

**ANNAMALAI UNIVERSITY**



**FACULTY OF ENGINEERING AND TECHNOLOGY**

**B.E. COMPUTER SCIENCE AND ENGINEERING  
(Data Science)  
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	<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>
6	Electronics and Instrumentation Engineering.		
7	Chemical Engineering	<ol style="list-style-type: none"> <li>1. Chemical Engineering</li> <li>2. Pharmacy</li> <li>3. Electronics and Instrumentation Engineering</li> </ol>	<ol style="list-style-type: none"> <li>1. Civil Engineering</li> <li>2. Mechanical Engineering</li> <li>3. Electronics and Instrumentation Engineering.</li> <li>4. Information Technology</li> <li>5. Civil and Structural Engineering.</li> <li>6. Electrical Engineering</li> <li>7. Electronics and Communication Engineering.</li> <li>8. Mechanical (Manufacturing) Engineering.</li> <li>9. Computer Science and Engineering</li> <li>10. Computer Science and Engineering (Artificial Intelligence and Machine Learning)</li> <li>11. Computer Science and Engineering(Data Science)</li> </ol>
8	Computer Science and Engineering	<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> <li>4. Computer Science and Engineering(Artificial Intelligence and Machine Learning)</li> <li>5. Computer Science and Engineering(Data Science)</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>
9	Information Technology		

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> </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>	<ol style="list-style-type: none"> <li>4. Civil and Structural Engineering.</li> <li>5. Chemical Engineering</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
22DSBS301	BS-V	Mathematical Foundations of Data Science	3	1	-	25	75	100	4
22ETES302	ES-III	Environmental Studies	3	-	-	25	75	100	3
22DSES303	ES-IV	Computer Organization	3	-	-	25	75	100	3
22DSES304	ES-V	Digital Electronics	3			25	75	100	3
22DSPC305	PC-I	Data Structures and Algorithms	3	-	-	25	75	100	3
22DSPC306	PC-II	Object Oriented Programming	3	1		25	75	100	4
22DSSP307	ESP-V	Digital Electronics Lab	-	-	3	40	60	100	1.5
22DSCP308	PCP-I	Data Structures and Algorithms Lab	-	-	3	40	60	100	1.5
22DSCP309	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
22DSBS401	BS-VI	Discrete Mathematics	3	-	-	25	75	100	3
22DSES402	ES -VI	Software Engineering	3	-	-	25	75	100	3
22DSPC403	PC-III	Operating Systems	3	-	-	25	75	100	3
22DSPC404	PC-IV	Database Technology	3	-	-	25	75	100	3
22DSPC405	PC-V	Python Programming	3	-	-	25	75	100	3
22DSPC406	PC-VI	Data Science	3	-	-	25	75	100	3
22ETHS407	HS-IV	Universal Human Values	2	1	-	25	75	100	3
22DSCP408	PCP-III	Operating System Lab	-	-	3	40	60	100	1.5
22DSCP409	PCP-IV	Database Technology Lab	-	-	3	40	60	100	1.5
22DSCP410	PCP-V	Data Science Lab	-	-	3	40	60	100	1.5
<b>Total Credits</b>									<b>25.5</b>

**Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming V Semester.**

SEMESTER V										
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	
22DSPC501	PC-VII	Map Reduce Programming with Hadoop	3	-	-	25	75	100	3	
22DSPC502	PC-VIII	Data Visualisation	3	-	-	25	75	100	3	
22DSPC503	PC-IX	Computer Networks	3	-	-	25	75	100	3	
22DSPC504	PC-X	Machine Learning	3			25	75	100	3	
22DSPE505	PE-I	Professional Elective - I	3	-	-	25	75	100	3	
22DSPE506	PE-II	Professional Elective - II	3	-		25	75	100	3	
22YYOE507	OE-I	Open Elective - I	3	-	-	25	75	100	3	
22DSCP508	PCP-VI	Map Reduce Programming with Hadoop Lab	-	-	3	40	60	100	1.5	
22DSCP509	PCP-VII	Data Visualisation Lab	-	-	3	40	60	100	1.5	
22DSCP510	PCP-VIII	Machine Learning Lab	-	-	3	40	60	100	1.5	
22ETIT511	IT-I	Industrial Training / Rural Internship/Innovation /Entrepreneurship	<b>Four weeks during the summer vacation at the end of IV Semester</b>					100	100	<b>4.0</b>
						<b>Total Credits</b>			<b>29.5</b>	

SEMESTER VI									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
22DSPC601	PC-XI	Data Analysis with R	3	-	-	25	75	100	3
22DSPC602	PC-XII	Cloud Computing	3	-	-	25	75	100	3
22DSPE603	PE-III	Professional Elective - III	3	-	-	25	75	100	3
22DSPE604	PE-IV	Professional Elective - IV	3	-	-	25	75	100	3
22DSPE605	PE-V	Professional Elective -V	3	-	-	25	75	100	3
22YYOE606	OE-II	Open Elective - II	3	-	-	25	75	100	3
22DSCP607	PCP-IX	Data Analysis with R Lab	-	-	3	40	60	100	1.5
22DSCP608	PCP-X	Cloud computing Lab	-	-	3	40	60	100	1.5
						<b>Total Credits</b>			<b>21</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	Ethics in Data Analytics	2	-	-	25	75	100	2
22DSPC702	PC-XIII	Internet of Things(IoT)	3	-	-	25	75	100	3
22DSPE703	PE-VI	Professional Elective - VI	3	-	-	25	75	100	3
22DSPE704	PE-VII	Professional Elective - VII	3	-	-	25	75	100	3
22DSOE705	OE-III	Open Elective - III	3	-	-	25	75	100	3
22DSCP706	PCP-XI	Internet of Things(IoT) Lab	-	-	3	40	60	100	1.5
22ETIT707	IT-II	Industrial Training / Rural Internship/Innovation /Entrepreneurship	Four weeks during the summer vacation at the end of VI Semester				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
22DSPV803	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. Distributed systems
2. Data Engineering
3. Scala Programming
4. No SQL databases
5. Advanced Java Programming
6. Optimization Techniques
7. Extract Transform & Load (ETL) Tools
8. Business Intelligence
9. Programming with Spark
10. Data Security
11. Web Analytics
12. GPU Computing
13. Mining for Big Data
14. Predictive Analytics
15. Text Analytics
16. Recommender Systems
17. Real Time Analytics
18. Applied Econometrics & Time Series Analysis
19. Social Media Analytics
20. Health care Analytics
21. Business Analytics

**OE- OPEN ELECTIVES**

1. Soft Computing
2. Mobile Application Development
3. Cyber Security
4. Big Data for Bio Informatics
5. Deep Learning
6. Information Retrieval
7. Block Chain Technology
8. Digital Forensics
9. Java Full Stack Development
10. Big Data Analytics [Naan Mudhalvan]

