Real-time system - task classes - Characterization of Real-Time systems and tasks - performance measures of real-time systems - Estimation of Program Run Times - Real-Time Specification and Design Techniques - Real Time Applications : Digital control systems, High level control systems, Signal processing and Multimedia applications.

### UNIT – II Task Assignment and Scheduling

Classical Uniprocessor scheduling Algorithms - Clock-driven approach, weighted round robin approach, Priority driven approach, dynamic versus static systems, Effective release times and deadlines, Optimality of EDF and LST algorithms, Challenges in validating timing constraints in priority driven systems, Offline versus online scheduling. Task Assignment - Mode Changes - Fault Tolerant Scheduling.

**UNIT – III Real-Time Communication**

Network topologies - Protocols - Real-Time Databases: Introduction - Real Time vs. General Purpose Database - Main memory Databases - Transaction Priorities and Aborts - Concurrency control issues, Disk Scheduling Algorithms, Two-phase approach to improve predictability, serialization consistency, Databases for Hard Real-Time systems - Fault Tolerance Techniques - Fault Types, Fault Detection - Fault Error containment Redundancy, Data Diversity, Reversal Checks, Integrated Failure handling.

**UNIT – IV Real-time Memory Management**

Process Stack Management - Dynamic Allocation - Resources and Resource Access Control: Assumptions on resources and their usage, effects of resource contention and resource access control - basic priority-inheritance protocol, basic priority-ceiling protocol – Real-time Kernels: Polled loop Systems - Phase/State - Driven Code - Co-routines - Interrupt Driven Systems - Foreground/ Background Systems - Capabilities of

commercial real - time operating systems, Predictability of general-purpose operating systems – Full - Featured Real-time Operating Systems.

**UNIT – V Programming Languages and Tools**

Desired language characteristics, Data typing, control structures, Facilitating hierarchical decomposition, packages, Run-Time error (exception) handling, overloading and generics - Multitasking, Low-level programming, Task scheduling - Timing specifications, Run-time-support Programming environments.

**Text Books :**

1. C.M.Krishna and Kang G. Shin, “Real-Time Systems”, Tata McGraw Hill,2010.
2. Philip.A.Laplante, “Real Time Systems Design and Analysis”, 3<sup>rd</sup> edition, Wiley-IEEE Press,2004.

**References :**

1. Jane W.Liu, "Real-Time Systems", Pearson Education,2001.
2. Alan Burns Andy Wellings, “Real Time systems and their programming languages”, 4<sup>th</sup> edition, Addison Wesley, 2009.
3. C.Sivamurthy and G.Manimaran, “Resource Management in Real-time Systems and Networks”, Prentice Hall of India,2005.
4. Rajib Mall, "Real-Time Systems: Theory and Practice," Pearson,2008.
5. Alan C. Shaw, “Real-Time Systems and Software”, Wiley,2001.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand real time computing, its characteristics and performance measures.
2. Design Task Assignment and Scheduling algorithms for real time systems.
3. Analyze various real-time approaches for concurrency and fault tolerance issues.
4. Analyze various real time system memory management issues.

5. Apply formal software engineering methods, programming tools and practices to design, analyze and develop small real-time systems.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	-	2	-	1	-	-	-	-	-	-	-
CO3	1	-	1	-	-	-	-	-	-	-	-	-
CO4	1	-	1	-	-	-	-	-	-	-	-	-
CO5	1	1	-	-	2	-	-	-	2	-	-	1

22CSPESCEN	ADVANCED JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

### Course Objectives:

- To demonstrate the uses of Applets and AWT concepts in Java.
- To learn the concepts of Network and Database programming.
- To familiarize students with Swing and Beans concepts.
- To build applications in Distributed Environment.
- To impart the knowledge of Spring and Hibernate frameworks.

### Unit – 1 Applets and Abstract Window Toolkit (AWT)

Applets: Introduction to Java Programming – Working with Java – Java Applet – Drawing Shapes and Text – Images – Variables and Methods.  
 Abstract Window Toolkit: Abstract Window Toolkit (AWT) – AWT Classes – Window Fundamentals – Working with Frame Windows – Introduction to Graphics – AWT Controls.

### Unit – 2 Network and Database Programming

Network Programming: Basic Network and Web Concepts – Streams – Output Streams – Input Streams – Filter Streams – Sockets for Clients – Socket Basics – Using Sockets – Socket Exceptions – Sockets for Servers – Broadcasting – Multicasting. Database Programming: Introduction to JDBC – Connection Troubles – Basic Database Access – JDBC Support Classes – Database Servlet – Advanced JDBC.

### Unit – 3 Swing and Beans

Swing: Introduction – Features – MVC Connection – Components and Containers – Swing Packages – Event Handling – Exploring Swing – Swing Menus. Java Beans: Advantages – Introspection – Persistence – Customizers – Java Beans API.

**Unit – 4 Applications in Distributed Environment**

Streams – Core Classes – Viewing a File – Layering Streams – Sockets – ServerSockets – Customizing Socket Behavior – Designing the Remote Interface – Building Data Objects – Accounting for Partial Failure – Serialization – RMI Registry – Naming Services – Security Policies – RMI, CORBA and RMI/IIOP.

**Unit – 5 Spring Framework and Hibernate Framework**

Spring Framework: Introduction to Spring – Scope and Lifecycle of Bean – Inversion of Control – Dependency Injection – Spring MVC – Building Spring Web Apps – Creating Controllers and Views – Request Params and Request Mapping – Form tags and Data Binding. Hibernate Framework: Introduction to Hibernate – Hibernate CURD Features – Advanced Mappings – Hibernate Query Languages and Transactions. Spring Hibernate Integrations: Hibernate DAO Implementation using Spring Framework.

**Text Books :**

1. Elizabeth Sugar Boese, “An Introduction to Programming with Java Applets”, Jones and Bartlett Publishers, 3<sup>rd</sup> Edition, 2010.
2. Herbert Schildt, “Java:The Complete Reference”, McGraw-Hill Publishers, 11<sup>th</sup> Edition, 2019.
3. William Grosso.“Java RMI”, O’Reilly Media Publication, 1<sup>st</sup> Edition, 2002.
4. Elliotte Rusty Harold, “JAVA Network Programming”, O’Reilly Media Publication, 4<sup>th</sup> Edition, 2013.

**Reference Books :**

1. D.T. Editorial Services “Java 8 Programming Black Book”, Wiley, 2015.
3. Santosh Kumar K, “Spring and Hibernate”, Mc.Graw Hill Education, 2<sup>nd</sup> Edition, 2013.
4. George Reese, “Database Programming with JDBC and Java”, O’Reilly Media Publication, 2<sup>nd</sup> Edition, 2000.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Understand the importance of Applets and Abstract Window Toolkit (AWT).
2. Work with Database and Network based application development.
3. Design Graphical User Interface using Swing and Beans.
4. Build and deploy distributed applications using RMI and CORBA.
5. Recognize the capabilities of Java framework to facilitate solving industrial applications using Spring and Hibernate framework.



Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	1	2	1	-	-	-	-	-	-	-	-	-
<b>CO2</b>	2	2	1	2	-	-	-	-	-	-	-	-
<b>CO3</b>	2	2	2	2	-	-	-	-	-	-	-	1
<b>CO4</b>	1	1	1	2	1	-	-	-	-	-	-	1
<b>CO5</b>	2	1	1	2	2	-	-	-	-	-	-	1

22CSPESCN	MOBILE APP DEVELOPMENT	L	T	P	C
		3	0	0	3

### Course Objectives:

- To introduce the fundamentals of Android operating system and its environment.
- To familiarize with the user interface concepts including layouts, fragments and activities.
- To teach the concepts of intents and broadcasts receivers.
- To educate how to share preferences and access SQLite databases.
- To develop the skills required to create alarms and map-based activities using Geocoder.

### UNIT – I Android

An Open Platform for Mobile Development - Native Android Applications - Android SDK features - Understanding the Android Software Stack - The Dalvik Virtual Machine - Android Application Architecture - Android Libraries - Creating the Android Application - Types of Android Applications - Android Development Tools - Externalizing the Resources - The Android Application Lifecycle.

### UNIT – II Building User Interface

Fundamental Android UI design - Android User Interface fundamentals - Layouts - Linear - Relative - Grid Layouts - Fragments - Creating new fragments - The Fragments Lifecycle -Introducing the Fragment Manager - Adding Fragments to Activities - Interfacing between Fragments and Activities.

### UNIT – III Intents And Broadcasts Receivers

Introducing Intents - Using intents to launch Activities - Introducing Linkify - Using Intents to Broadcast Events - Introducing the Local Broadcast Manager - Introducing pending intents - Using Intent filters to service implicit Intents - Using Intent Filters for Plugins and extensibility - Listening for Native Broadcast Intents - Monitoring Device State Changes Using Broadcast Intents.

**UNIT – IV Files , Saving State And Preferences**

Saving Simple Application Data - creating and Saving Shared Preferences - Retrieving Shared Preferences – Introducing the Preference Framework and the Preference Activity – Working with the File System – Introducing Android Databases Introducing SQLite – Content Values and Cursors – Working with SQLite Databases - Creating Content Providers, Using Content Providers.

**UNIT – V Advanced Topics**

Alarms - Creating and using alarms - Using Location Based Services – Using the Emulator with Location-Based Services - Finding the Current Location – Using the Geocoder - Creating Map-Based Activities.

**Text Books :**

1. Reto Meier, “Professional Android 4 Application Development”, John Wiley & Sons, Inc, India, (Wrox), 4<sup>th</sup> edition, 2012.
2. Android Application Development for Java Programmers, James C Sheusi, Course Technology Cengage Learning, 1<sup>st</sup> edition, 2013.

**References :**

1. Wei-Meng Lee, “Beginning Android 4 Application Development”, Wiley India (Wrox), 2013.
2. Wei – Meng Lee,” Beginning Android Application Development”, Wiley, 2011.
3. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, Dream Tech., 2012.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Infer the fundamentals of Android operating system and its environment.
2. Analyze the user interface concepts including layouts, fragments and activities.
3. Examine the concepts of intents and broadcasts receivers.
4. Build applications involving share preferences and SQLite databases.
5. Design and develop applications using alarms and Geocoder.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	1	-	-	-	-	-	-	-
CO2	3	2	1	-	1	-	-	-	-	-	-	-
CO3	3	1	1	-	1	-	-	-	-	-	-	-
CO4	3	2	1	2	2	-	-	-	1	-	-	1
CO5	2	2	1	2	2	-	-	-	1	-	-	1

22CSPESEN	SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To impart knowledge on software testing techniques.
- To impart knowledge on integration testing techniques.
- To impart the knowledge on performance testing and test management.
- To understand software Quality management and its components
- To explain the components of quality plan for software projects.

**UNIT - I Phases of Software Project**

Quality, Quality assurance and quality control – Testing, Verification and Validation – White box testing – Static testing – Structural testing – Black box testing – Definition, need for black box testing – Black box testing techniques - Requirements based testing, Positive and Negative testing, Boundary Value Analysis, Decision Tables, Equivalence Partitioning, Graph based Testing, Compatibility Testing, Domain Testing.

**UNIT - II Integration Testing**

Integration testing as a type of testing - Integration testing as a phase of testing – Scenario testing – Defect bash - System and Acceptance testing – System testing overview – Need for System testing – Functional system testing – Non- functional testing – Acceptance testing.

**UNIT – III Performance Testing**

Factors governing performance testing – Methodology for performance testing –Tools for performance testing – Process for performance testing – Regression testing Types of Regression testing – When and how to do Regression testing – Test planning – Test management – Test process – Test reporting.

**UNIT - IV Software Quality**

Definition - Software quality assurance – definition and objectives - Software quality assurance and software engineering - Software quality factors - The components of the software quality assurance system – The SQA system - SQAarchitecture-Pre-project components - Software project life cycle components - Infrastructure components for error prevention and improvement - Management SQA components - SQA standards, system certification, and assessment components - Organizing for SQA – The human components - Considerations guiding construction of an organization’s SQA system.

**UNIT – V Development plan and Quality Plan**

Objectives - Elements of the development plan - Elements of the quality plan - Development and quality plans for small projects and for internal projects - Integrating quality activities in the project life cycle - Classic and other software development

methodologies - Factors affecting intensity of quality assurance activities in the development process - Verification, validation and qualification - A model for SQA defect removal effectiveness and cost.

#### Text Books :

1. Srinivasan Desikan, Gopaldaswamy Ramesh, “Software Testing: Principles and Practices”, Pearson Education India, 1<sup>st</sup> edition,2005.
2. Daniel Galin, “Software quality assurance – from theory to implementation”, Pearson Education India, 1<sup>st</sup> edition, 2009.

#### References :

1. Aditya Mathur, “Foundations of software testing”, Pearson Education, 1<sup>st</sup> edition,2008.
2. Ron Patton, “Software Testing”, Pearson education, 2<sup>nd</sup> edition,2007.
3. William E. Perry, "Effective Methods for Software Testing: Includes Complete Guidelines, Checklists, and Templates", Wiley Publishing, 3<sup>rd</sup> edition,2006.
4. Alan C Gillies, “Software Quality Theory and Management”, Cengage Learning, 2<sup>nd</sup> edition, 2003.

#### Course Outcomes :

At the end of this course, the students will be able to

1. Understand the need for testing and to compare white box testing and black box testing
2. Understand the levels of Integration testing techniques including unit testing, integration testing, system testing and acceptance testing .
3. compare and contrast performance testing with regression testing
4. Acquire Knowledge of Software project life cycle.
5. Understand the concepts of Quality plan and design plan.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	1	-	-	-	-	-	-	-
CO2	1	1	-	-	1	-	-	-	-	-	-	-
CO3	1	1	-	-	1	-	-	-	-	-	-	-
CO4	1	1	-	-	-	1	-	-	2	-	1	-
CO5	1	-	1	-	-	-	-	-	2	-	-	-

22CSPESCEN	MOBILE COMPUTING	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To provide an overview of wireless communication networks area and its applications
- To enable students to compare and contrast the various medium access control techniques
- To explain the terminologies, principles, devices, schemes, concepts used in GSM
- To learn the infrastructure, technologies related to IEEE 802.11 and Bluetooth
- To understand the TCP extensions, WAP and security aspects for mobile and wireless networking

**UNIT – I Mobile Computing**

Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application- Need and types of multiplexing techniques - modulation types - use of spread spectrum - cellular Systems.

**UNIT – II MAC**

Motivation for a specialized MAC – SDMA – FDMA– TDMA – CDMA and comparison of these methods.

**UNIT – III GSM**

Mobile services - system architecture - radio interface – protocols - localization and calling - handover – security - new data services – DECT : system and protocol architecture – TETRA.

**UNIT – IV Infrared Transmission**

Introduction - Infrared vs. radio transmission - Infrastructure and ad-hoc networks - IEEE 802.11: system and protocol architecture - physical and MAC layer HIPERLAN: protocol architecture - physical layer and MAC sub layer - Bluetooth: physical and MAC layer.

**UNIT – V Mobile IP**

Mobile IP – Dynamic host configuration protocol – Ad- hoc networks -- Mobile transport layer – Traditional TCP – Indirect TCP - Snooping TCP - Mobile TCP - Wireless Application Protocol – architecture - datagram protocol - transport layer security – Transaction and session protocol.

**Text Books :**

1. Jachen Schiller, “Mobile Communications”, Addison, Wesley,2014.
2. PrasantKumarPattnaik,RajibMall,“Fundamentals of Mobile Computing”,PHI Learning Pvt. Ltd, New Delhi, 2012.

**References :**

1. Reza B, Far, “Mobile Computing Principles:, Designing And Developing Mobile Application With UML and XML”, Cambridge University Press, 2005.
2. William C.Y.Lee, “Mobile Communication Design Fundamentals”, John Wiley, 2010.
3. William Stallings, “Wireless Communications and Networks”, Pearson Education, 2009.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Understand the infrastructure for mobile communication
2. Design a MAC technique in order to maintain flow control
3. Summarize the terminologies, concepts, principles related to GSM and DECT
4. Illustrate the importance of IEEE 802.11, HIPERLAN and Bluetooth
5. Analyze the protocol and techniques related to mobile IP, TCP extensions, WAP and security

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-
CO4	3	2	-	2	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-

22CSPESC	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To introduce the basic concepts of Computer security and Cryptography.
- To impart knowledge about Symmetric key algorithms and AES.
- To provide basic knowledge of Asymmetric key algorithms and Digital signatures.
- To familiarize the basic properties and concepts of Digital certificates and public key Infrastructure (PKI)
- To explain about Firewalls, Virtual private networks, Secure Socket Layer, Transport Layer Security, Secure Electronic Transaction and E-mail security.

**UNIT – I Introduction**

Need for security -Principles of Security - Types of Attacks - Plain text and Cipher Text – Substitution techniques- Caesar Cipher- Mono alphabetic Cipher- Polygram- Polyalphabetic Substitution- Play air- Hill Cipher- Transposition techniques- Encryption

and Decryption- Symmetric and Asymmetric Key Cryptography- Steganography- Key Range and Key Size-Possible Types of Attacks.

### UNIT – II Cryptography Algorithms

Algorithms types and modes- Overview of Symmetric key Cryptography- Data Encryption Standard (DES)-International Data Encryption Algorithm (IDEA)- RC4- RC5- Blowfish- Advanced Encryption Standard (AES).

### UNIT – III Asymmetric Key Cryptography

Brief history of Asymmetric Key Cryptography- Overview of Asymmetric Key Cryptography- RSA algorithm- Symmetric and Asymmetric key cryptography together- Digital Signatures-Knapsack Algorithm- Some other algorithms (Elliptic curve Cryptography- ElGamal- problems with the public key exchange).

### UNIT – IV Primary Key Management

Digital Certificates-Private Key Management- The PKIX Model-Public Key Cryptography Standards (PKCS)-XML-PKI and Security- Hash functions- Key Predistribution- Blom's Scheme- Diffie-Hellman Key Predistribution- Kerberos- Diffie-Hellman Key Exchange- The Station-to-station Protocol.

### UNIT – V TCP/IP and Firewalls

Introduction to TCP/IP- Firewalls- IP Security- Virtual Private Networks (VPN)- Intrusion-Internet Security Protocols: Basic concepts- Secure Socket Layer (SSL)- Transport Layer Security (TLS) - Secure Hyper Text Transfer Protocol (SHTTP)-Time Stamping Protocol (TSP) - Secure Electronic Transaction (SET) - SSL Vs SET- 3-D Secure Protocol- Electronic Money- E-mail Security- Wireless Application Protocol (WAP) Security- Security in GSM- Security in 3G.

### Text Books :

1. Atul Kahate “Cryptography and Network Security”, Tata McGrawHill, 4<sup>th</sup>Edition, 2008.
2. Charlie Kauffman, Radia Perlman, Mike Spciner, “Network Security”,Pearson Education, 2nd Edition, 16 March 2012

### References :

1. William Stallings “Cryptography and Network Security”, Pearson Education, 7<sup>th</sup> Edition,2017.
2. Cryptography & Network Security, Atul Kahate, McGraw Hill, 3<sup>rd</sup> edition,2013.
3. Cryptography & Network Security, V.K. Jain, Khanna Publishing House,2013.

### Course Outcomes:

At the end of this course, the students will be able to

1. Acquire the basic concepts in Computer security and Cryptography.
2. Understand the concepts of Symmetric key algorithms and AES.

3. Analyze RSA algorithms, ECC algorithms and Digital signatures.
4. Implement Key management using public key cryptography.
5. Understand the basic concepts of Firewalls, SET, SSL and E-mail security.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	-	-	-	-
CO2	2	2	1	-	1	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-
CO4	2	2	-	-	1	-	-	-	-	-	-	-
CO5	2	-	2	-	-	-	-	-	-	-	-	-

22CSPESCN	PERVASIVE COMPUTING	L	T	P	C
		3	0	0	3

### Course Objectives:

- To familiarize the pervasive computing technologies of past, present and future with examples.
- To impart knowledge on the basic concepts, characteristics and components of device technologies in pervasive computing.
- To introduce the fundamentals of WAP architecture and protocols in pervasive computing.
- To educate the recent trends and latest development of the server side programming technologies.
- To make the student to understand the performance of different data dissemination techniques and algorithms for mobile real-time applications.

### UNIT – I Introduction

Technologies: Past - Present- Future - Pervasive Computing - The pervasive computing market - m-Business - Conclusions and Challenges – Future. Application Examples: Retail - Airline check-in and booking - Sales Force Automation – Healthcare - Tracking – car information systems – Email access via WAP and voice.

### UNIT – II Device Technology

Hardware - Human-machine interfaces - Biometrics - Operating Systems - Java for Pervasive devices. Device Connectivity: Protocols - Security - Device Management. Web Application Concepts: History of World Wide Web - World Wide Web Architecture - Protocols - Transcoding - Client Authentication via the Internet.



**UNIT – III WAP**

Introduction - Components of the WAP architecture - WAP infrastructure - WAP Security Issues - Wireless Markup Language - WAP push - Products - i-mode. Voice Technology: Basics of speech recognition - Voice standards - Speech applications - Speech and pervasive computing - Security.

**UNIT – IV Server Side Programming in Java**

Architecture - J2EE and overview - Servlets- Enterprise Java Beans - Java Server Pages - Extensible Markup Language - Web services - Model-View-Controller Pattern. Pervasive web application architecture: Background- scalability and availability- Development of pervasive computing web applications- Pervasive application architecture.

**UNIT – V Application**

Introduction- User Interface overview- Architecture- Implementation. Access from PCs: Smart Card-based authentication via the Internet- Ordering goods. Access via WAP: WAP functionality- Implementation. Access via voice: Extending the example application to voice access.

**Text Books :**

1. Jochen Burkhardt, Dr. Horst Henn, Stefan Hepper, Klaus Rintdorff, Thomas schaeck “Pervasive Computing Technology and Architecture of Mobile Internet Applications”, Pearson Education, 6<sup>th</sup> edition,2009.
2. Debashis Saha, “Networking Infrastructure for Pervasive Computing: Enabling Technologies”, Kluwer Academic Publisher, Springer; 1<sup>st</sup> edition,2002.

**References :**

1. Seng Loke, “Context-Aware Computing Pervasive Systems”,Auerbach Publication, New York, 2007.
2. Uwe Hansmann etl, “Pervasive Computing”, Springer, New York,2001.
3. Frank Adelstein, Sandeep KS Gupta, Golden Richard, “Fundamentals of Mobile and Pervasive Computing”, McGraw-Hill, 2005.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Summarize the pervasive computing technologies of past, present and future with examples and also develop an attitude to propose solutions with comparisons for problems related to pervasive computing system through investigation.
2. Classify different device technologies of pervasive computing and to demonstrate knowledge about the strengths and limitations of the tools and devices used for development of pervasive computing systems.
3. Illustrate the major system components of WAP architecture and to demonstrate about the standards and basics of voice technologies.
4. Discover the characteristics of pervasive computing applications including server side programming and architectures of the pervasive computing systems.
5. Design application and to develop authentication process for application services including voice access to pervasive computing applications.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	1
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	2	-	1	-	1	-	-	-	-	-	-	-

22CSPESCN	ADHOC AND SENSOR NETWORKS	L	T	P	C
		3	0	0	3

### Course Objectives:

- To make the students understand ad hoc wireless networks and routing protocols.
- To describe the QoS protocols and MAC layer classification
- To explain the concepts of energy management techniques.
- To teach the architecture and issues of wireless sensor networks
- To provide an overview of hybrid wireless networks.

### UNIT – I Routing

Cellular and Ad hoc wireless networks – Issues of MAC layer and Routing – Proactive, Reactive and Hybrid Routing protocols – Multicast Routing – Tree based and Mesh based protocols – Multicast with Quality of Service Provision.

### UNIT – II Quality of Services

Real-time traffic support – Issues and challenges in providing QoS – Classification of QoS Solutions – MAC layer classifications – QoS Aware Routing Protocols – Ticket based and Predictive location based QoS Routing Protocols.

### UNIT – III Energy Management

Need for Energy Management – Classification of Energy Management Schemes- Battery Management and Transmission Power Management Schemes – Network Layer and Data Link Layer Solutions – System power Management schemes.

### UNIT – IV Sensor Networks

Introduction – Sensor Network architecture – Data Dissemination – Data Gathering – MAC Protocols for sensor Networks – Location discovery – Quality of Sensor Networks – Evolving Standards – Other Issues – Recent trends in Infrastructure less Networks.

**UNIT – V Hybrid Wireless Networks**

Introduction – Next Generation Hybrid Wireless Architectures – Routing in Hybrid Wireless Networks – Pricing in Multi-Hop Wireless Networks – Power Control Schemes in Hybrid Wireless Networks – Load Balancing in Hybrid Wireless Networks.

**Text Books :**

1. C. Siva Ram Murthy and B.S. Manoj, “Ad hoc Wireless Networks – Architectures and Protocols”, 1<sup>st</sup> Edition, Pearson Education, 2006.
2. Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks – An Information Processing Approach”, 1<sup>st</sup> Edition, Morgan Kaufman Publishers, 2004.

**References :**

1. C.K.Toh, “Adhoc Mobile Wireless Networks: Protocols and Systems”, Pearson Education, 2002.
2. Thomas Krag and Sebastin Buettrich, “Wireless Mesh Networking”, O’Reilly Publishers, 2007.
3. Carlos De Morais Cordeiro, Dharma Prakash Agarwal, “Adhoc and Sensor Networks: Theory and Applications”, World Scientific Publishing Company Private Limited, 2006.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Explain the principles of mobile ad hoc networks (MANETs) and routing protocols.
2. Analyze QoS protocols and MAC layer classification
3. Analyze and design energy and power management schemes.
4. Describe the architecture and analyze the issues of wireless sensor networks.
5. Discuss the features of hybrid wireless networks.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	1	1	-	-	-	-	-	-	-	-	-	-

22CSPESCN	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To introduce basic concepts like acquiring, storing and processing of images.
- To provide details about image enhancement in spatial and frequency domain.
- To impart knowledge on various techniques of image segmentation.
- To illustrate the concepts of Multi resolution Analysis and image compression.
- To inculcate knowledge on Morphological image processing, image representation scheme and applications of Image Processing.

**UNIT - I Fundamentals**

Digital Imaging: Introduction – Steps in Image Processing Systems – Image Acquisition – Image Sampling and Quantization – Pixel Relationships – Linear and Nonlinear Operations. MATLAB: The MATLAB Desktop – Using the MATLAB Editor/Debugger – Getting Help – Saving and Retrieving work Session Data – Digital Image Representation – Image I/O and Display – Classes and Image Types – M- Function Programming.

**UNIT - II Image Enhancement**

Spatial Domain – Gray level Transformations – Histogram Processing – Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – DFT, FFT, DCT – Smoothing and Sharpening filters – Homomorphic Filtering.

**UNIT - III Image Segmentation**

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Morphological Watersheds Motion Segmentation.

**UNIT - IV Multi Resolution Analysis and Compression**

Image Pyramids – Multi resolution expansion – Wavelet Transforms image Compression: Fundamentals – Models – Elements of Information Theory – Error Free Compression – Lossy Compression – Compression Standards.

**UNIT - V Morphological Processing and Representation**

Morphological Image Processing – Preliminaries – Dilation and Erosion – Opening and Closing – The Hit-or-Miss Transformation-Representation – Boundary Descriptors – Regional Descriptors – Use of Principal Components for Description – Relational Descriptors – Applications of Image Processing – Image Watermarking – Fingerprint Recognition – Iris Recognition.

**Text Books :**

1. Rafael C.Gonzalez and Richard E.Woods, “Digital Image Processing”,3<sup>rd</sup> edition, Pearson Education, 2009.
2. Rafael C.Gonzalez, Richard E.Woods and Steven L.Eddins, “Digital Image Processing Using Matlab”, 2<sup>nd</sup> edition, McGraw Hill,2010.