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

### **LIST OF HONORS ELECTIVE COURSES**

S. No	Course Code	Course Name	Credits
1	22DSHESCN	Big Data Testing Tools	4
2	22DSHESCN	Big Data Analytics Tools	4
3	22DSHESCN	Data Management	3
4	22DSHESCN	Cognitive Computing	3
5	22DSHESCN	High Performance Big Data Analytics	3
6	22DSHESCN	Financial Analytics	3

### **LIST OF MINOR ENGINEERING ELECTIVE COURSES**

S. No	Course Code	Course Name	Credits
1	22DSMISCN	Data Structures and Algorithms	4
2	22DSMISCN	Python Programming (or) Data Analysis with R	4
3	22DSMISCN	Data Science	3
4	22DSMISCN	Map Reduce Programming with Hadoop	3
5	22DSMISCN	Machine Learning (or) Mining for Big Data	3
6	22DSMISCN	NoSQL Databases	3

**ONE CREDIT COURSES**

1. Deep Learning Tools Lab
2. Image and Speech Processing Lab
3. Computer Networks 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.
5. Rai.G.D, "Solar Energy Utilization" Volume-1 & 2 by - Khanna Publishers, New Delhi
6. Pajput. R. K. Non -Conventional energy sources and Utilization - S. Chand Publication -2013.

**REFERENCE BOOKS**

1. Rajendran.V , “Engineering Physics”, Tata McGraw Hill publishers, 2009.
2. Rai G.D., “Non-conventional Energy sources”, Khauna Publications, 1993.
3. Mani. P. “Engineering Physics”, Dhanam Publication, Chennai, 2011.
4. 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

1. Gain knowledge on the construction of different types of interferometer.
2. Description on different types of laser and its application.
3. Analyze the importance of packing factor in different crystal system.
4. Evaluate the quantum mechanical concept of wave velocity and group velocity.
5. 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", Tata McGraw-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 பௌத்த 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, Yash 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. Thinaï 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.

<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>	<b>3</b>			<b>2</b>			<b>2</b>					<b>3</b>
<b>CO2</b>	<b>3</b>			<b>2</b>			<b>2</b>		<b>2</b>			<b>3</b>
<b>CO3</b>	<b>3</b>			<b>2</b>			<b>2</b>		<b>2</b>			<b>3</b>
<b>CO4</b>	<b>3</b>			<b>2</b>			<b>2</b>		<b>2</b>			<b>3</b>
<b>CO5</b>	<b>3</b>			<b>2</b>			<b>2</b>		<b>2</b>			<b>3</b>

**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 be 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		L	T	P/D	C
	தமிழரும் தொழில்நுட்பமும்		1	0	0	1

**அலகு I: நெசவு மற்றும் பாணைத் தொழில்நுட்பம்:** 3  
சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு 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 – 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 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 Civilizationon 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.

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

### 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. Newton'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, permananganometry, 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.

<b>Mapping of Course Outcomes with Programme Outcomes</b>												
<b>COs</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>			<b>2</b>		<b>2</b>					<b>2</b>		<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>				<b>2</b>	<b>2</b>		<b>2</b>
<b>CO3</b>	<b>2</b>		<b>2</b>									
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>								
<b>CO5</b>										<b>3</b>		<b>3</b>

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**B.E. COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)**  
**(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.COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)**  
**PROGRAMME OUTCOMES (PO)**

After the successful completion of the B.E.COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE) 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.

PO4	<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.
PO5	<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.
PO6	<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.
PO7	<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.
PO8	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	<b>Individual and Team Work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	<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.
PO11	<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.
PO12	<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.COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)  
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.COMPUTER SCIENCE & ENGINEERING (Data Science)  
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 Data Science and Artificial Intelligence which uses complex machine learning algorithms to build predictive models and to provide the core concepts of computer science as well as data analytics.
<b>PSO2</b>	Learn <b>specialized courses</b> in Data Science to build up the aptitude for applying typical practices and approaches to handle huge amounts of data and then analyze it using data-driven methodologies, communicate it to the information technology leadership teams and understanding the patterns and trends through visualizations.
<b>PSO3</b>	Apply <b>technical and programming skills</b> to deal with vast volumes of data using modern tools and techniques to find unseen patterns, derive meaningful information, to assist companies in making smarter business decisions and to use statistical techniques to draw conclusions.

**B.E.COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)–  
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.COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)–  
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

22DSBS301	MATHEMATICAL FOUNDATIONS OF DATA SCIENCE	L	T	P	C
		3	1	0	4

**Course Objectives :**

- To study the characteristics of a population through a sample of population with varieties.
- To understand probability theory for investigating the important features of the Random experiments.
- To explain certain probability distribution which is useful in constructing probabilistic models for observed phenomena.
- To describe the theory of sampling and the test of hypothesis.

**UNIT – I Introduction to Statistics**

Statistics: Classification-Graphical representation –Bar chart-Pie diagram-Frequency graph-Measures of central tendency: Mean – Median – Mode. Measures of Dispersion: Range – Quartile deviation – Mean deviation- Standard deviation.

**UNIT– II Correlation and Regression**

Correlation and Regression – Rank correlation- curve fitting: Method of least squares – Straight line – Parabola – Exponential curve.

**UNIT – III Probability Theory**

Probability Theory: Random Experiment – Axiomatic Definition of probability – Conditional probability – Independent Events – Theorem of total probability – Problems based on Baye’s theorem.

**UNIT– IV Probability distributions**

Probability Distributions: Discrete distributions-Binomial and Poisson distribution. Continuous distributions: Uniform, Exponential and Normal distributions.

**UNIT – V Test of Hypothesis**

Test of Hypothesis: Critical region-level of significance-Confidence interval- Large sample: Test for single proportion and difference of proportions – Test for single mean and difference of means. Small sample test: t – test for single mean and difference of means, F-test for significance of variance – Chi square test for goodness of fit and independence of attributes.

**Text Books :**

1. Veerarajan.T, “Probability, Statistics and Random Processes”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2014.
2. Kandasamy.P, Thilagavathy Kand Gunavathy.K, “Engineering Mathematics”, Volume II, S. Chand & co Ltd, New Delhi, 2006.



**References :**

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons,” 9<sup>th</sup> Edition, 2010.
2. N.P.Bali and Manish Goyal, “A text book of Engineering Mathematics”, Laxmi Publication, 2012.
3. Ramana .B.V, “Higher Engineering Mathematics”, Tata McGraw Hill, 2016.

**Course Outcomes :**

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

1. Acquire the basic concepts about the characteristics of a population.
2. Understand the characteristics of the data associated with two variables.
3. Investigate the important features of the random experiments.
4. Identify and apply probability distributions in engineering and data analysis applications.
5. Explain the theory of sampling and measure the goodness of fit.

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

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

**Course Objectives**

- To study the types of resources such as forest, water, mineral, food, energy and land.
- To describe the structure and function of an ecosystem.
- To explain the value of biodiversity.
- To increase the types of pollution and increase awareness to protect the environment.