**References :**

1. AL. Bovik, “The Essential Guide to Image processing”, 2<sup>nd</sup> edition, Elsevier,2009.
2. Anil K.Jain, “Fundamentals of Digital Image Processing”, PHI,2006.
3. Sanjit K. Mitra, & Giovanni L. Sicuranza, “Non Linear ImageP rocessing”, elsevier, 2007.
4. Maria Petrou, Costas Petrou, “Image Processing: The Fundamentals”,Wiley, 2<sup>nd</sup>edition, 2010.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Understand fundamentals of digital image processing and capable of using MATLAB tools.
2. Apply image enhancement techniques in spatial and frequency domains.
3. Evaluate algorithms based on image segmentation methods.
4. Analyze basics of multi resolution analysis, image compression and apply both lossy and lossless image compression techniques in image and video based applications.
5. Design image processing techniques for real time applications and understand Morphological image processing, image representation schemes.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	2	-	-	-	-	-	-	-
CO2	1	1	1	1	2	-	-	-	-	-	-	-
CO3	1	1	1	1	2	-	-	-	-	-	-	-
CO4	1	1	1	1	2	-	-	-	-	-	-	-
CO5	1	1	2	1	2	-	-	-	--	-	-	1

22CSPESCN	MACHINE LEARNING				L	T	P	C
					3	0	0	3

**Course objectives :**

- To introduce basic concepts of machine learning, Bayesian Decision Theory and Normal Distribution.
- To explain the classification and regression based machine learning algorithms.
- To teach the concept of component analysis and clustering algorithms.

- To describe deep learning architectures and its applications.
- To guide the students to understand the concept of combining multiple learners.

### UNIT – I Bayesian Decision Theory and Normal Distribution

Machine perception - feature extraction - classification, clustering, linear and logistic regression - Types of learning - Bayesian decision theory - classifiers, discriminant functions, and decision surfaces - univariate and multivariate normal densities - Bayesian belief networks.

### UNIT – II Classification Algorithms

Perceptron and backpropagation neural network - k-nearest-neighbor rule. Support vector machine: multicategory generalizations - Regression. Decision trees: classification and regression tree - random forest.

### UNIT – III Component analysis and Clustering Algorithms

Principal component analysis - Linear discriminant analysis - Independent component analysis. k-means clustering - fuzzy k-means clustering - Expectation-maximization algorithm-Gaussian mixture models – auto associative neural network.

### UNIT – IV Deep Learning Architectures and Applications

Convolution neural network (CNN) - Layers in CNN - CNN architectures. Recurrent Neural Network - Applications: Speech-to-text conversion-image classification-time series prediction.

### UNIT – V Combining Multiple Learners

Generating diverse learners - model combination schemes - voting - error-correcting output codes - bagging - boosting - mixture of experts revisited - stacked generalization - fine-tuning an ensemble – cascading.

### Text Books :

1. R. O. Duda, E. Hart, and D.G. Stork, Pattern classification, Second edition, John Wiley & Sons, Singapore, 2012.
2. Francois Chollet, Deep Learning with Python, Manning Publications, Shelter Island, New York, 2018.

### References :

1. Ethem Alpaydin, Introduction to Machine Learning, 3<sup>rd</sup> Edition, MIT Press, 2014.
2. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006
3. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
4. Navin Kumar Manaswi, Deep Learning with Applications using Python, A press, New York, 2018.

### Course Outcomes :

At the end of this course, the students will be able to

1. Understand the basic concepts of Bayesian theory and normal densities.
2. Implement different classification algorithms used in machine learning.
3. Implement clustering and component analysis techniques.
4. Design and implement deep learning architectures for solving real life problems.
5. Combine the evidence from two or more models/methods for designing a system.

Mapping of Course Outcomes with Program Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	1	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	2	3	3	2	1	-	-	-	-	-	-	-
CO5	2	3	3	2	1	-	-	-	-	-	-	-

22CSPESCNC	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

### Course Objectives:

- To introduce the basic components of DSP systems
- To acquire provide knowledge on DFT and its various transformation techniques.
- To explain about the different digital filters (IIR & FIR).
- To impart knowledge on errors associated with digital signal processing.
- To develop the skills required to process speech, music and image.

### UNIT - I Basic of Digital Signal Processing Systems

Classification of Signals - The concept of frequency in Continuous time and Discrete time domain - Discrete-time Signals and Systems - Analysis of Discrete Time - Linear Shift-Invariant Systems – Linearity - Causality and Stability criterion. Discrete-time Systems described Difference Equation - Correlation of Discrete - Time Signals.

### UNIT – II Introduction to DFT

Properties of DFT - Filtering methods based on DFT - Relation between DTFT and DFT - FFT computations using Decimation in time and Decimation in frequency algorithms - Overlap-add and save methods.

### UNIT – III Filters

General Consideration - Design of IIR filters - IIR Filter Design by Impulse Invariance & Bilinear Transformation - pre warping - Realization using direct, cascade and parallel forms - Design of Linear Phase FIR Filters - Design of FIR filter using Windows and by Frequency Sampling Method - Frequency Transformation in the Analog Domain and Digital Domain - Realization of FIR filters - Transversal, Linear phase and Polyphase structures.

### UNIT – IV Quantization

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power -

coefficient quantization error - Product quantization error - Overflow error - Round off noise power - limit cycle oscillations due to product round off and overflow errors - signal scaling.

### UNIT – V Multirate Signal Processing

Speech Compression - Adaptive Filter - Musical Sound Processing - Image enhancement - Applications of Multi rate signal Processing

#### Text Books :

1. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing Principles, Algorithms and applications”, Pearson education / Prentice Hall, 4<sup>th</sup> edition, 2007.
2. Alan V. Oppenheim, Ronald W.R.Back, “Discrete Time Signal Processing”, Pearson Education, 2<sup>nd</sup> edition, 2005.

#### References :

1. S.Salivahanan, A.Vallavaraj, C.Gnanapriya, “Digital Signal Processing”, TMH/McGraw Hill International,2007.
2. S.K. Mitra, “Digital Signal Processing, A Computer Based approach”,TataMcGraw Hill, 1998.
3. Johny R. Johnson, Introduction to Digital Signal Processing, PHI,2006.

#### Course Outcomes :

At the end of this course, the students will be able to

1. Understand the basic elements of DSP system and to analyze discrete time signals.
2. Apply DFT and FFT in digital signal processing.
3. Design IIR, FIR filters in analog and digital domain.
4. Estimate noise, errors and oscillations in digital signals.
5. Develop applications using MATLAB tool for processing multirate signals speech, sound and image.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	1	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-
CO5	2	2	3	1	2	-	-	-	-	-	-	-



22CSPE SCN	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To expose the fundamentals of cloud computing and private clouds
- To understand the role of network in cloud computing
- To illustrate the enterprise architecture, VCL cloud architecture, SwinDeW-G Environment and SwinDeW-C architecture.
- To describe cloud services and cloud roles and the applications of cloud computing.
- To provide in-depth knowledge to Google App Engine and Microsoft Azure software vendor specific cloud services.

**UNIT – I Introduction**

Layers of Cloud Computing - Types - Cloud Computing Versus Cloud services - Cloud Computing Features - Platforms - Challenges - Cloud Computing Security - Model Application Methodology - Cloud-Based High Performance Computing Clusters - Virtual Private Clouds - Data Centers - Applications.

**UNIT – II The Role of Networks in Cloud Computing**

Cloud Deployment Models and Network - Network Architectures for Clouds - Requirements and Architecture for Hybrid Cloud Networking - Data-Intensive Technologies for Cloud Computing - Characteristics of Data-Intensive Computing Systems - Data-Intensive System Architecture - Distributed Agent Based Scheduling Platform Inside Clouds -Basics of Grid and Cloud Computing - Layered Models and Usage patterns in Grid and Cloud.

**UNIT – III Enterprise Architecture**

Enterprise Knowledge Management - Enterprise Knowledge Architecture - Enterprise Computing Clouds - Enterprise Knowledge Clouds - Enterprise Knowledge Cloud Technologies - The VCL Cloud Architecture - Integrating High- Performance Computing into the VCL Cloud Architecture - Overview of SwinDeW-G Environment - SwinDeW-C System Architecture - Architecture of SwinDeW-C Peers.

**UNIT - IV Cloud Services and Cloud Roles**

Infrastructure as a Service - Platform as a Service - Software as a Service -Grids and Clouds - Application Scalability - Automating Scalability - General Cloud Architectures for Scaling - Delivering Scientific Computing services in the Cloud - A Dynamic Collaborative Cloud Services Platform.

**UNIT - V Amazon Web Services**

Google App Engine - Microsoft Azure - Scientific Applications - Business and Consumer Applications - Case Study: Cloud as Infrastructure for an Internet Data Center - Cloud

Computing for Software Parks - Cloud Computing Supporting SaaS.

**Text Books :**

1. L Borko Furht and Armando J. Escalante, “Handbook of Cloud Computing”, Springer, 2010.
2. Dr. Rajkumar Buyya, Dr. Christian Vecchiola and Dr. S Thamarai Selvi, “Mastering Cloud Computing”, Tata McGraw Hill, 1<sup>st</sup> Edition, 2013.

**References :**

1. Michael Miller, “Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate”, Que Publishing, 1<sup>st</sup> Edition, 2008.
2. D Anthony T Velte, Toby J Velte and Robert Elsenpeter, “Cloud Computing: A Practical Approach”, Tata McGraw-Hill, 1<sup>st</sup> Edition, 2010.
3. John Rittinghouse & James Ransome, “Cloud Computing, Implementation, Management and Strategy”, CRC Press, 1<sup>st</sup> Edition, 2010.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Describe the fundamentals and technologies of cloud computing technologies and cloud services.
2. Discover the Role of Networks in Cloud Computing.
3. Compare and contrast cloud architectures VCL cloud and SwinDew.
4. Analyze cloud services and roles by forming a dynamic collaborative cloud services platform.
5. Understand vendor specific cloud Web services including but not restricted to Amazon web services, goggle app engine, Microsoft azure.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	1	-	-	-	-	-	-	-	-	-	1
<b>CO2</b>	3	-	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	3	1	-	-	-	-	-	-	-	-	-	-
<b>CO4</b>	3	1	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	3	1	-	-	1	-	-	-	-	-	-	-

22CSPE SCN	SPEECH PROCESSING AND SYNTHESIS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To provide fundamental knowledge on speech and signal processing.
- To analyze the time domain and spectral domain features and the process of feature extraction.
- To model speech using Hidden markov model
- To understand the basics of speech recognition
- To understand Concatenative and waveform speech synthesis methods and its application

**UNIT – I Basic Concepts**

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

**UNIT – II Speech Analysis**

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

**UNIT –III Speech Modeling**

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, and Implementation issues.

**UNIT – IV Speech Recognition**

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models- grams, context dependent sub-word units; Applications and present status.

**UNIT – V Speech Synthesis**

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub- word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

**Text Books :**

1. Lawrence Rabiner and Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.

- Daniel Jurafsky and James H Martin, “Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education,2008.

**References :**

- Steven W. Smith, “The Scientist and Engineer’s Guide to DigitalSignalProcessing”, California Technical Publishing, 2<sup>nd</sup> Edition, 1999.
- Thomas F Quatieri, “Discrete-Time Speech Signal Processing – Principles and Practice”, Pearson Education,2001.
- Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, JohnWileyandSons, 1999.
- Frederick Jelinek, “Statistical Methods of Speech Recognition”, MIT Press,1997.

**Course Outcomes:**

At the end of this courses Students will able to

- Understand the basics of speech including production and fundamental approaches of Signal processing.
- Analyze various feature extraction techniques in time and frequency domain.
- Build static machine learning architecture for solving real time speech problems using Open Source Programming including Python.
- Design large vocabulary systems and able to work in real, task-oriented speech recognition projects.
- Develop new algorithms for speech synthesis based applications.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	1	-	-	-	-	-	-	-	-	-	-	-
<b>CO2</b>	2	-	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	1	2	1	1	2	-	-	-	-	-	-	-
<b>CO4</b>	2	2	1	2	2	-	-	-	-	-	-	-
<b>CO5</b>	2	2	1	2	2	-	-	-	-	-	-	-

22CSPESCN	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To make students understand the basics of information retrieval and search interfaces.
- To impart knowledge on basic information retrieval models and metrics.
- To enable the student learn and apply different classification, searching and indexing algorithms for information retrieval.

- To introduce search engines and search engine architectures including cluster based and distributed architectures.
- To familiarize students with the basics of Content-based Recommender Systems.

### **UNIT – I Introduction**

Information Retrieval – Early Developments – The IR Problem – The Users Task Information versus Data Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes – The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

### **UNIT - II Basic IR models**

Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

### **UNIT - III Classification, Searching and Indexing**

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k- NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

### **UNIT - IV Web – Search Engine Architectures**

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations — Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

### **UNIT - V Content-based Recommender Systems**

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

### **Text Books :**

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —Modern Information Retrieval: The Concepts and Technology behind Search, 2<sup>nd</sup> edition, ACM Press Books,2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, —Recommender Systems Handbook, 1<sup>st</sup> edition,2011.

**References :**

1. C. Manning, P. Raghavan, and H. Schütze, —Introduction to Information Retrieval, Cambridge University Press,2008.
2. Stefan Buettcher, Charles L.A. Clarke and GordonV. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand the basics of Information Retrieval and search interfaces.
2. Analyze various Information Retrieval models and retrieval metrics.
3. Apply appropriate method of classification, Searching and Indexing Algorithms for information retrieval.
4. Understand Search engine architectures and its Ranking.
5. Comprehend the basics of content based recommender system.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	-
CO3	2	-	1	-	2	-	-	-	-	-	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	-
CO5	1	1	1	1	-	-	-	-	-	-	-	-

22CSPE SCN	DATA MINING				L	T	P	C
					3	0	0	3

**Course Objectives:**

- To introduce Data mining and warehousing principles and techniques and Data mining as a cutting edge business intelligence.
- To explain the different types of OLAP Servers and data warehouse.
- To educate the students to learn data mining techniques
- To expose the students to Decision Tree Induction
- To teach the overview of Statistics and Data Analysis.

**UNIT – I Evolution of Decision Support Systems**

Data warehousing Components – Building a Data warehouse - Data Warehouse and DBMS - Data marts – Metadata - Multidimensional data model - OLAP Vs OLTP - OLAP operations - Data cubes - Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations.

**UNIT – II Types of OLAP Servers**

Three – Tier data warehouse architecture - distributed and virtual data warehouses - Data warehouse implementation - tuning and testing of data warehouse - Data Staging (ETL) Design and Development - data warehouse visualization - Data Warehouse Deployment – Maintenance – Growth - Business Intelligence Overview - Data Warehousing and Business Intelligence Trends - Business Applications - tools- SAS.

**UNIT – III Data Mining**

KDD versus data mining - Stages of the Data Mining Process - task primitives-Data Mining Techniques - Data mining knowledge representation – Data mining query languages - Integration of a Data Mining System with a Data Warehouse – Issues-Data preprocessing – Data cleaning - Data transformation - Feature selection - Dimensionality reduction - Discretization and generating concept hierarchies - Mining frequent patterns – association - correlation.

**UNIT – IV Decision Tree Induction**

Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners Other Classification Methods – Clustering techniques – Partitioning methods - k- means- Hierarchical Methods – distance based agglomerative and divisible clustering - Density-Based Methods – expectation maximization - Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis Outlier Analysis.

**UNIT – V Statistics and Data Analysis**

EDA – Small and Big Data – Logistic Regression Model - Ordinary Regression Model - Mining complex data objects – Spatial databases – Temporal databases – Multimedia databases – Time series and sequence data – Text mining – Web mining Applications in Data mining.

**Text Books :**

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, third edition, 2011.
2. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw Hill Edition, Tenth Reprint, 2007.

**References :**

1. G.K.Gupta, “Introduction to Data Mining with Case Studies”, Prentice Hall of India, Easter Economy Edition, 2006.
2. Ian.H.Witten, Eibe Frank and Mark.A.Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, 3<sup>rd</sup> edition, (Then Morgan Kaufmann series in Data Management systems), 2011.
3. Mehmed Kantardzic, “Data mining concepts, models, methods, and algorithms”, Wiley- Interscience, IEEE Press, 2<sup>nd</sup> Edition, 2003.
4. Ian Witten, Eibe Frank, “Data Mining: Practical Machine Learning Tools and

Techniques”, Morgan Kaufmann, 3<sup>rd</sup> edition,2011.

- George M Marakas,“Modern Data Warehousing, Mining and Visualization”, Prentice Hall, 2<sup>nd</sup> edition, 2003.

### Course Outcomes :

At the end of this course, the students will be able to

- Understand the basic concepts of data warehousing and OLAP
- Classify the types of OLAP Servers in data warehouse and able to design data warehouses.
- Implement different stages of data mining methods
- Design decision tree inductions and data classification methods.
- Apply acquired knowledge for understanding data and select suitable methods for data analysis.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	2	1	2	1	1	-	-	-	-	-	-	-
CO4	2	-	2	-	2	-	-	-	-	-	-	-
CO5	3	-	-	-	2	-	-	-	-	-	-	-

22CSPESCN	WEB APPLICATION FRAMEWORK	L	T	P	C
		3	0	0	3

### Course Objectives:

- To introduce the basics of Ruby, Advanced Ruby techniques.
- To make the student to learn Rails Architecture and Techniques.
- To impart knowledge on Active record, Advanced active records and CRUD operations.
- To train the students to create a home page and skeleton.
- To develop the skills required for event handling and plugins techniques.

### UNIT – I Introduction

Introduction to Web Application - Introduction to Ruby – Hello Application – Nature of Ruby – Object Oriented Programming – Ruby basics – Classes, Objects and Variables – Built-in Classes and Modules: Scalar Objects – Collections. Control Flow: Conditionals – Loops, Blocks, and Iterators – Exception handling – Advanced Ruby Techniques.



**UNIT – II Rails**

Introduction to Rails - History of Rails- Installing Rails on Windows, Linux – Setting Development Environment – What is Ruby on Rails – Rails Architecture – Rails Scripts – Creating First Rails Application.

**UNIT – III Ruby**

Active Record – Basics – Setting up a Model – Migrations – CRUD Operations – Defining Relationships – implementing Validations – Custom Validations – Advanced Active Record. Action Controller – Routing – Creating and using Controllers – Using Filters – Working with Sessions – Caching. Action View– Embedded Ruby – Layouts – Partial – Helpers – JavaScript, Ajax and RJS.

**UNIT – IV Developing Book Shelf**

Application Overview – Creating a Skeleton – Create Home Page – Implementing Users. Adding Core Functionality: Adding Support – Refactor Sidebar Code – Implementing Search – Implementing Addition and Deletion Operations – Display content. Testing Application: Using Test::Unit – Testing Rails – Test Database – Functional Test – Unit Tests – Integration Tests – Running, Test Coverage and Debugging Techniques.

**UNIT – V Prototype**

Overview – Extension to JavaScript – OOP with Prototype – Event Handling - Ajax. Script.aculo.us: Overview – Visual Effects – Controls – Drag and Drop – JavaScript Testing. Extending Rails: Generators – Plugins – Writing Plugins – Techniques used to develop plugins – Pagination – exception notifier – Adding User Authentication. RESTful Rails – Working with Legacy Databases – Using Action Mailer – Active Resource and XML – Deploying with Capistrano.

**Text Books :**

1. Timothy Fisher, “Ruby on Rails Bible”, Wiley India Pvt. Ltd., 2009.

**References :**

1. Chad Pytel, Tammer Saleh, ”Rails AntiPatterns: Best Practice Ruby on Rails Refactoring”, 1<sup>st</sup> edition, Addison-Wesley, 2010.
2. David A. Black, “The Well-Founded Rubyist”, Manning Publications, 2<sup>nd</sup> edition, 2014.
3. Peter Cooper, “Beginning Ruby: From Novice to Professional”, Apress, 3<sup>rd</sup> edition, 2016.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand Rails framework and also know program constructs in Ruby.
2. Develop the application in Ruby on Rail.
3. Acquire knowledge about embedded ruby, active record and custom validations.
4. Apply knowledge to test applications such as functional test , unit tests and integration tests.
5. Understand the concept of OOP with prototype and pagination.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	1	1	-	-	-	-	-	-	-	-
CO3	1	-	-	-	-	-	-	-	-	-	-	-
CO4	1	-	1	1	-	-	-	-	-	-	-	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

22CSPE SCN	OPEN SOURCE PROGRAMMING	L	T	P	C
		3	0	0	3

### Course Objectives :

- To make the student to learn about LINUX.
- To familiarize students with the PHP.
- To illustrate the Unix file systems.
- To impart knowledge on Python concepts.
- To guide about the Unix file operations commands.

### UNIT - I Introduction to Open Source

Need – Advantages – Application of open sources – Open source operating systems: LINUX: Introduction – General overview – Kernel mode and user mode Process – Scheduling – Personalities Cloning Signals – Development with Linux.

### UNIT - II Introduction to PHP

Introduction – Variables types in PHP – Understanding data types – Loose typing – Testing variable – Changing variables data type – Type casting – Operators and expressions – Operator types – Operator precedence Constants – Decisions and loops – Strings- Arrays – Functions.

### UNIT - III Working with Files and Directories

Getting information on files – Opening and closing files – Reading and writing to files – Reading and writing strings of characters – Testing – Reading and writing entire files – Working with file permissions – Working with directories – Introduction to databases and SQL.

### UNIT - IV Exploring Python

Creating python programs Statements Building blocks Testing functions – Strings – Lists and tuples String functions – Sets – Dictionaries Combining dictionaries Making copies Zip list Loops Dynamic programming Persistent variables.

**UNIT – V Files Operations Commands**

Files Operating system commands Errors and exceptions – Input and output –Functions  
 Modules Classes: Constructors Boundaries Object reference Inheritance Types – Tests  
 Variables Classes as dynamic records – Object oriented programming.

**Text Books :**

1. Remy Card, The Linux Kernel Book, Wiley Publications,2012.
2. Timothy A Budd, Exploring Python, Tata McGrawHill,2014.

**References :**

1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux In A Nutshell”, 6<sup>th</sup> edition, OReilly Media,2009.
2. Kenneth A. Lambert, The Fundamentals of Python: First Programs,2011.
3. Matt Doyle, Beginning PHP 5.3, Wiley Publishing,2013.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand the fundamentals of Linux operating system.
2. Describe about the PHP programming.
3. Implement the concepts of file handling and database programming.
4. Analyze the basic concepts in Python.
5. Demonstrate the programming concepts of files and error handling.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	1	-	-	-	-	-	-	-
CO3	2	2	-	2	-	-	-	-	-	-	-	-
CO4	-	1	-	-	1	-	-	-	-	-	-	-
CO5	-	1	2	2	-	-	-	-	-	-	-	-

22CSPESCN	SOFT COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To introduce the fundamentals of various soft computing frameworks including Neural Networks, Fuzzy Systems and Genetic Algorithms.
- To explain the architecture, training and testing algorithms of different types of Artificial Neural Networks.
- To teach the basics of membership functions including fuzzy sets, fuzzy relations and expert systems.

- To familiarize the students with genetic algorithms and their applications.
- To describe the importance and use of various hybrid soft computing techniques including Neuro-fuzzy hybrid systems, Genetic Neuro Hybrid systems and Genetic fuzzy hybrid systems.

### **UNIT - I Artificial neural network Introduction**

Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

### **UNIT - II Learning Networks**

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

### **UNIT – III Membership Function**

Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

### **UNIT – IV Genetic Algorithm and Search Space**

General genetic algorithm – operators - Generational cycle - stopping condition constraints - classification - genetic programming – multilevel optimization – real life problem- advances in GA.

### **UNIT – V Neuro- Fuzzy Hybrid Systems**

Genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

**Text Books :**

1. J.S.R.Jang,C.T.SunandE.Mizutani,“Neuro-FuzzyandSoftComputing”,PHI / Pearson Education 2004.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd,2011.

**References :**

1. Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002.
2. Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning,2009.
3. Neural Networks and Learning Machines, (3rd Edn.), Simon Haykin, PHI Learning,2011.
4. S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd.,2006.
5. DavidE.Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Understand the basics of Artificial Neural Networks, fuzzy sets and genetic algorithms.
2. Build Neural Network architectures and solve real world problems.
3. Determine membership functions to define the fuzziness in the fuzzy sets and to experiment the decision-making methods to achieve the problem goals.
4. Implement and apply genetic algorithms for problems including creation of Internet search engine.
5. Develop hybrid soft computing models to analyze flood affected areas, optimize travelling sales person problem and create hybrid fuzzy controllers.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	1	-	-	-	-	-	-	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-
CO5	2	2	1	1	1	-	-	-	-	-	-	-

## OPEN ELECTIVES

22CSOESCN	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To introduce the basics of Internet of Things and characteristics.
- To familiarize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- To impart knowledge on issues in IoT and IOT applications
- To provide knowledge on Raspberry PI with Python and Arduino
- To develop the skills required for Development of IoTs.

**UNIT – I Introduction to IoT**

Defining IoT- Characteristics of IoT-Physical design of IoT- Logical design of IoT- Functional blocks of IoT-Communication models & APIs, Machine to Machine-Difference between IoT and M2M-Software defined Network(SDN).

**UNIT – II Network and Communication Aspects**

Network and communication aspects: Wireless medium access issues- MAC protocol survey, Survey routing protocols- Sensor deployment & Node discovery- Data aggregation & dissemination.

**UNIT – III Challenges of IoT**

Design challenges- Development challenges-Security challenges- Other challenges- Applications of IoT- Home automation, Industry applications, Surveillance applications- Other IoT applications.

**UNIT – IV Rasperry PI with Python and Arduino**

Introduction to Python -Building IOT with RASPERRY Pi- IoT Systems - IoT Physical Devices & Endpoints - IoT Device -Building blocks -Rasperry Pi -Board - Linux on Rasperry Pi - Rasperry Pi Interfaces -Programming Rasperry Pi with Python - Other IoT Platforms – Arduino.

**UNIT – V Development IoTs**

Developing sensor based application through embedded system platform, - Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT.

**Text Books :**

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”, Orient Blackswan Pvt., Ltd., New Delhi,2015.

- Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", A John Wiley and Sons, Ltd., Publication,2010.

**References :**

- Jeeva Jose, "Internet of Things", (ISBN: 978-93-86173-591) KBP House,1<sup>st</sup> edition,2018.

**Course outcomes :**

At the end of this course, the students will be able to

- Understand the characteristics, physical and logical structure and functions of IOT
- Acquire the knowledge for analyzing network and communication aspects of IOT
- Design a system for solving real-world problems using IOT
- Construct Python based IOT product using Raspberry Pi and Arduino.
- Develop an IOT based application using embedded system.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	-	3	2	3	-	-	-	-	-	-	1
CO4	1	-	3	1	3	-	-	-	-	-	-	-
CO5	1	-	3	1	3	-	-	-	-	-	-	-

22CSOESCN	ENTERPRISE RESOURCE PLANNING	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To introduce the basic concepts of ERP and to impart knowledge about data mining and warehousing.
- To understand the key implementation issues of ERP.
- To explain the concepts on the business UNIT - s of ER.
- To expose knowledge of some popular products in the area of ERP.
- To familiarize the current and future trends in ERP.

**UNIT – I ERP**

Enterprise - An Overview – Basic ERP Concepts – Risks of ERP - Benefits of ERP - ERP and Related Technologies – Business Intelligence(BI) - Business Process Reengineering (BPR) - Data Warehousing - Data Mining – OLAP – SCM.

**UNIT - II ERP Implementation**

Implementation Challenges – Implementation Strategies - ERP Implementation Lifecycle - Implementation Methodologies - Vendors and Consultants - Contracts with Vendors - Consultants and Employees - Project Management and Monitoring – Post Implementation Activities.

**UNIT – III Maintenance and Management**

Business Unit of an ERP Package - Finance, Manufacturing - Human Resources - Plant Maintenance - Materials Management - Quality Management – Marketing - Sales and Distribution.

**UNIT - IV ERP Market Place**

ERP Market Place and Market Place Dynamics - SAP AG – PeopleSoft - JD Edwards – Oracle Corporation – QAD Inc – QAD Analytics - QAD Open Technology – SSA Global – Lawson Software - Epicor – Intuitive – ERP Unit.

**UNIT – V Advanced Topics**

Turbo Charge the ERP System – Limitations of ERP Systems – Enterprise Application Integration (EAI) - ERP and E-Business – ERP, Internet and WWW – ERP and Total Quality Management - Future Directions and Trends in ERP.