**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 land slides. 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. Erach Bharucha, “Textbook of Environmental Studies”, University Press, 2005.
2. MP Poonia & SC Sharma, “Environmental Studies”, Khanna Publishing House, 2017.

**References :**

1. Rajagopalan, "Environmental Studies", 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 Eastern 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	-	-	-	-	-

22DSES303	COMPUTER ORGANIZATION	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To understand the basic structure of computers and control unit design.
- To study the hierarchical memory system including cache memories and virtual memory.
- To study the different ways of accessing I/O devices and standard I/O interfaces.
- To study the concept of pipelining and superscalar operation.

**UNIT – I Basic Structure of Computers**

Functional Units – Basic operational concepts – Bus structures – Performance and metrics – Numbers, Arithmetic Operations and Characters-Memory Locations and Addresses-Memory operations-Instructions and instruction sequencing – Instruction set architecture – Addressing modes – Basic Input/output operations-Stacks and queues -Subroutines-Additional instructions.

**UNIT – II Basic Processing Unit**

Fundamental concepts - Control of the Processor- Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control –Micro programmed sequencing-Micro Programming Execution – TI8800- Nano programming.

**UNIT – III Memory System**

Basic concepts- Semiconductor RAM – ROM – Speed, Size and cost – Cache memory – Cache memory principle – Elements of cache design- Cache performance considerations– Virtual memory – Memory management requirements – Secondary storage devices.

**UNIT – IV I/O Organization**

Accessing I/O devices – Programmed I/O – Interrupts driven I/O – Direct memory access – Buses – Interface Circuits – Standard I/O interfaces: PCI, SCSI and USB– I/O Channels and processors.

**UNIT - V Pipelining**

Basic Concepts - Data hazards – Instruction hazards – Influence on instruction sets – Data path and control considerations – Superscalar Operation- Ultra SPARCII Example- Performance considerations.

**Text Books :**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, Tata McGraw-Hill Education Pvt. Ltd, 5th edition, 2011.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Pearson Education Ltd.,10th Edition, 2016.

**References :**

1. David A. Patterson and John L. Hennessy, “Computer Architecture – A Quantitative Approach”, Elsevier, a division of reed India Private Limited, 5th edition, 2012.
2. Hayes, J.P., “Computer Architecture and Organization”, Tata Mc-Graw Hill, 3rd Edition, 2012.
3. Ghosh T. K., “Computer Organization and Architecture”, Tata McGraw-Hill, 3rd edition, 2011.
4. Behrooz Parahami, “Computer Architecture”, Oxford University Press, 8th Impression, 2011.

**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	-	-	-	-	-	-	-	-	-	-	-

22DSES304	DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To understand the fundamentals of semiconductor devices, transistors and amplifiers.
- To introduce the laws of Boolean algebra and solve problems in combinational logic.
- To illuminate the basic concepts of memory.
- To explain sequential logic and memory circuits and systems.

**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 system - 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 Function**

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**

1-bit memory, the circuit properties of Bistable 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 of 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, Albert Paul Malvino, Goutan Saha, "Digital Principles and Applications", 7<sup>th</sup> 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. A.Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
6. Rashid, "Micro electronic 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	-	-	-	-	-	-	-	-

22DSPC305	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

### Course Objectives:

- To understand various types of linear and non-linear data structures.
- To analyze algorithms for run time complexities and the space requirements.
- To understand algorithms that use data structures for operations such as storing, searching, hashing etc.
- To apply various data structures and algorithms to design, formulate and implement solution for any real time problem

### UNIT - I Introduction to Data Structures

Data Types - Data Structures - Abstract Data Types (ADTs) - Goal of the Analysis of Algorithms Commonly Used Rates of Growth - Types of Analysis - Asymptotic Notation - Big-O Notation - Omega Notation - Theta Notation - Guidelines for Asymptotic Analysis - Simplifying properties of asymptotic notations - Commonly used Logarithms and Summations -Amortized Analysis- Linked Lists - Linked Lists ADT - Comparison of Linked Lists with Arrays & Dynamic Arrays - Singly Linked Lists - Doubly Linked Lists - Circular Linked Lists.

### UNIT - II Stacks, Trees and Graphs

Stacks - Definition - How Stacks are used - Stack ADT - Applications - Implementation - Queues - Queue ADT - Applications – Implementation-Trees - Glossary - Binary Trees - Types and Properties of Binary Trees - Binary Tree Traversals - Generic Trees (N-ary Trees) - Expression Trees - Binary Search Trees (BSTs) – AVL(Adelson-Velskii and Landis) Trees - Priority Queues and Heaps - Priority Queue ADT - Priority Queue

Applications - Priority Queue Implementations - Heaps - Binary Heaps - Graph - Glossary  
- Applications of Graphs - Graph Representation - Graph Traversals - Shortest Path  
Algorithms - Minimal Spanning Tree.

### **UNIT - III Sorting and Searching**

Sorting - Classification of Sorting Algorithms - Bubble Sort - Selection Sort - Insertion  
Sort - Shell Sort - Merge Sort - Heap Sort - Quick Sort - Searching - Types of Searching  
- Unordered Linear Search - Sorted/Ordered Linear Search - Binary Search - Hashing -  
Hash Table ADT - Components of Hashing - Hash Table - Hash Function - Load Factor -  
Separate Chaining - Open Addressing - Hashing Complexity - Hashing Techniques.

### **UNIT - IV Greedy Method and Divide & Conquer Method**

Algorithm Design Techniques - Greedy Algorithms - Greedy Strategy - Elements of  
Greedy Algorithms - Advantages and Disadvantages of Greedy Method - Greedy  
Applications – Topological Sort - Selection sort - Prim's and Kruskal's algorithms -  
Divide and Conquer Algorithms – General strategy - Divide and Conquer Visualization -  
Advantages and Disadvantages of Divide and Conquer - Divide and Conquer  
Applications – Quick sort and Binary Search.

### **UNIT - V Dynamic Programming and Backtracking Methods**

Dynamic Programming – General Strategy - Properties of Dynamic Programming  
Strategy - Dynamic Programming Approaches - Examples of Dynamic Programming  
Algorithms- Shortest Path problem - Dijkstra's and Floyd's algorithms - Backtracking - 8  
Queen's Problem - Knapsack Problem.

### **Text Books :**

1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", 5th Edition, Career Monk Publications, 2017.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2002.

### **References :**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
3. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.
5. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2011.



**Course Outcomes :**

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

1. Understand the concepts of data structure, data type and algorithms and critically analyze the various algorithms for their time complexity.
2. Implement abstract data types for linear data structures such as lists stacks and queues.
3. Understand and apply various data structure such as trees and graphs to solve various real-time problems.
4. Implement and know where and when to apply standard algorithms for searching, sorting etc.
5. Effectively choose the data structure that efficiently models the information in a problem.