**Text Books :**

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill, New Delhi,2008.
2. Mary Sumner, “Enterprise Resource Planning”, Pearson Education,2007.

**References :**

1. Joseph A Brady, Ellen F Monk, Bret Wagner, “Concepts in Enterprise Resource Planning”, Thompson Course Technology, USA,2012.
2. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise ResourcePlanning– Concepts and Practice”, PHI, New Delhi, 2003.
3. K.Ganesh, Sanjay Mohapatra, S.P.Anbuudayasankar, P.Sivakumar, “Enterprise Resource Planning: Fundamentals of Design and Implementation”, Springer,2014.

**Course outcomes:**

At the end of this course, the students will be able to

1. Understand the risk associated with business process and data mining.
2. Analyze the methodologies associated with project management and monitoring.
3. Design and develop ERP implementation cycle.
4. Identify the core and extended UNIT - s of ERP.
5. Differentiate the different applications of ERP.



Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	1	1	-	-	-	-	-	-	-	2
CO4	1	-	-	-	2	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-

22CSOESCN	E- COMMERCE	L	T	P	C
		3	0	0	3

**Course objectives :**

- To teach the components and applications of e-commerce infrastructure
- To impart knowledge on e-commerce and web
- To provide an understanding of the design and types of Electronic Payment Systems and EDI
- To explain the concepts of Internal Information Systems, Digital Library and Digital Documents
- To educate the students on On-Demand Education and Software Agents

**UNIT – I E-Commerce Infrastructure**

E-Commerce framework – Media Convergence – Anatomy of E-Commerce Applications – Consumer and Organization Applications – Market forces influencing the I-way – Components of the I-way – Network Access Equipment – Distribution Networks – Issues – Internet Terminology – NSFNET – Research and Education network – Internet Governance.

**UNIT - II E-Commerce and Web**

E-Commerce and Web: Architecture frame work for E- Commerce – WWW as the architecture – Hypertext publishing – Technology and Security on Web – Consumer Oriented Applications – Mercantile Process Model – Mercantile Models from the perspective of Consumer and merchants.

**UNIT –III Electronic Payment Systems and EDI**

Types of Electronic payment systems – Digital token based system – Smart cards – Credit card based system – Risk factors – Designing Electronic payment systems. EDI – EDI Applications in business – Legal, Security and Privacy issues – Standardization in EDI – EDI software implementation - EDI envelope – VANs – Internet based EDI.

**UNIT - IV Inter Organizational E-Commerce and Marketing**

Internal Information Systems - Macro forces and Internal Commerce – Work- flow

automation – Customization – SCM – Corporate Digital Library: Dimensions, Making a business case, Types of Digital Documents – Advertising on Internet – Charting the online marketing process – Market Research.

### UNIT - V On-Demand Education and Software Agents

Computer based Education and Training – Technological Components – Digital Copyrights and E-Commerce – History of software agents – Characteristics and Properties of Agents – Technology behind the Agents – Tele script Agent Language – Safe-Tcl – Software Agents in action –SGML.

#### Text Book :

1. Kenneth C. Laudon, “E -Commerce : Business, Technology”, Society, 10<sup>th</sup> Edition, 2016.

#### References :

1. Ravi Kalakota, Andrew B. Whinston, “Frontiers Electronic Commerce”, Paperback – Addison-Wesley Publishing Company, 1999.
2. Dave Chaffey, “E - Business and E - Commerce Management: Strategy, Implementation and Practice”, 2013.
3. Tharam Dillon, Elizabeth Chang, “E-Commerce: Fundamentals and Applications “, Wiley publication, 2007.
4. David Whiteley, “E-Commerce Strategy, Technologies and Applications”, Tata Mcgraw Hill, 2001.

#### Course Outcomes :

At the end of this course, the students will be able to

1. Summarize the features and components of e-commerce framework and applications.
2. Explain the relationship between E-Commerce and web.
3. Design Electronic Payment Systems and implement EDI software taking into account risks, legal, security, privacy issues.
4. Describe the features of Internal Information Systems, Digital Library and Digital Documents.
5. Explain the characteristics, properties, technology and language of software agents.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	1	1	-	-	-	-	-	-	-	2
CO4	1	-	-	-	2	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-

22CSOESCN	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

**Course objectives:**

- To provide a conceptual understanding of a supply chain and its significance and to explain the issues while designing, planning or operating a supply chain.
- To introduce the logistical drivers including sourcing that determine the performance of any supply chain and to describe the role that sourcing plays in the supply chain.
- To familiarize about designing a distribution network and to enable the students to develop a framework for making network design decisions.
- To disseminate the knowledge regarding the components of demand forecasting and on balancing the appropriate costs and cycle inventory in a supply chain.
- To impart knowledge on supply chain integration, the impact of Bullwhip effect, SC restructuring and to expose specialized supply chains including agile, reverse and agro supply chains.

**UNIT – I Introduction**

Supply Chain – Fundamentals –Evolution- Role in Economy - Importance - Decision Phases - Supplier- Manufacturer-Customer chain - Enablers/ Drivers of Supply Chain Performance -Supply chain strategy - Supply Chain Performance Measures.

**UNIT - II Different Approaches**

Outsourcing – Make Vs buy - Identifying core processes - Market Vs Hierarchy Make Vs buy continuum - Sourcing strategy: Portfolio Approach - Reconfiguration of the Supply Base -Impact of the internet on Sourcing Strategy.

**UNIT – III Design**

Distribution Network Design – Role - Factors Influencing Distribution Network Design – Design Option for a Distribution Network – E-Business and the Distribution Network – Network Design in Supply Chain – Role - Factors Influencing Network Design Decisions – Framework for Network Design Decisions - Impact of uncertainty on Network Design.

**UNIT – IV Management**

Demand Forecasting in a Supply Chain – The Role of Forecasting in a Supply Chain – Characteristics - Components – Risk Management in Forecasting – Managing Economies of Scale in a Supply Chain – Role – Economies of Scale to Exploit Fixed Costs – Estimating Cycle Inventory- Managing supply chain cycle inventory - Uncertainty in the supply chain.

**UNIT – V Integration**

Supply Chain Integration - Building partnership and trust in SC Value of Information: Bullwhip Effect - Effective forecasting - Coordinating the supply chain SC Restructuring - SC Mapping - SC process restructuring, Postpone the point of differentiation – IT in Supply Chain - Agile Supply Chains -Reverse Supply chain - Agro Supply Chains. XT

**Text Books :**

1. Janat Shah, "Supply Chain Management–Text and Cases", Pearson Education, 2009.
2. Sunil Chopra and Peter Meindl, "Supply Chain Management- Strategy Planning and Operation", PHI Learning / Pearson Education, 2007.

**References :**

1. Ballou Ronald H, "Business Logistics and Supply Chain Management", Pearson Education, 5th Edition, 2007.
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, "Designing and Managing the Supply Chain: Concepts, Strategies, and Cases", Tata McGraw-Hill, 2005.
3. Altekar Rahul V, "Supply Chain Management-Concept and Cases", PHI, 2005.
4. Joel D. Wisner, G. Keong Leong, Keah-Choon Tan, "Principles of Supply Chain Management- A Balanced Approach", South-Western, Cengage Learning, 2008.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Identify the goal of supply chain and understand the impact of supply chain decisions on the success of a firm.
2. Analyse the key sourcing related decisions and review the impact of the internet on outsourcing.
3. Identify designs for distribution networks and apply the ideas to develop a framework for making network design decisions.
4. Describe and demonstrate the historical demand information for forecasting the future demand.
5. Create and implement a supply chain and build specialized supply chains including agile, reverse and agro supply chains.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	1	-	-	-	-	-	-	-	-
CO2	3	-	2	-	1	-	-	-	-	-	-	-
CO3	2	-	-	1	-	-	-	-	-	-	-	-
CO4	2	2	2	-	1	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-

22CSOESCN	CYBER FORENSICS				L	T	P	C
					3	0	0	3

**Course Objectives :**

- To introduce the fundamental concepts of Computer Forensics.
- To familiarize the methods and technologies used to capture and analyze Forensics Data.

- To investigate the electronic evidence and threats including military, terrorist, rogues and private companies.
- To study about information warfare and the measures taken to reduce the crime
- To Process the Evidences and to prepare Reports

**UNIT – I Introduction**

Computer Forensics Fundamentals – Types of Computer Forensics Technology Types of Computer Forensics Systems - Vendor and Computer Forensics Services.

**UNIT – II Computer Forensics Evidence and Capture**

Data Recovery – Evidence Collection and Data Seizure – Duplication and Preservation of Digital Evidence – Computer Image Verification and Authentication.

**UNIT – III Computer Forensic Analysis**

Discover of Electronic Evidence – Identification of Data – Reconstructing Past Events - Fighting against Macro Threats – Information Warfare Arsenal - Tactics of the Military - Tactics of Terrorist and Rogues – Tactics of Private Companies.

**UNIT – IV Information Warfare**

Arsenal – Surveillance Tools - Hackers and Theft of Components - Contemporary Computer Crime - Identity Theft and Identity Fraud - Organized Crime & Terrorism - Avenues Prosecution and Government Efforts - Applying the First Amendment to Computer Related Crime - The Fourth Amendment and other Legal Issues.

**UNIT – V Computer Forensic Cases**

Developing Forensic Capabilities - Searching and Seizing Computer Related Evidence - Processing Evidence and Report Preparation - Future Issues.

**Text Books :**

1. John R. Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Cengage Learning, 2<sup>nd</sup> Edition, 2005.
2. Marjie T Britz, “Computer Forensics and Cyber Crime: An Introduction”, Pearson Education, 2<sup>nd</sup> Edition, 2008.

**References :**

1. Marie-Helen Maras, “Computer Forensics: Cybercriminals, Laws, and Evidence”, Jones & Bartlett Learning; 2<sup>nd</sup> Edition, 2014.
2. Chad Steel, “Windows Forensics”, Wiley, 1<sup>st</sup> Edition, 2006.
3. Majid Yar, “Cybercrime and Society”, SAGE Publications Ltd, Hardcover, 2<sup>nd</sup> Edition, 2013.
4. Robert M Slade, “Software Forensics: Collecting Evidence from the Scene of a Digital Crime”, Tata McGraw Hill, Paperback, 1<sup>st</sup> Edition, 2004.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand the fundamental concepts and technologies related to computer forensics.
2. Identify the methodologies related to forensics data capture and evidence processes.
3. Classify the Threats and Tactics in Cyber Security and Computer Forensic Investigations.
4. Understand the legal issues involved in computer related crime.
5. Examine the techniques used in processing digital evidence and report preparation.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	1	-	-	-	-	-	-	2
CO2	2	2	1	-	1	-	-	-	-	-	-	-
CO3	-	2	-	-	-	1	-	-	-	-	-	-
CO4	-	1	-	-	1	2	-	-	-	-	-	-
CO5	2	2	-	-	1	-	-	-	-	-	-	2

22CSOESCN	SYSTEM MODELING AND SIMULATION	L	T	P	C
		3	0	0	3

**Course objectives :**

- To introduce the terms in simulation and explain the types and applications of simulation.
- To explain the types of distributions, concepts of queuing systems and Markovian models.
- To impart the statistical knowledge required for system modelling.
- To teach the steps in model building.
- To present the use of tools for simulation.

**UNIT-I Introduction**

Simulation Terminologies- Application areas – Model Classification – Types of Simulation- Steps in a Simulation study- Concepts in Discrete Event Simulation – Monte Carlo Simulation - Simulation Examples.

**UNIT - II Statistical Models**

Concepts – Discrete Distribution- Continuous Distribution – Poisson Process- Empirical Distributions- Queuing Models – Characteristics- Notation – Queuing Systems – Markovian Models- Properties of random numbers- Generation of Pseudo Random numbers- Techniques for generating random numbers-Testing random number generators- Generating Random-Variates- Inverse Transform technique – Acceptance- Rejection technique – Composition and Convolution Method.

**UNIT - III Input Modeling**

Data collection - Assessing sample independence - Hypothesizing distribution family with data - Parameter Estimation - Goodness-of-fit tests – Selecting input models in absence of data- Output analysis for a Single system – Terminating Simulations – Steady state simulations.

**UNIT – IV Model Building**

Verification of Simulation Models – Calibration and Validation of Models – Validation of Model Assumptions – Validating Input – Output Transformations.

**UNIT – V Simulation Tools**

Model Input – High level computer system simulation – CPU – Memory Simulation – Comparison of systems via simulation – Simulation Programming techniques - Development of Simulation models – Simulation Project Management.

**Text Books :**

1. Banks J and John Carson, “Discrete Event System Simulation”, Pearson Education,2010.
2. Geoffrey Gordon, “System Simulation”, Second Edition, PHI,2006.

**References :**

1. Kelton, WD, Sadowski, R, Zupick, Simulation with Arena, McGraw-Hill,2014.
2. Frank L. Severance, “System Modeling and Simulation”, Wiley,2001.
3. Averill M. Law and W.David Kelton, “Simulation Modeling and Analysis, Third Edition, McGraw Hill, 2006.
4. JerryBanks,“Handbook of Simulation: Principles, Methodology, Advances, Applications and Practice”, Wiley, 1998.

**Course outcomes :**

At the end of this course, the students will be able to

1. Describe the types of simulation and the steps in simulation.
2. Apply distribution, queuing and Markovian models.
3. Select models for simulation.
4. Test simulation models.
5. Choose tools for simulation.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	2	-	-	-	-	-	-	-	-
CO3	2	1	-	2	1	-	-	-	-	-	-	-
CO4	1	-	-	2	-	-	-	-	-	-	-	-
CO5	-	-	-	-	2	-	-	-	-	-	-	-

22CSOESCN	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To introduce the concept of semantic web and related applications.
- To teach knowledge representation using ontology.
- To explain about communities in social network.
- To impart the knowledge of human behavior in social web and related communities.
- To develop the skills required to visualize social networks.

**UNIT – I Introduction**

Development of Semantic Web - Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

**UNIT – II Knowledge Representation**

Ontology-based knowledge Representation –Resource Description Framework – Web Ontology Language - Modeling and aggregating social network data: State-of- the-art in network data representation - Ontological representation of social individuals – Ontological representation of social relationships - Aggregating and reasoning with social network data – Advanced representations.

**UNIT –III Evolution**

Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks.

**UNIT – IV Data Management**

Understanding and predicting human behavior for social communities – User data management - Inference and Distribution – Enabling new human experiences– Reality mining – Context – Awareness - Privacy in online social networks – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and countermeasures.

**UNIT – V Graph Theory**

Graph theory – Centrality – Clustering – Node - Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix - based representations – Matrix and Node-Link Diagrams – Hybrid representations –



Applications – Cover networks – Community welfare - Collaboration networks – Co-Citation networks.

#### Text Books :

1. Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer, 1<sup>st</sup> edition, 2010.
2. Peter Mika, “Social Networks and the Semantic Web”, Springer, 1<sup>st</sup> edition, 2007.

#### References :

1. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, Springer , 1<sup>st</sup> edition, 2011.
2. Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, “Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling”, IGI Global Snippet, 2009.
4. John G Breslin, Alexander Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

#### Course Outcomes :

At the end of this course, the students will be able to

1. Understand the concept of semantic web and related applications.
2. Derive knowledge using ontology.
3. Identify communities in social network.
4. Analyze human behavior in social web and related Communities.
5. Develop the visualization diagrams for social networks

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	1	-	-	-	-	-	-
CO2	2	2	1	-	2	1	-	-	-	-	-	-
CO3	1	-	-	-	2	1	-	-	-	-	-	-
CO4	2	-	-	-	-	1	-	-	-	-	-	-
CO5	2	1	1	-	2	1	-	-	-	-	-	-

22CSOESCN	JAVA FULL STACK DEVELOPMENT	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To design web pages using HTML & CSS elements.
- To make use of JavaScript for writing programs to perform client-side validation on web applications and utilize TypeScript to develop web applications.
- To practice MySQL database and queries.
- To impart knowledge on java servlet to develop dynamic web pages.
- To understand the Java Server Pages for developing web applications.

**UNIT - I Introduction and Front-End Development**

Introduction to Full Stack Development: Definition of Full Stack Web Development - Introduction to Web Application Development - Front-End Technologies - Back-End Technologies - Introduction to Back-End Development with Java - Introduction to Model View Controller (MVC) - Introduction to Web Services - Communication Between Front-End and Back-End. HTML: Introduction, Basic HTML Elements - Table Elements - Form Elements – Embedded Elements – HTML5 Security – Best Practices – Capstone Project. CSS: Getting Started with CSS3 – Selectors – Cascading Order – Typography – Box Model – Transformations – Transitions – Animations – Responsive Web Design – Security – Capstone Projects.

**UNIT – II Scripting Languages**

JavaScript: Getting Started with JavaScript – Setting-up the Environment – Identifiers – Data Types – Operators – Statements and Expressions – Loops – Functions – Classes – Event Handling – Objects – Iterables – Asynchronous Programming – Modular Programming – Security – Best Practices – Capstone Project. TypeScript: Getting Started with TypeScript – TypeScript Basics – Function – Interface – Class – Modules and Namespaces – Generics – Capstone Project.

**UNIT – III Database**

MySQL: Introduction to MySQL – Using SQL to Manage Data – Data Types – Stored Programs – Query Optimization – MySQL Programming. JDBC – JDBC Driver – JDBC Interface – Using JDBC with Java Applications.

**UNIT – IV Back-End Development using Java Servlets and EJB**

Java Servlets: Usage – Servlet Life Cycle – Servlets for World Wide Web – Coding HttpServlet – Servlet Configuration– ServletContext – Servlet Event Listeners. Enterprise JavaBean: Introduction to Enterprise - Enterprise Bean Architecture- EJB Container – Benefits of Enterprise Bean – Types of Enterprise Bean – Accessing Enterprise Beans – Packaging Enterprise Beans – Java Message Service.

**UNIT – V Back-End Development using Java Server Pages**

Java Server Pages: JSP Specification – JSP Life Cycle – JSP Syntax and Semantics – Comments – JSP Document – JSP Elements – JSP GUI Example – JSP and Servlet Exceptions – Web Application Exception Handling. Case Study: Building a Complete Web Application.

**Text Books :**

1. Mayur Ramgir, “Full Stack Java Development with Spring MVC, Hibernate, jQuery, and Bootstrap”, Wiley India Pvt. Ltd., 2020.
2. Jon Duckett, “HTML & CSS: Design and Build Websites”, Wiley, 2011.
3. Colin J Ihrig, Adam Bretz, “Full Stack JavaScript Development with MEAN”, SitePoint Pty. Ltd., 2014.
4. Aristeidis Bampakos, Pablo Deeleman, “Learning Angular: A No-nonsense Beginner's Guide to Building Web Applications with Angular 10 and TypeScript”, 3<sup>rd</sup> Edition, Packt Publishing Ltd., 2020.
5. Paul DuBios, “MySQL”, 4<sup>th</sup> Edition, Developers Library book, Pearson Education Inc., 2009.
6. Jayson Falkner, Kevin Jones, “Servlets and Java Server Pages - The J2EETM Technology Web Tier” Pearson Education Inc., 2004.

**References :**

1. [https://infyspringboard.onwingspan.com/en/app/toc/lex\\_17739732834840810000\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview) (HTML5).
2. [https://infyspringboard.onwingspan.com/en/app/toc/lex\\_18109698366332810000\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview) (Javascript).
3. [https://infyspringboard.onwingspan.com/en/app/toc/lex\\_9436233116512678000\\_shared/overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/overview) (Typescript).
4. Mark Matthews, Jim Cole, Joseph D. Gradecki, “MySQL and Java Developer’s Guide”, 4<sup>th</sup> Edition, Developers Library book, Wiley Publishing Inc., 2003.

**Course Outcomes:**

After the completion of the course, the students will be able to

1. Build web pages using HTML & CSS elements.
2. Apply JavaScript to embed programming interface for web pages to perform client-side validations and Develop applications using Typescript.
3. Work with MySQL database using queries.
4. Develop a dynamic content for the Webpage using Java servlet and java bean.
5. Utilize Java Server Pages to design dynamic and responsive web pages.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	-	-	-	-	-	-	-	-	-
CO2	2	1	3	-	1	-	-	-	-	-	-	1
CO3	3	1	3	2	-	-	-	-	-	-	-	1
CO4	3	1	3	2	2	-	-	-	-	-	-	1
CO5	2	1	3	3	2	-	-	-	-	-	-	1

22CSOESCN	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

### Course objectives :

- To introduce the fundamentals of data science, big data analytics and its applications.
- To familiarize R programming to write simple programs.
- To impart programming skills on Map Reduce processing technique.
- To illustrate the concept of data analysis techniques with case studies.
- To develop the skills required to perform data visualization.

### UNIT – I Introduction

Data science process – roles, stages in data science project – State of the practice in analytics – Role of data scientists – Key roles for successful analytic project – Main phases of life cycle – Working with data from files – Exploring data – Managing data – Cleaning and sampling for modeling and validation – Challenges of conventional systems – Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting – Modern data analytic tools. Introduction to Big Data Platform – Big Data and its importance, Five Vs, Drivers for Big data, Big data analytics, Big data applications.

### UNIT – II R Programming

R basics – Reading and getting data into R – Ordered and unordered factors – Arrays and matrices – Lists and data frames – Reading data from files – Probability distributions – Statistical models in R – Manipulating objects – Data distribution – Simple programs using R.

### UNIT – III Map Reduce

Introduction – Distributed file system – Algorithms using map reduce, Matrix– Vector Multiplication by Map Reduce – Hadoop – Understanding the Map Reduce architecture – Writing Hadoop MapReduce Programs – Loading data into HDFS – Executing the Map phase – Shuffling and sorting – Reducing phase execution.

**UNIT – IV Data Analysis Techniques**

Linear and logistic regression modeling – Naïve Baye's classifier – Support vector machine – Neural networks – Principal component analysis – Linear Discriminant Analysis – Decision Trees – Fuzzy logic – Clustering Techniques : Hierarchical, agglomerative, K– Means – Associative Rule Mining.

Case Studies: Social Network Analysis – Text analysis –Marketing analysis.

**UNIT – V Data Visualization**

Documentation and deployment – Producing effective presentations – Introduction to graphical analysis – plot() function – Displaying multivariate data – Matrix plots – Multiple plots in one window – Exporting graph – Using graphics parameters – Visualizations – Visual data analysis techniques, interaction techniques; Systems and applications.

**Text Books :**

1. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014.
2. Chris Eaton, Dirk Deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.

**References :**

1. Big Data & Hadoop, V.K. Jain, Khanna Publishing House, 1<sup>st</sup> edition, 2016.
2. Big Data Black Book, DT Editorial Services, Wiley India, Dreamtech Press, 2015
3. Data Science & Analytics, V.K. Jain, Khanna Publishing House, 1<sup>st</sup> edition, 2018.
4. Beginner’s Guide for Data Analysis using R Programming, Jeeva Jose Khanna Book Publishing; 1<sup>st</sup> edition, 2018.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Understand the fundamentals of data science, big data analytics and its applications.
2. Solve simple problems using R programming.
3. Implement MapReduce processing technique.
4. Build applications with suitable data analysis technique.
5. Perform data visualization for graphical analysis.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	-	2	-	-	-	-	-	-	2
CO3	1	-	1	-	2	-	-	-	-	-	-	-
CO4	3	2	2	2	-	1	-	-	-	-	-	-
CO5	2	2	1	2	1	-	-	-	-	-	-	1

22CSOESCN	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To understand the concepts IPR
- To understand Trademarks, Trade Secretes and GI of goods.
- To understand Copyrights, Patents and Industrial Designs.
- To learn about how to manage IP rights and legal aspects.
- To understand the concepts of Cyber laws in IPR.

**UNIT - I**

**Introduction to Intellectual Property:** IPR - Definition - Types of IPR: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, IP as a factor in R&D; Few Case Studies WTO - Definition - Functions - Forms of IPR Protection.

**UNIT-II**

**Trade Marks:** Purpose and function of trademarks, Acquisition of trade mark rights, transfer of rights, Selecting and evaluating trademark, registration of trademarks, claims.

**Trade Secrets:** Trade secret law, determination of trade secret status, liability for misappropriation of trade secrets, trade secret litigation. Geographical Indication of Goods: Basic aspects and need for the registration.

**UNIT-III**

**Copyrights:** Fundamentals of copyright law, originality of material, right of reproduction, right to perform the work publicly, copyright ownership issues, notice of copyright.

**Patents:** Foundation of patent law, patent searching process, Basic Criteria of Patentability

**Industrial Designs:** Kind of protection provided in Industrial design.

**UNIT-IV**

**Managing IP Rights:** Acquiring IP Rights: letters of instruction, joint collaboration agreement.

**Protecting IP Rights:** nondisclosure agreement, cease and desist letter, settlement memorandum.

**Transferring IP Rights:** Assignment contract, license agreement, deed of assignment .

**UNIT-V**

**Introduction to Cyber law:** Information Technology Act, cybercrime and e-commerce, data security, confidentiality, privacy, international aspects of computer and online crime.

**References :**

1. Bare Act, The Indian Patent Act 1970 and the Patent Rules, Universal Law Publishing Co. Pvt. Ltd., 2007.
2. Mittal D.P., Indian Patents Law. Taxmann Allied Services (p) Ltd., 1999.
3. Deborah E Bouchoux, Intellectual Property: Right: The Law of Trademarks, Copyrights, Patents and Trade Secrets, 2012.
4. Gerald R. Ferrera, \_Cyber law: Text and Cases, South-Western Cengage Learning, 2012.

5. N.K Acharya, Intellectual property rights, Scandinavian Languages Edition, 2021.
6. Kompal Bansal, Fundamentals of Intellectual Property for Engineers, BS Publications 2013.
7. P. Radhakrishna, Intellectual Property Rights: Text and Cases, Excel Books, 2008.

### Course Outcomes :

At the end of this course, students will demonstrate the ability to

1. Learner should be able to demonstrate understanding of basic concepts of IPR.
2. Able to differentiate between Trademarks, Trade secrets and GI of goods.
3. Able to understand Copyrights, Patents and Industrial Designs.
4. Able to manage and protect IP.
5. Will gain Knowledge on Cyber law.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	2	-	-	2	2	-	-
CO2	2	-	-	-	-	2	-	-	2	3	-	-
CO3	2	-	-	-	-	3	-	3	2	2	-	-
CO4	2	-	-	-	-	2	-	3	2	3	-	-
CO5	2	-	-	-	-	2	-	3	2	3	-	-

22CSOESCN	NCC (Army Wing)	L	T	P	C
		2	0	2	3

### Course Objective

This course is designed especially for NCC Cadets. This course will help develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, learning military subjects including weapon training.

### Unit – I NCC Organization and National Integration

NCC Organization – History of NCC- NCC Organization - NCC Training- Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honours and Awards – Incentives for NCC cadets by central and state govt. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Factors affecting national integration.

### Unit – II Personality Development and Leadership

Introduction - Factors influencing / shaping Personality - Self-Awareness – Know yourself/ Insight - Communication Skills - Leadership Traits – Types – Attitude - Time Management - Effects of Leadership - Stress Management Skills - Interview Skills - Conflict Motives - Resolution - Importance of Group / Team Work - Influencing Skills - Body Language - Sociability: Social Skills.

**Unit – III Social Awareness and Community Development**

Aims of Social service-Various Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSY-JGSY-NSAP-PMGSY-Terrorism and counter terrorism- Corruption – female foeticide -dowry –child abuse-RTI Act- RTE Act- Protection of children from sexual offences act- civic sense and responsibility.

**Unit – IV Specialized Subject (Army Wing)**

Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war-Param Vir Chakra- Career in the Defence forces- Service tests and interviews-Fieldcraft and Battlecraft-Basics of Map reading.

**Unit – V Basic Physical Training and Weapon Training**

Basic physical Training – various exercises for fitness (with Demonstration) - Food – Hygiene and Cleanliness. Drill- Words of commands- position and commands- sizing and forming- saluting- marching (WITH DEMONSTRATION)

Main Parts of a Rifle- Characteristics of .22 rifle- Characteristics of 7.62mm SLR- Characteristics of 5.56mm INSAS rifle - stripping and assembling – position and holding- safety precautions – range procedure- firing simulation.