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

<b>22DSPC306</b>	<b>OBJECT ORIENTED PROGRAMMING</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 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 Separators, 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 Separators, 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>22DSSP307</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 study and experiment the characteristics of semiconductor diode and Zener diode.
- To do estimation of parameters of amplifiers, oscillators and multivibrators.
- To implement the concepts of Digital Logic design such as logic gates, flip flops, multiplexer and demultiplexer.
- To verify state table of flip-flops.

**LIST OF EXERCISES**

1. Characteristics of semiconductor 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 Understand the basic digital circuits and to verify their operation.

- 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

22DSCP308	DATA STRUCTURES AND ALGORITHMS LAB	L	T	P	C
		0	0	3	1.5

#### Course Objectives:

- To understand and implement linear data structures such as linear list, stack and queue.
- To implement non-linear data structures such as linear trees and graphs.
- To understand algorithms that use data structures for operations such as sorting and searching.
- To study algorithm design methods such as the greedy method, divide and conquer, dynamic programming and backtracking.

#### LIST OF EXERCISES

(The Exercises are to be done in C++)

- Write a program to create a Stack and perform insertion and deletion operations on it.
- Write a program to create a List and perform operations such as insert, delete, update and reverse.
- Write a program to create a Queue and perform operations such as insertion and deletion.
- Using iteration and recursion concepts write programs for finding the element in the array using the Binary Search method.
- Write a program and simulate various graph traversing techniques.
- Write a program to Implement Binary Search Tree.
- Write a program to simulate Bubble sort algorithm.
- Write a program to implement separate chaining to handle collisions in hashing.
- Write a program to Implement Heaps using Priority Queues.
- Implement the Quick sort algorithm to illustrate Divide and Conquer method.
- Using Dynamic programming method implement Dijkstra's shortest path Algorithm.
- Write a program to simulate the n-Queens problem using backtracking approach.
- Implement the Selection sort algorithm to illustrate Greedy Approach.

#### Course Outcomes :

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

- 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

22DSCP309	OBJECT ORIENTED PROGRAMMING LAB	L	T	P	C
		0	0	3	1.5

### Course Objectives:

- To learn object-oriented design principles and gain experience writing programs in C++ and Java.
- To develop applications using Object Oriented Programming Concepts.
- To implement features of Object Oriented programming to solve real world problems.
- To create packages, interfaces and threads in Java.

### LIST OF EXERCISES

#### C++ Program

1. Write a C++ program to design a class having static function names show count() 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 sports and tests 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

9. Simple Java Applications
  - a. Understanding References to an Instant of a Class
  - b. Handling Strings
10. Simple Package Creation
  - a. Creating User Defined Packages
  - b. Creating User Defined Packages - Array of Objects
11. Interfaces
  - a. Implementing User Defined Interfaces
  - b. Implementing Pre Defined Exceptions
12. Threading
  - a. Creation of Threading
  - b. Multi-Threading
13. 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	1	2	1	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22DSBS401	DISCRETE MATHEMATICS	L	T	P	C
		3	0	0	3

### Course Objectives:

- To study the various finite structures of Mathematics which are essential to understand the various concepts of Computer Science.
- To learn the operations on sets and relations.
- To understand the representation methods and algorithms for graphs.
- To acquire the knowledge of Automata theory and formal languages for the purpose

of developing compilers, programming languages and other natural language processing applications in Computer Science.

### **Unit – I Mathematical Logic**

Mathematical Logic: Propositions – Connectives – Tautology and contradiction – Equivalence of propositions – Tautological Implication – Normal Forms – Theory of Inference – Rules of Inference.

### **Unit – II Set Theory and Relations**

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 Graph Theory**

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

### **Unit – IV Finite Automata**

Finite automata – Representation of a finite automaton – Language Accepted by a finite automaton – Non-deterministic finite automata – Acceptability of string by NFA – Equivalence of FA and NFA -  $\epsilon$  - NFA - Equivalence of  $\epsilon$  - NFA and NFA.

### **Unit – V Grammar**

Phase – Structure grammar – Derivation in a grammar G – Regular grammar – Context free grammar – Derivation trees of CFG – Normal forms of CFG.

### **Text Books :**

1. Veerarajan T, “Discrete Mathematics with Graph Theory and Combinatorics”, Tata McGraw Hill Publishing Company Ltd, 2014.
2. Venkataraman M. K, “Discrete Mathematics Structures”, the National Publishing Company, 2008.

### **References :**

1. Kolman Busby Ross, “Discrete Mathematical Structures”, Pearson Education Pvt. Ltd., 2000.
2. 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	-	-	-

22DSES402	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

### Course Objectives :

- To understand the 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 learn various testing, maintenance measures and risk management methods.
- To learn the Software quality management and configuration management concepts.

### 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", Mc Graw-Hill International Edition, Seventh Edition, 2010.
2. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International, 2<sup>nd</sup> edition, 2006.

**References :**

1. Ian Sommerville, "Software Engineering", Pearson Education Asia, 9th Edition, 2011.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning Private Limited, Third Edition, 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
<b>CO1</b>	1	1	-	-	-	-	-	-	1	-	1	-
<b>CO2</b>	1	1	2	-	-	-	-	-	-	-	-	-
<b>CO3</b>	1	2	2	-	-	-	-	-	-	-	-	-
<b>CO4</b>	1	1	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	1	1	-	-	1	1	-	-	-	-	-	-

<b>22DSPC403</b>	<b>OPERATING SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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	-	-	-	-	-	-	-	-	-

22DSPC404	DATA BASE TECHNOLOGY	L	T	P	C
		3	0	0	3

### Course Objectives:

- To understand the fundamental concepts of DBMS, E-R Diagrams, Relational model and SQL.
- To disseminate the knowledge on various Normal Forms.
- To inculcate the fundamentals of transaction management and Query processing.
- To give an introduction on 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. RamezElmasri, 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	-	-	-	-	-	-	-	-	-	-	-

22DSPC405	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

#### Course Objectives:

- To understand the variables, conditionals, loops, recursion and function calls in Python.
- To use basic data structures such as List, Dictionary and be able to manipulate text files and images.
- To learn the object oriented concepts in Python.
- To acquire skills in database and GUI programming through 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-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 aFunction –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 – Newsgroup – 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”, Prentice Hall, 2012.
3. Jeeva Jose, “Taming Python by Programming”, Khanna Publishing House, 1st edition, 2017.
4. J.Jose, “Introduction to Computing and Problem Solving with Python”, Khanna Publications, 1st edition, 2015.
5. ReemaThareja, “Python Programming”, Pearson, 1st 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
<b>CO1</b>	1	-	1	-	-	-	-	-	-	-	-	-
<b>CO2</b>	2	1	-	-	1	-	-	-	-	-	-	-
<b>CO3</b>	1	2	-	-	1	-	-	-	-	-	-	-
<b>CO4</b>	1	2	2	1	-	-	-	-	-	-	-	-
<b>CO5</b>	1	2	3	1	2	-	-	-	1	-	-	2

22DSPC406	DATA SCIENCE	L	T	P	C
		3	0	0	3

#### COURSE OBJECTIVES:

- To understand the core activities of data analysis.
- To acquire knowledge on Models and Inferencing..
- To study the concepts of data science.
- To learn the mechanisms for data storage, wrangling, and aggregation.

#### UNIT - I Epicycles of Analysis

Setting the Scene - Epicycle of Analysis - Setting Expectations - Collecting Information - Comparing Expectations to Data -Applying the Epicycle of Analysis Process. Exploratory Data Analysis

**Exploratory Data Analysis Checklist:** A Case Study -Formulate your question- Read in your data - Check the Packaging - Look at the Top and the Bottom of your Data - ABC: Always be Checking Your “n”s - Validate With at Least One External Data Source - Make a Plot - Try the Easy Solution First.

#### UNIT –II Using Models to Explore Your Data

Models as Expectations - Comparing Model Expectations to Reality - Reacting to Data: Refining Our Expectations - Examining Linear Relationships - When Do We Stop? -Summary. Inference: A Primer - Identify the population - Describe the



sampling process - Describe a model for the population - A Quick Example - Factors Affecting the Quality of Inference - Example: Apple Music Usage - Populations Come in Many Forms.

### **UNIT – III Arrays and Data Structures in Python**

Arrays and Vectorized Computation – Multidimensional Array object – Fast element-wise array functions – data processing using arrays - Data Structures – Series, Data Frame – Index Objects - Essential Functionality – Summarizing and Computing Descriptive Statistics – Handling Missing Data – Hierarchical Indexing.

### **UNIT –IV Data Storage and Wrangling**

Data Loading, Storage, File Formats: Reading Writing data in text format – binary data format – interacting with HTML and We API – Interacting with databases - Data Wrangling: Clean, Transform, Merge and Reshape - Combining and Merging Data sets – Reshaping and Pivoting – Data Transformation – String Manipulation.

### **UNIT – V Plotting and Data Aggregation**

Plotting and visualization – figures and subplots – line plots, bar lots, histograms, density plots, scatter plots- Data Aggregation and Group Operations – Group by Mechanisms – Data Aggregation – Group-wise operations and transformations – Pivot Tables and Cross Tabulation.

#### **Text Books:**

1. Roger D. Peng and Elizabeth Matsui, “ The Art of Data Science -A Guide for Anyone Who Works with Data”, Skybrude Consulting, LLC, 2015.
2. Wes McKinney, “Python for Data Analysis”, O’Reilly, First Edition, 2012.

#### **References:**

1. Jorl Gurus, “Data Science from Scratch”, O’Reilly, First Edition, 2015.
2. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, First Edition, 2016.
3. Samir Madhavan, “Mastering Python for Data Science”, PACKT Publishing, 2015.
4. Alberto Boschetti, Luca Massaron, “Python Data Science Essentials”, PACKT Publishing, Third Edition, 2018.
5. Gopi Subramanian, “Python Data Science Cookbook”, PACKT Publishing, 2015.

#### **COURSE OUTCOMES:**

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

1. Summarize the core activities of data analysis.
2. Describe the process of using a model to explore data and make inferences.

3. Describe the data structures suitable for handling data.
4. Apply data cleaning and transformation techniques on datasets.
5. Create simple visualization plots of 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	2	1	-	2	-	-	-	-	-	-	2
CO3	1	1	1	-	2	-	-	-	-	-	-	-
CO4	3	2	2	2	-	1	-	-	-	-	-	-
CO5	2	2	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 Karam chand Gandhi
- 5 Small is Beautiful - E. F Schumacher.
- 6 Slow is Beautiful - Cecile Andrews
- 7 Economy of Permanence - J C Kumarappa
- 8 Bharat Mein Angreji Raj – Pandit Sunderlal
- 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

22DSCP408	OPERATING SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

#### Course Objectives:

- To understand the basic concepts such as techniques, management of operating systems.
- To understand Operating System features and its difference from structured design.
- To use the UNIX as a modeling and communication utilities.
- To utilize the step of the process to produce better software.

#### LIST OF EXERCISES

1. Job scheduling techniques.
2. Disk scheduling techniques.
3. Memory allocation techniques.
4. Memory management techniques.
5. Page replacement techniques.
6. Producer consumer problem.
7. Bankers' algorithm.
8. Dining Philosophers problem.
9. Write a shell script to perform the file operations using UNIX commands.
10. Write a shell script to perform the operations of basic UNIX utilities.
11. Write a shell script for arrange 'n' numbers using 'awk'.
12. Write a shell script to perform  ${}^n C_r$  calculation using recursion.
13. Write a shell script to sort numbers and alphabetic from a text file using single 'awk' command.

14. 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.
15. Write a Shell script to display the numbers between 1 and 9999 in words.
16. Write a Shell script for Palindrome Checking.

**Course Outcomes :**

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

1. 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

22DSCP409	DATABASE TECHNOLOGY LAB	L	T	P	C
		0	0	3	1.5

**Course Objectives :**

- To understand basic database concepts, including the structure and operation of the relational data model.
- To construct simple and moderately advanced database queries using Structured Query Language (SQL).
- To understand and successfully apply logical database design principles, including E-R diagrams and database normalization.
- To design and implement a small database project.

**LIST OF EXERCISES**

1. Implementation of queries for student data base.
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, Roll back.
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, not exist.
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
<b>CO1</b>	2	2	-	-	-	-	-	-	-	-	-	-
<b>CO2</b>	2	2	2	3	-	-	-	-	-	-	-	-
<b>CO3</b>	2	2	-	-	-	-	-	-	-	2	-	2

<b>22DSCP410</b>	<b>DATA SCIENCE 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 learn to implement the concepts of data science through Python programs.
- To load various kinds of data and display them in various formats for better understanding.
- To learn to collect, explore, clean, munge and manipulate data.
- To understand how statistics and probability is used in data science applications.

**LIST OF EXERCISES****(The exercises are to be done in Python)**

1. Study of Python Data Science Environment (NumPy, SciPy, matplotlib, Pandas, Scikit-learn).
2. Operations on Python Data Structures.
3. Reading data from various sources (Text files, CSV files, Excel files, HTML/XML files, JSON files).
4. Exploring data through simple visualization tools like charts and graphs using matplotlib.
5. Data cleansing operations for handling missing data.
6. Data Wrangling (Filtering, Pivoting dataset, Melting Shifted Datasets, Merging Melted data, Concatenating data, Exporting Data).
7. Data Aggregation (Grouping, Group wise operations and transformations).
8. Data Transformations (Rescaling and Dimensionality Reduction).
9. Measuring Central Tendency, Variability and Correlation.
10. Creating, Plotting and Understanding Probability Distributions.
11. Hypothesis Testing.
12. Creating and Displaying Geographic Maps.
13. Handling Graph Data.
14. Creating and Displaying Heat Maps.
15. Developing a simple spam filter application.