**Text Book :**

1. “National Cadet Corps- A Concise handbook of NCC Cadets”, Ramesh Publishing House, New Delhi, 2014.

**References:**

1. “Cadets Handbook – Common Subjects SD/SW”, published by DG NCC, New Delhi.
2. “Cadets Handbook- Specialized Subjects SD/SW”, published by DG NCC, New Delhi.
3. “NCC OTA Precise”, published by DG NCC, New Delhi.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

1. Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion
2. Acquaint and provide knowledge on personality development, self awareness, communication skills with leadership traits to work as a team and sociability values
3. Understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils
4. Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles.
5. Demonstrate health exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders and basic knowledge of weapons and their use and handling.



**HONOURS SUBJECTS**

<b>22CSHESCN</b>	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Course Objectives :**

- To introduce the scope of software project management and to impart knowledge on the basic steps in project planning.
- To teach the students to carry out an evaluation and selection of projects against strategic, technical and economic criteria.
- To explain software project scheduling and to teach risk analysis and management that helps to understand and manage uncertainty.
- To educate about focusing on ensuring progress of the project and to guide the students about steps in planning for different types of contract.
- To motivate group working and use appropriate leadership styles to accomplish the completion of software project.

**UNIT - I Software Project Planning**

Project Definition–Contract Management–Activities Covered By Software Project Management – Overview of Project Planning – Stepwise Project Planning.

**UNIT - II Assessment and Evaluation Techniques**

Strategic Assessment – Technical Assessment – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

**UNIT - III Project Scheduling and Risk Management**

Objectives – Project Schedule – Sequencing and Scheduling Activities – Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.

**UNIT - IV Monitoring and Managing Contracts**

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target– Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms of A Contract – Contract Management – Acceptance.

**UNIT - V Organizational Behaviour**

Introduction – Understanding Behaviour – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The Oldman – Hackman Job Characteristics Model – Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress –Health And Safety – Case Studies.

**Text Books :**

1. Bob Hughes, Mike Cotterell, Rajib Mall “Software Project Management”, 5<sup>th</sup> edition, Tata McGraw Hill, 2011.
2. Gopalaswamy Ramesh, “Managing Global Software Projects”, Tata McGraw Hill, New Delhi, 2006.

**References :**

1. Pankaj Jalote, “Software Project Management in Practice”, Pearson Education, reprinted, 2009.
2. Walker Royce, “Software Project Management”, Pearson Education, 2002.
3. Kelkar Sa, “Software Project Management”, PHI Learning, New Delhi, 2013.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Define the scope of software project management and to develop it in an organized manner through proper planning.
2. Apply and evaluate a variety of cost benefit analysis techniques for choosing among competing project proposals.
3. Develop project tasks and track their progress to build software by taking proactive measures.
4. Predict and monitor what is happening to bring the project back on target.
5. Select the appropriate people for a project and motivate them using different leadership styles.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	1	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	1	-
CO3	1	-	2	1	2	-	-	-	-	-	-	-
CO4	1	1	-	-	1	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	1	2	1	-	-

22CSHESCN	NANO COMPUTING	L	T	P	C
		3	1	0	4

**Course objectives:**

- To understand the basic concept and its impacts on nano computing
- To be familiar with the imperfections
- To be exposed to reliability evaluation strategies
- To learn nano scale quantum computing
- To understand Molecular Computing and Optimal Computing.

**UNIT - I Nano Computing Fundamentals**

Introduction - History of Computing – Nano computing - Quantum Computers Nano computing Technologies - Nano Information Processing - Prospects and Challenges - Physics of Nano computing : Digital Signals and Gates - Silicon Nano electronics - Carbon Nanotube Electronics - Carbon Nanotube Field-effect Transistors – Nanolithography.

**UNIT – II Nano Computing with Imperfections**

Introduction – Nano computing in the Presence of Defects and Faults - Defect Tolerance - Towards Quadrillion Transistor Logic Systems.

**UNIT – III Reliability of Nano Computing**

Markov Random Fields - Reliability Evaluation Strategies - NANOLAB - NANOPRISM - Reliable Manufacturing and Behavior from Law of Large Numbers.

**UNIT – IV Nano Scale Quantum Computing**

Quantum Computers - Hardware Challenges to Large Quantum Computers - Fabrication, Test, and Architectural Challenges - Quantum-dot Cellular Automata (QCA) - Computing with QCA - QCA Clocking - QCA Design Rules.

**UNIT-V QCA Designer and QCA Implementation**

Basic QCA Circuits using QCA Designer - QCA Implementation - Molecular and Optical Computing: Molecular Computing - Optimal Computing - Ultrafast Pulse Shaping and Tb/sec - Data Speeds.

**Text Book :**

1. Sahni V. and Goswami D., Nano Computing, McGraw Hill Education Asia Ltd.,2008.

**References :**

1. Reza B, Far, “Mobile Computing Principles:, Designing And Developing Mobile Application With UML and XML”, Cambridge University Press,2005.
2. William C.Y. Lee, “Mobile Communication Design Fundamentals”,John Wiley, 2010.
3. William Stallings, “Wireless Communications and Networks”, Pearson Education,2009.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Summarize the Nano Computing technologies of past, present and future with examples and also develop an attitude to propose solutions with comparisons for problems related to Nano Computing
2. Handle the imperfections in Nano Computing
3. Design a reliability evaluation strategies for Nano Computing
4. Illustrate the hardware and architectural challenges of Nano Scale Quantum Computing

5. Analyze the QCA concepts and its implementation

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	1	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	1	-	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	-

22CSHESCN	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	1	0	4

### Course Objectives :

- To introduce the fundamentals of Artificial Intelligence, intelligent agents and environments.
- To explain issues in knowledge representation, reasoning and uncertainty.
- To describe searching algorithms including uninformed search, informed search and heuristic search algorithms.
- To teach advanced topics in Artificial Intelligence including planning, learning, expert systems and fuzzy systems.
- To train the students in applications including information retrieval, machine translation and robotics.

### UNIT – I Introduction

What is Artificial Intelligence-Problems, Problem spaces and search- Heuristic Search Techniques. Intelligent Agents: Agents and Environments-Rationality- Nature of Environments – Structure of Agents.

### UNIT - II Knowledge Representation and Reasoning

Issues in knowledge representation-Predicate logic-Symbolic reasoning under uncertainty-statistical reasoning-weak, strong slot and filter structures. Ontological Engineering-Categories and Objects-Actions, situations and Events.

### UNIT - III Problem Solving Methods

Problem solving by searching : Problem solving agents –uninformed search strategies. Informed search: A\* search, Heuristic Search - Local search algorithms and optimization problems. Constraint satisfaction problems. Adversarial search: Games, Alpha-beta Pruning.

**UNIT - IV Advanced Topics**

Planning – understanding – natural language processing – Parallel and distributed AI – Learning – Connectionist models – Expert Systems – Fuzzy logic systems. Learning: Inductive learning – Learning decision trees – ensemble learning – Explanation based learning – Reinforcement Learning.

**UNIT – V Applications**

Communication as action – syntactic analysis – augmented grammars – semantic interpretation – ambiguity and disambiguity – induction. Probabilistic language models – information retrieval – information extraction – machine translation – Perception – Robotics.

**Text Books :**

1. S. Russell and P. Norvig, “Artificial Intelligence: A Modern Approach”, Prentice Hall, Third Edition, 2009.
2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, Artificial Intelligence, 3<sup>rd</sup> Edition, Tata McGraw Hill, 2010.

**References :**

1. M. Tim Jones, Artificial Intelligence: A Systems Approach, Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, 2009.
3. Gerhard Weiss, Multi Agent Systems, Second Edition, MIT Press, 2013.
4. David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Build intelligent agents for solving real time problems in the environment.
2. Apply the suitable knowledge representation method for solving problems using symbolic reasoning and uncertainty.
3. Design problem solving approaches using search algorithms including uninformed search, informed search and heuristic search.
4. Develop an expert system and NLP for communicating with an intelligent system using natural languages.
5. Design artificial intelligence application problems for information retrieval, information extraction, machine translation and robotics.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	1	-	-	-	-	-	-	-
CO4	3	2	1	-	-	1	-	-	-	-	-	1
CO5	3	2	1	-	1	-	-	-	-	-	-	-

22CSHESCN	GRAPH THEORY	L	T	P	C
		3	0	0	3

### Course Objectives:

- To introduce the fundamentals of Graph theory.
- To impart knowledge about Trees and planer graph.
- To explain about Graph coloring and directed graph.
- To make the student to understand permutation and combination.
- To familiarize generating functions.

### UNIT – I Introduction

Graphs – Introduction – Isomorphism – Sub Graphs – Walks, Paths, Circuits – Connectedness– Components – Euler Graphs – Hamiltonian paths and circuits – Trees – Properties of Trees– Distance and Centers in Tree – Rooted and Binary Trees.

### UNIT – II Trees, Connectivity & Planarity

Spanning Trees – Fundamental Circuits – Spanning Trees in a Weighted Graph– Cut Sets – Properties of Cut Set – All Cut Sets – Fundamental Circuits and Cut Sets – Connectivity and Separability – Network Flows – 1-Isomorphism – 2- Isomorphism – Combinational and Geometric Graphs – Planer Graphs – Different Representation of a Planer Graph.

### UNIT – III Matrices, Coloring and Directed Graph

Chromatic Number – Chromatic Partitioning – Chromatic Polynomial – Matching – Covering – Four Color Problem – Directed Graphs – Types of Directed Graphs – Digraphs and Binary Relations – Directed Paths and Connectedness – Euler Graphs

### UNIT – IV Permutations & Combinations

Fundamental Principles of Counting - Permutations and Combinations - Binomial Theorem - Combinations with Repetition - Combinatorial Numbers - Principle of Inclusion and Exclusion - Derangements - Arrangements with Forbidden Positions.

**UNIT –V Generating Functions**

Generating Functions - Partitions Of Integers - Exponential Generating Function - Summation Operator - Recurrence Relations - First Order and Second Order – Non-Homogeneous Recurrence Relations - Method of Generating Functions.

**Text Books :**

1. Narsingh Deo, Graph theory, Prentice Hall India,2008.
2. Douglas B. West, Introduction to Graph Theory, Prentice Hall India Ltd., 2001.

**References :**

1. H.Cormen,C.E. Leiserson and R.L.Rivest,“Introduction to Algorithms,” McGraw-Hill, 2007.
2. Baase, Computer algorithms, Pearson India 2008.
3. “Graph Theory” by Frank Harary

**Course Outcomes:**

At the end of this course, the students will be able to

1. Understand the fundamentals of graphs.
2. Acquire the knowledge about Trees and planer graph.
3. Apply graph coloring and use directed graph in discrete problems.
4. Solve problems in permutation and combination.
5. Implement the Generating function in solving recurrence relations.

Mapping of Course Outcomes with Program Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	-
CO4	2	2	2	2	-	-	-	-	-	-	-	-
CO5	2	2	2	2	2	-	-	-	-	-	-	-

22CSHESCN	DEEP LEARNING	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To provide in-depth understanding of back propagation neural network architecture and its training.
- To introduce the concepts of deep learning and its applications.
- To familiarize the deep learning architectures including auto encoders, Alex Net VGG, Inception and Res Net.

- To explain the method of modeling sequential data using recurrent neural network (RNN) and long short-term memory (LSTM).
- To describe the methods for solving real-world problems in the areas of natural language processing, speech and image processing.

### UNIT – I Introduction

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression) - Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

### UNIT - II Concepts of Deep Learning

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

### UNIT - III Metric Learning

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization

### UNIT – IV Optimization

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.

### UNIT - V Advanced Techniques

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection- BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions

### Text Books :

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View,2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.

### References :

1. Ian Good fellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press,2016.
2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press,2015.



**Course Outcomes:**

At the end of this course, the students will be able to:

1. Construct back propagation neural network to perform function approximation.
2. Understand the training and testing of deep learning architectures including convolution neural network (CNN) and generative adversarial networks (GAN).
3. Analyze deep learning architectures including auto encoders, AlexNet, VGG, Inception and ResNet.
4. Design deep learning architectures for modeling sequential data using recurrent neural network (RNN) and long short-term memory (LSTM).
5. Build deep learning architectures for solving real-world problems using open source Python package Keras.

Mapping of Course Outcomes with Program Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	1	2	1	1	-	-	-	-	-	-	-
<b>CO2</b>	3	-	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	3	-	1	1	-	-	-	-	-	-	-	-
<b>CO4</b>	2	1	2	2	2	-	-	-	-	-	-	-
<b>CO5</b>	1	2	2	2	3	-	-	-	-	-	-	-

22CSHESCN	OPERATION RESEARCH	L	T	P	C
		3	0	0	3

**Course objectives:**

- To introduce the basic concepts of linear programming.
- To explain the fundamentals of transportation and assignment algorithms.
- To impart knowledge about non-linear programming techniques.
- To describe the interior point methods of solving linear programming problems.
- To familiarize the concepts of dynamic programming.

**UNIT-I Linear Programming**

Introduction-formulation of linear programming model -Graphical solution- solving LPP using simplex algorithm -Revised Simplex Method.

**UNIT-II Advances in LPP**

Dualit theory-Dual simplex method-Sensitivity analysis--Transportation problems--Assignment problems-Traveling sales man problem-Data Envelopment Analysis

**UNIT-III Non-linear Programming**

Classification of Non Linear programming –Lagrange multiplier method– Karush –Kuhn Tucker conditions–Reduced gradient algorithms –Quadratic programming Method – Penalty and Barrier method.

**UNIT-IV Interior Point Methods**

Karmarkar’ algorithm –Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.

**UNIT-V Dynamic programming**

Formulation of Multi stage decision problem–Characteristics–Concept of sub - optimization and the principle of optimality –Formulation of Dynamic programming– Backward and Forward recursion –Computational procedure –Conversion of final Value problem in to Initial value problem

**Text Books :**

1. Hillier and Lieberman “Introduction to Operations Research”, TMH,2000.
2. R.Panneer selvam, “Operations Research”, PHI, 2006
3. Hamdy A Taha,“Operations – Research–An Introduction”, Prentice Hall India, 2003.