**Course Outcomes :**

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

1. Experiment the various data structures and libraries in Python for data science programming.
2. Conduct and present statistical measurements, hypothesis and tests on data.
3. Develop practical applications covering the concepts of Data Science.

**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	-	-	-	-	-	-	-	-
<b>CO3</b>	2	2	-	-	-	-	-	-	-	2	-	2

<b>22DSPC501</b>	<b>MAPREDUCE PROGRAMMING WITH HADOOP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- To acquire the basics of Hadoopv2 configuration and administration.
- To understand concepts of Map Reduce design patterns namely summarization, filtering, data organization, join, output and Meta patterns.
- To develop Map Reduce applications.



- To solve real-time problems such as simple analytics, classifications, finding relationships, online marketing recommendations, massive text data processing and searching using Map Reduce.

### **UNIT -I Hadoopv2 Configuration and Administration**

Hadoop v2 : Introduction - Setting up Hadoop v2 in local machine - Writing a Word Count MapReduce application, bundling it, and running it using the Hadoop local mode - Adding a combiner step to the Word Count MapReduce program - Setting up HDFS - Setting up Hadoop YARN in a distributed cluster environment using Hadoop v2 - Setting up Hadoop ecosystem in a distributed cluster environment using a Hadoop distribution - HDFS command-line file operations - Running the Word Count program in a distributed cluster environment - Using Hadoop YARN on Cloud Environments - Hadoop Configurations, Unit Tests, and Other APIs.

### **UNIT- II MapReduce Design Patterns I**

Summarization Patterns: Numerical Summarizations - Inverted Index Summarizations - Counting with Counters - Filtering Patterns: Filtering - Bloom Filtering - Top Ten Examples - Data Organization Patterns: Structured to Hierarchical - Partitioning - Binning - Total Order Sorting – Shuffling.

### **UNIT -III MapReduce Design Patterns II**

Join Patterns : A Refresher on Joins - Reduce Side Join - Replicated Join - Composite Join - Cartesian Product – Meta patterns : Job Chaining - Chain Folding - Job Merging - Input and Output Patterns : Customizing Input and Output in Hadoop - Generating Data - External Source Output - External Source Input - Partition Pruning.

### **UNIT -IV Developing Complex MapReduce Applications**

Introduction - Hadoop data types - Custom Hadoop Writable data type - Hadoop key type - Emitting data from a Mapper - Hadoop InputFormat- Adding support for new input data formats - Formatting the results of MapReduce computations – Hadoop OutputFormats - Writing multiple outputs - Intermediate data partitioning - Secondary sorting – sorting Reduce input values - Using Hadoop with legacy applications – Hadoop streaming - Adding dependencies between MapReduce jobs - Hadoop counters to report custom metrics.

### **UNIT -V Analytics and Applications Using MapReduce**

Analytics : Introduction - Simple analytics using MapReduce - Performing GROUP BY - Calculating frequency distributions and sorting - Plotting the results using gnuplot - Calculating histograms - Calculating Scatter plots - Parsing a complex dataset with Hadoop - Joining two datasets Applications : Content-based recommendations - Classification using the naïve Bayes - Assigning advertisements to keywords - Data preprocessing and De-duplicating data using Hadoop streaming and Python.

**Text Books :**

1. Thilina Gunarathne, “HadoopMapReducev2 Cookbook”, Second Edition, Packt Publishing Ltd., 2015.
2. Donald Miner and Adam Shook, “MapReduce Design Pattern”, O’Reilly Media Inc., First Edition, 2012.

**References :**

1. Garry Turkington, “Hadoop Beginner's Guide”, Packt Publishing Ltd., First Edition, 2013.
2. Tom White, “Hadoop: The Definitive Guide”, O’Reilly Media Inc., Fourth Edition, 2015.
3. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, “Professional Hadoop® Solutions”, Wrox, First Edition, 2013.
4. Srinath Perera, “Instant MapReduce Patterns – Hadoop Essentials How-to”, Packt Publishing Ltd., First Edition, 2013.
5. Kevin Schmidt and Christopher Phillips, “Programming Elastic MapReduce”, O’Reilly Media Inc., First Edition, 2013.
6. <https://data-flair.training/blogs/hadoop-mapreduce-tutorial/> - “Hadoop MapReduce Tutorial, A Complete Guide to Map Reduce”, Data flair Team · Published on November 23, 2016 · Updated on November 14, 2018.

**Course Outcomes :**

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

1. Configure and administer Hadoop v2, Hadoop YARN, and HDFS clusters and deploy clusters to cloud environments.
2. Design MapReduce patterns such as summarization patterns, filtering patterns, and data organization patterns.
3. Develop MapReduce patterns such as join patterns, metapatterns, output Patterns.
4. Solve large-scale analytics problems using MapReduce-based applications.
5. Tackle complex problems such as classifications, finding relationships, online marketing recommendations, massive text data processing and searching using Hadoop MapReduce.

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	1	-	-	1	-	-	-	-	-	-	-
<b>CO3</b>	1	2	-	-	1	-	-	-	-	-	-	-
<b>CO4</b>	1	2	2	1	-	-	-	-	-	-	-	-
<b>CO5</b>	1	2	3	1	2	-	-	-	1	-	-	2

22DSPC502	DATA VISUALISATION	L	T	P	C
		3	0	0	3

**COURSE OBJECTIVES:**

- To understand the concepts and significance of data visualization.
- To learn the visualization idioms and map data attributes to graphical attributes.
- To evaluate the effectiveness of visualization designs.
- To comprehend the considerations in information dashboard design.

**UNIT - I Introduction**

Visualization Definition and Need – Data Abstraction – Data Semantics and Types - Data Types – Dataset Types (DL) – Attribute Types – Semantics – Task Abstraction – Analyze tasks abstractly – Actions – Targets – Analyzing and Deriving.

**UNIT - II Analysis**

Four levels for Validation – Reasons to Validate – Four levels of Design – Angles of Attack – Threats to Validity – Validation Approaches – Validation Examples – Marks and Channels – Defining Marks and Channels – Using Marks and Channels – Channel Effectiveness – Relative versus Absolute Judgements – Rules of Thumb to be followed – No unjustified 3D - No unjustified 2D – Eyes beat memory – Resolution over Immersion – Overview, Zoom, Filter, Details on demand – Responsiveness is required – Get it Right in Black and White.

**UNIT - III Tables and Spatial Data**

Arrange by Keys and Values – Express: Quantitative Values – Separate, Order, and Align: Categorical Regions – Matrix Alignment: Two Keys – Volumetric Grid: Three Keys – Recursive Subdivision: Multiple Keys – Spatial Axis Orientation – Spatial Layout Density – Arrange Spatial data – Geometry – Scalar Fields: One Value – Vector Fields: Multiple Values – Tensor Fields: Many Values.

**UNIT - IV Networks, Trees, Map Color**

Connection: Link Marks – Matrix Views - Connection versus Matrix – Containment: Hierarchy Marks – Map Color and Other Channels – Color Theory – Color maps – Other Channels – Reduce items and attributes – Reasons to Reduce - Filter – Aggregate – Manipulate View – Reasons for Change - Change View over Time – Select Elements – Navigate: Changing Viewpoint, Reducing Attributes. Embed: Elide—Superimpose--Distort

**UNIT – V Information Dashboard Design**

Dashboards – Purpose – Importance – Reasons for Failure – Common Mistakes in Dashboard Design – Assessing what is needed from dashboards – Fundamental considerations in dashboard design.

**Text Books:**

1. Tamara Munzner, “Visualization Analysis and Design”, CRC Press, 2014.
2. Stephen Few, “Information Dashboard Design: Displaying Data for At-a-glance Monitoring”, Analytics Press, Second Edition, 2013.

**References:**

1. Ben Fry, “Visualizing Data”, O’Reilly, 2008.
2. Andy Kirk, “Data Visualization: A Successful Design Process”, PACKT Publishing, 2012.
3. Alexander Telea, “Data Visualization Principles and Practice”, CRC Press, Second Edition, 2014.
4. Julia Steele, Noah Ilinsky, “Beautiful Visualization: Looking at Data through the Eyes of Experts”, O’Reilly, 2010.
5. Karl Pover, “Learning Qlik View Data Visualization”, PACKT, 2013.
6. Stephen Few, “Show Me the Numbers: Designing Tables and Graphs to Enlighten”, Analytics Press, Second Edition, June 2012.

**Course Outcomes:**

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

1. Design and create data visualizations.
2. Apply data transformations such as aggregation and filtering for visualization.
3. Evaluate choice of colour and visual encoding suitable for visualization.
4. Build visual presentations of wide variety of data for effective communication.
5. Use knowledge of perception and cognition to design information dashboards.

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	2	-	-	1	-	-	-	-	-	-	-
CO4	2	2	2	1	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-

22DSPC503	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	-	-	-	-	-	-	-	-	-	-

22DSPC504	MACHINE LEARNING				L	T	P	C
					3	0	0	3

### Course Objectives:

- To introduce the fundamental concepts of machine learning and its applications
- To learn the classification, clustering and regression based machine learning algorithms
- To understand the deep learning architectures
- To understand the methods of solving real life problems using the machine learning techniques

**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 back propagation neural network - k-nearest-neighbor rule. Support vector machine: multi category 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. Francois Chollet, “Deep Learning with Python”, Manning Publications, Shelter Island, New York, 2018.
2. R. O. Duda, E. Hart, and D.G. Stork, “Pattern classification”, John Wiley & Sons, Second edition, Singapore, 2012.

**References :**

1. Ethem Alpaydin, “Introduction to Machine Learning”, Third 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”, Apress, 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 Programme 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	-	-	-	-	-	-	-

22DSCP508	MAP REDUCE PROGRAMMING WITH HADOOP LAB	L	T	P	C
		0	0	3	1.5

### Course Objectives :

- To learn how to setup standalone Hadoopv2 on a local machine, Hadoop YARN and Hadoop ecosystem in a distributed cluster environment and HDFS.
- To gather knowledge to execute HadoopMapReducev2 computations on standalone Hadoopv2 on a local machine and distributed cluster environment.
- To understand how to run HadoopMapReducev2 computations using Amazon Elastic MapReduce cloud environment.
- To perform simple analytics, accomplish mass text data processing and develop applications such as classifications, recommendations and finding relationships.

### LIST OF EXERCISES

1. Study on setting up standalone Hadoopv2 on a local machine and Hadoop YARN in a distributed cluster environment.
2. Write a MapReduce application to count the number of occurrences of words in a dataset and run it using the Hadoop local mode.
3. Write a MapReduce application to count the number of occurrences of words in a dataset and run it in the Hadoop distributed cluster environment.
4. Execute Word Count MapReduce application (count the number of occurrences of words in a dataset) on Amazon Elastic MapReduce (EMR).
5. Write a MapReduce application to calculate simple aggregate metrics about the weblog dataset.
6. Write a MapReduce application to group web server log data and calculate histogram and other analytics.
7. Write a MapReduce application to calculate frequency distributions; the number of hits received by each URL.
8. Write a MapReduce application to calculate the correlation between two datasets using scatter plots.



9. Write a MapReduce application to parse the Tomcat e-mail list dataset that has complex data format using Hadoop by writing an input formatter.
10. Write a MapReduce application to join two MBOX-formatted e-mail datasets.
11. Write a MapReduce application to perform content-based recommendations for the Amazon product co-purchasing network metadata dataset.
12. Write a MapReduce application to assign advertisements to keywords using the AdWords balance algorithm for the Amazon product co-purchasing network metadata dataset.
13. Write a MapReduce application to clean and extract data from the 20news dataset and store the data as a tab-separated file and remove duplicate mail records using Python.

**Course Outcomes :**

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

1. Install standalone Hadoop v2 on a local machine and Hadoop YARN in a distributed cluster environment.
2. Execute MapReduce applications on Amazon Elastic MapReduce.
3. Formulate new solutions for programming problems or improve existing code using learned MapReduce techniques.

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

22DSCP509	DATA VISUALISATION LAB	L	T	P	C
		0	0	3	1.5

**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

<b>22DSCP510</b>	<b>MACHINE LEARNING LABORATORY</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 understand the Gaussian densities and its implementation using Python
- To implement classification, clustering and regression algorithms in Python.
- To implement the convolution neural network architecture using Python
- To solve the challenging research problems in the area of Speech and Image processing

**LIST OF EXERCISES**

1. Linear and logistic regression with error estimation
2. Implementation of univariate and multivariate Gaussian densities
3. Dimensionality reduction using principal component analysis (PCA)
4. Clustering using
  - a) k-means
  - b) Gaussian mixture modeling (GMM)
5. Classification using
  - a) Back propagation neural network (BPNN)
  - b) Support vector machine (SVM)
6. Construction of decision tree and random forest
7. Implementation of convolution neural network (CNN)
8. Sequence prediction using recurrent neural network (RNN)
9. Isolated-word speech recognition
10. Face detection and tracking

## 11. Object recognition

**Course Outcomes :**

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

1. Understand the basic concepts of machine learning.
2. Design and implement the classification, clustering and regression algorithms using Python.
3. Design and implement methods for solving real life problems using a suitable machine learning technique.

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	-	2	-	-	-	-	-	-	-	-
CO3	2	2	-	1	-	-	-	-	-	2	-	2

22DSPC601	DATA ANALYSIS WITH R	L	T	P	C
		3	0	0	3

**Course Objectives :**

- Gain a thorough understanding of statistical reasoning and sampling theory and Employ hypothesis testing to draw inferences from your data.
- Learn Bayesian methods for estimating parameters and Train regression, classification, and time series models.
- Handle missing data gracefully using multiple imputation; Identify and manage problematic data points.
- Learn how to scale your analyses to larger data with Rcpp, data.table, dplyr, and parallelization.