**References :**

1. Philips, Ravindran and Solberg, “Operations Research”, John Wiley,2002.
2. Ronald L.Rardin, “Optimization in Operation Research” Pearson Education Pvt. Ltd., New Delhi, 2005.

**Course Outcomes:**

At the end of this course, the students will be able to:

1. Formulate and optimize the linear programming problems.
2. Solve the transportation and assignment problems.
3. Implement the Non-linear programming algorithm for optimization.
4. Evaluate the linear programming problem by interior point methods.
5. Implement dynamic programming in solving linear programming problems.

Mapping of Course Outcomes with Program Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	2	-	-	-	-	-	-	-	-	-
<b>CO2</b>	3	3	2	-	-	-	-	-	-	-	-	-
<b>CO3</b>	3	3	2	2	-	-	-	-	-	-	-	-
<b>CO4</b>	3	3	2	-	-	-	-	-	-	-	-	-
<b>CO5</b>	3	3	2	2	-	-	-	-	-	-	-	-

22CSHESCN	PARALLEL AND DISTRIBUTED ALGORITHMS	L	T	P	C
		3	0	0	3

**Course objectives :**

- To introduce the basics of parallel computing, architecture and organization of parallel platforms and process-processor mapping techniques.
- To teach the techniques to decompose a computation for concurrent execution and to communicate between processes on various parallel architectures.
- To explain the Message-Passing and shared address space architectures and to prepare the students to write programs using Message Passing Interface topologies.
- To provide an understanding of the models for Message Passing systems and to illustrate the ring topology and shared memory model with suitable problems.
- To familiarize the students with different failures in distributed systems and to explain the fault-tolerant distributed systems.

**UNIT – I Introduction to Parallel Computing**

Scope of Parallel Computing –Parallel Programming Platforms –Implicit Parallelism – Limitations of Memory System Performance –Control Structure of Parallel platforms – Communication Model of Parallel Platforms –Physical Organization of Parallel Platforms –Communication Costs in Parallel Machines – Impact of Process - Processor Mapping and Mapping Techniques.

**UNIT – II Parallel Algorithm Design**

Preliminaries –Decomposition Techniques –Characteristics of Tasks and Interactions – Mapping Techniques for Load Balancing –Methods for Containing Interaction Overheads –Parallel Algorithm Models –Basic Communication Operations –One -to-All Broadcast and All-to-One Reduction –All to -All Broadcast and Reduction –All -Reduce and Prefix Sum Operations –Scatter and Gather –All - to-All Personalized Communication -Circular Shift –Improving the Speed of some Communication Operations.

**UNIT – III Programming using Message Passing and Shared Address Space**

Principles of Message Passing Programming –Building Blocks –Send and Receive Operations –MPI –Message Passing Interface –Topologies and Embedding – Overlapping Communication with Computation –Collective Communication and Computation Operations –Groups and Communicators –POSIX thread API – OpenMP: a Standard for Directive based Parallel Programming –Applications of Parallel Programming -Matrix-Matrix Multiplication –Solving Systems of Equations– Sorting Networks -Bubble Sort Variations –Parallel Depth First Search.

**UNIT – IV Distributed Computing Paradigm**

Paradigms for Distributed applications–Basic algorithms in Message passing Systems– Leader Election in Rings –Mutual Exclusion in Shared Memory.

**UNIT – V Fault Tolerant Design**

Synchronous Systems with Crash Failures–Byzantine Failures–Impossibility in Asynchronous Systems -Formal Model for Simulation –Broadcast and Multicast–Specification of a Broadcast Service –Implementing a Broadcast Service –Multicast in Groups -Distributed Shared Memory–Linearizable–Sequentially Consistent Shared Memory –Algorithms.

**Text Books :**

1. Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar,—Introduction to Parallel Computing, 2<sup>nd</sup> Edition, Pearson Education, 2009.
2. Haggit Attiya and Jennifer Welch, —Distributed Computing – Fundamentals, Simulations and Advanced Topics, 2<sup>nd</sup> Edition, Wiley,2012.

**References :**

1. Michael Quinn, —Parallel Computing -Theory and Practice, Second Edition, Tata McGraw Hill,2002.
2. Norman Matloff, —Parallel Computing for Data Science –With Examples in R, C++ and CUDA, Chapman and Hall/CRC,2015.
3. Wan Fokkink, —Distributed Algorithms: An Intuitive Approach, MIT Press, 2013.
4. M.L. Liu, —Distributed Computing –Principles and Applications, 1<sup>st</sup> Edition, Pearson Education,2011.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Understand the communication models and costs in parallel platforms to build efficient mappings between processes and processors.
2. Design algorithms to decompose problems for parallel execution using communication operations including broadcast & reduction and methods to speed up the communication between processes.
3. Develop Message Passing environment and solve problems including matrix-matrix multiplication, sorting and searching.
4. Implement suitable distributed algorithms to solve problems including Leader Election in ring topology and Mutual Exclusion in shared memory architectures.
5. Design and construct fault-tolerant systems to simulate communication between and failures of processors.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	-	-	-	-	-	-	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	3	-	-	-	-	-	-	-
CO4	1	2	2	1	1	-	-	-	-	-	-	-
CO5	1	1	2	1	-	-	-	-	-	-	-	-

22CSHESCN	DIGITAL WATERMARKING AND STEGANOGRAPHY	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To provide the basic principles and applications of watermarking.
- To represent the various current watermarking techniques.
- To teach the steganography methods associated with secret communication.
- To explain various transform and statistical techniques suitable for steganography.
- To enable the students to understand steganalysis.

**UNIT-I Watermarking**

Watermarking techniques– History and terminology – Basic Principles – Applications – Requirements of algorithmic design issues: Imperceptibility, Robustness, Security– Evaluation and benchmarking of watermarking system.

**UNIT-II Survey of Current Watermarking Techniques**

Cryptographic and psycho visual aspects – Choice of a workspace – Formatting the watermark bits – Merging the watermark and the cover – Optimization of the watermark receiver – Extension from still images to video.

**UNIT-III Steganography**

Principles of Steganography – Frameworks for secret communication – Security of Steganography systems – Information hiding in noisy data – Adaptive versus non-Adaptive Algorithms – Active and Malicious Attackers – Examples of Invisible communications.

**UNIT-IV Techniques for Steganography**

Steganographic techniques – Substitution system and bit plane tools – Transform domain techniques – Spread spectrum and information hiding – Statistical Steganography – Distortion and cover generation techniques.

**UNIT-V Steganalysis**

Overview of steganalysis- Statistical Properties of Images - Visual Steganalytic System - IQM-Based Steganalytic System - Learning Strategies - Frequency-Domain Steganalytic System.

**Text books :**

1. Stefan Katzenbelsser and Fabien A. P. Petitcolas, “Information Hiding Techniques for Steganography and Digital Watermarking”, Artech House Publishers,2004.
2. Frank Y. Shih, “Digital Watermarking and Steganography: fundamentals and techniques”, CRC Press,2007.

**References :**

1. Jessica Fridrich, “Steganography in Digital Media: Principles, Algorithms, and Applications”, Cambridge University Press,2010.
2. Abbas Cheddad, Vdm Verlag and Dr. Muller, “Digital Image Steganography: Concepts, Algorithms and Applications”, Aktienge sells Chaft & Co. Kg,2009.
3. Ingemar Cox, Matthew Miller, Jeffrey Bloom, Jessica Fridrich and Ton Kalker, “Digital Watermarking and Steganography”, Morgan Kaufmann Publishers,2007.

**Course Outcomes:**

At the end of this course, the students will be able to

1. Understand watermarking techniques, analyze the design issues and to evaluate watermarking system.
2. Analyze watermarking techniques used in images and video.
3. Explain principles, information hiding security and attacks of Steganography.
4. Implement Steganography techniques in transform domain and Distortion and cover generation techniques using MATLAB tool.
5. Describe and Develop steganalytic system in discrete and frequency domain.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	1	2	2	2	-	-	-	-	-	-	-	-
CO4	2	1	1	1	3	-	-	-	-	-	-	-
CO5	2	2	3	3	-	-	-	-	-	-	-	-

## ONE CREDIT COURSES

22CSOCSCN	DEEP LEARNING TOOLS LAB	L	T	P	C
		0	0	2	1

**Course Objectives :**

- To learn how to create and manipulate tensors using Tensorflow tool.
- To get to know Applied Deep Learning with PyTorch.
- To create and manipulate applications for artificial intelligence in the Scala programming language.
- To learn Character-Level RNN.

**LIST OF EXERCISES**

1. Introduction to TensorFlow.
2. Learning about Features and Outliers.
3. Working with Training Sets and Test Sets.
4. Scala program to demonstrate example of collection list and for loop.
5. Appending and merging Lists using scala.
6. Scala List class and pattern matching
7. L2 Regularization and Correlated Features.
8. Classifying Names with a Character-Level RNN
9. Generating Shakespeare with a Character-Level RNN

**Course Outcomes :**

At the end of this course, the students will be able to

1. Create and manipulate tensors using Tensorflow tool and to understand tensorflow concepts.
2. Know supervised learning and working with features and labels.
3. Acquire knowledge on CNN, RNN.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	2	-	2	-	-	-	-	-	-	-
CO2	-	3	3	1	3	1	-	-	-	-	-	2
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22CSOCSCN	IMAGE AND SPEECH PROCESSING LAB	L	T	P	C
		0	0	2	1

**Course Objectives :**

- To illustrate the image processing concepts through actual processing of images using python.
- To analyze simple Image enhancement techniques in spatial domain.
- To understand the concept of color image processing.
- To study various concepts in speech processing through various signal processing techniques.

**LIST OF EXERCISES**

1. Write a program to implement simple and adaptive thresholding for a given image.
2. Smoothing and Sharpening filters in spatial domain.
3. Implementation of Edge detection methods.
4. Write a program to find the histogram equalization
  - a) For full image.
  - b) For part of the image.
5. Write a program to find the Fourier transform of a given image.
6. Displaying individual color components(R,G,B,Cr,CB,H,S,I) of a color image.
7. Implementation of Huffman encoding and decoding for a given image.
8. Write a program to segment the given image using watershed algorithm.
9. Implementation of morphological dilation and erosion operations for a given image.
10. Write programs to extract SIFT and SURF features for given input image samples.
11. Write a program to perform convolution and correlation of speech signals.
12. Write a program to perform simple low pass filtering and high pass filtering of speech signal.
13. Extraction of pitch and formants for a given speech signal.
14. Write a program to find short time energy and zero crossing rate of pre-processed speech signal.
15. Write a program to extract MFCC feature from sample speech signal.
16. Text dependent speaker recognition using Dynamic Time Warping.

**Course Outcomes:**

At the end of this course, students will be able to:

1. Work with Digital Image and Speech fundamentals using python.
2. Analyse how Image Enhancement techniques in spatial domain used in processing of images.
3. Work with applications of image and speech processing.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	2



22CSOCSCN	DATA VISUALISATION LAB	L	T	P	C
		0	0	2	1

**Course Objectives :**

- To learn the interface in Tableau / MS-Excel for creating visualisations.
- To understand the methods for drawing charts and graphs.
- To learn the use of maps and tables in creating visualisation.
- To prepare dashboard design for data analytics applications.

**LIST OF EXERCISES****(The exercises are to be done in Tableau / MS-Excel)**

1. Study of interface, screen and visual cues in Tableau / MS-Excel
2. Connecting with various data sources
3. Working with measures and dimensions
4. Working with Colours
5. Working with Expressions, Functions, Date, Time
6. Drawing Charts and Graphs
7. Creating Maps
8. Working with Table Calculations
9. Sorting Data
10. Applying Filters
11. Dashboard design

**Course Outcomes :**

At the end of this course, the students will be able to

1. Discover the various elements in the interface to load and analyze data.
2. Design filters for data visualization.
3. Develop dashboard design for typical data analytics applications.

**Mapping of Course Outcomes with Programme Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	2	2	3	-	-	-	-	-	-	-	-	-
<b>CO2</b>	1	2	2	2	-	-	-	-	-	-	-	-
<b>CO3</b>	2	2	2	-	-	-	-	-	-	2	-	2

22CSOCSCN	<b>MOBILE APPLICATION DEVELOPMENT LABORATORY</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Course Objectives :**

- To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- To understand how to work with various mobile application development frameworks.
- To learn the basic and important design concepts and issues of development of mobile applications.
- To understand the capabilities and limitations of mobile devices.

**LIST OF EXERCISES**

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message
10. Write a mobile application that makes use of RSS feed
11. Develop a mobile application to send an email.
12. Develop a Mobile application for simple needs (Mini Project)

**Course Outcomes :**

At the end of this course, the students will be able to

1. Develop mobile applications using GUI and Layouts.
2. Develop mobile applications using Event Listener and Databases.
3. Develop mobile applications using RSS Feed, Internal/External Storage, SMS, Multi-threading and GPS.

<b>Mapping of Course Outcomes with Programme Outcomes</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	3	3	3	3	2	-	-	-	-	-	-	-
<b>CO2</b>	3	3	2	2	2	-	-	-	-	-	-	-
<b>CO3</b>	2	2	-	-	-	-	-	-	-	-	-	2

22CSOCSCN	PROFESSIONAL COMMUNICATION	L	T	P	C
		0	1	0	1

**COURSE OBJECTIVES**

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

**UNIT I**

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

**UNIT II**

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

**UNIT III**

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -- questioning and clarifying –GD strategies- activities to improve GD skills

**UNIT IV**

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

**UNIT V**

Recognizing differences between groups and teams- managing time-managing stress-networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

**Recommended Software** 1. Globearena 2. Win English

**References :**

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
2. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

**Course Outcomes :**

At the end of this course, the students will be able to

1. Make effective presentations.
2. Participate confidently in Group Discussions.
3. Attend job interviews and be successful in them.
4. Develop adequate Soft Skills required for the workplace .

Mapping of Course Outcomes with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	2	-	-	-	-	-	3	-	3
CO2	-	2	-	2	-	-	-	-	-	3	-	3
CO3	-	-	3	-	-	-	-	-	-	3	-	3
CO4	-	-	2	3	-	-	-	-	-	3	-	3
CO5	-	-	3	2	-	-	-	-	-	3	-	3