**UNIT – I Introduction to Data and its Relationship**

Basics: Navigating the basics - Getting help in R – Vectors – Functions – Matrices - Loading data into R - Working with packages. The Shape of Data: Univariate data - Frequency distributions - Central tendency – Spread. - Populations, samples, and estimation - Probability distributions - Visualization methods. Describing Relationships: Multivariate data - Relationships between a categorical and continuous variable - Relationships between two categorical variables - The relationship between two continuous variables - Visualization methods.

**UNIT - II Probability and Hypothesis Testing**

Basic probability – Sampling from distributions – The normal distribution. Using Data to Reason: Estimating means - The sampling distribution - Interval estimation - Smaller samples. Testing Hypotheses: The null hypothesis significance testing framework - Testing the mean of one sample - Testing two means - Testing more than two means - Testing independence of proportions.

**UNIT – III Bayesian Methods and Bootstrap:**

Bayesian Methods: The big idea behind Bayesian analysis - Choosing a prior - Who cares about coin flips - Enter MCMC – stage left - Using JAGS and run jags - Fitting distributions the Bayesian way - The Bayesian independent samples t-test. The Bootstrap: Performing the bootstrap in R - Confidence intervals - A one-sample test of means - Bootstrapping statistics other than the mean - Busting bootstrap myths.

**UNIT - IV Predictive Analysis**

Predicting Continuous Variables: Linear models - Simple linear regression - Simple linear regression with a binary predictor - Multiple regression - Regression with a non-binary predictor - Kitchen sink regression - The bias-variance trade-off - Linear regression diagnostics. Predicting Changes with Time: Creating and plotting time series – Components of time series – Time series decomposition – White noise – Autocorrelation - Smoothing – ETS and the state space model – Interventions for improvement. Predicting Categorical Variables: k-Nearest neighbors - Logistic regression - Decision trees - Random forests - Choosing a classifier.

**UNIT - V Implementation of Data Analysis**

Sources of Data: Relational databases – Using JSON – XML – Other data formats – Online repositories. Dealing with Missing Data: Analysis with missing data – Visualizing missing data – Types of missing data – Unsophisticated methods for dealing with missing data. Dealing with Messy Data: Checking unsanitized data - Regular expressions - Other tools for messy data. Dealing with Large Data: Wait to optimize - Using a bigger and faster machine - Be smart about the code - Using optimized packages - Using another R implementation - Using parallelization - Using Rcpp. Working with Popular R Packages: The data. Table package - Using dplyr and tidyr to manipulate data - Functional programming as a main tidyverse principle - Reshaping data with tidyr. Reproducibility and Best Practices: R scripting - R projects - Version control - Communicating results.

**Text Book :**

1. Tony Fischetti, “Data Analysis with R”, O’Reilly Packt Publisher, Second Edition, 2018.

**References :**

1. Richard Cotton, “Learning R: A Step-by-Step Function Guide to Data Analysis”, O’Reilly Media, First Edition, 2013.
2. Dr. Bharti Motwani, “Data Analytics with R”, Willey, First Edition, 2019.

- Joseph Schmuller, "Statistical Analysis with R for Dummies", Dummies First Edition, 2017.
- Hadley Wickham, "R for Data Science", O'Reilly, First Edition, 2016.

**Course Outcomes :**

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

- Get the knowledge about the data and its relationship by applying various statistical methods.
- Acquire the knowledge on probability and different testing hypothesis testing methods.
- Analyze different Bayesian methods to test the sample taken independently.
- Apply the predictive analysis by various regression statistical methods.
- Apply various statistical methods for analysis of the real world data using R language.

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

22DSPC602	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To know the fundamentals of cloud computing.
- To acquire the knowledge of cloud computing technologies and architecture.
- To be familiar with cloud services and applications of cloud computing.
- To understand the role of Networks in Cloud Computing

**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, 1st Edition, 2013.

### **References :**

1. Michael Miller, “Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate”, Que Publishing, 1st Edition, 2008.
2. D Anthony T Velte, Toby J Velte and Robert Elsenpeter, “Cloud Computing : A Practical Approach”, Tata McGraw-Hill, 1st Edition, 2010.
3. John Ritting house& James Ransome, “Cloud Computing, Implementation, Management and Strategy”, CRC Press, 1st Edition, 2010.

### **Course Outcomes :**

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

1. Explain the fundamentals and technologies of cloud computing.
2. Describe the role of networks in cloud computing.
3. Address different cloud architectures and cloud services.
4. Explore various applications by integrating the cloud services.
5. Fundamentals of Web services.

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	-	-	-	-	-	-	-

<b>22DSCP607</b>	<b>DATAANALYSIS WITH R 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 :

- Gain a thorough understanding of statistical reasoning and sampling theory and Employ hypothesis testing to draw inferences from your data.
- Learn Bayesian methods for estimating parameters, and Train regression, classification, and time series models.
- Handle missing data gracefully using multiple imputation; Identify and manage problematic data points.
- Learn how to scale your analyses to larger data with Rcpp, data.table, dplyr, and parallelization

### LIST OF EXERCISES

1. Write a function that takes two matrices as arguments and returns a logical value representing whether the matrices can be matrix multiplied.
2. Find a free dataset on the web, download it, and load it into R. Explore the structure of the dataset.
3. Write an R function to compute the interquartile range.
4. For each species of iris, find the correlation coefficient between the sepal length and width. Are there any differences? How did we just combine two different types of the broad categories of bivariate analyses to perform a complex multivariate analysis?
5. Download a dataset from the web, or find another built-into-R dataset that suits your fancy (using `library(help = "datasets")`). Explore relationships between the variables.
6. Write a function that takes a vector and returns the 95 percent confidence interval for that vector. You can return the interval as a vector of length two: the lower bound and the upper bound. Then, parameterize the confidence coefficient by letting the user of your function choose their own confidence level, but keep 95 percent as the default. Hint: the first line will look like this: `conf.int <- function(data.vector, conf.coeff=.95)`
7. Read about data-dredging and p-hacking and formulate a hypothesis, set an alpha level, and set a sample size before collecting data and analyzing results?
8. Use the `library(help="datasets")` command to find a list of datasets that R has already inbuilt. Pick a few interesting ones and form a hypothesis about each one. Rigorously define your null and alternative hypotheses before you start. Test those hypotheses even if it means learning about other statistical tests.

9. Write a function that will take a vector holding MCMC samples for a parameter and plot a density curve depicting the posterior distribution and the 95% credible interval. Be careful of different scales on the y-axis.
10. Examine the various distributions on chosen data sets.
11. Examine and plot the pressure dataset, which describes the relationship between the vapour pressure of mercury and temperature. What assumption of linear regression does?
12. Write a function called `dt_table` similar to the `table` function in base R. The arguments will be a `data.table`, and a string specifying a column name. Do the same thing for `tibbles` and call it `dp_table`.

### Course Outcomes :

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

1. The power and domain-specificity of R allows the user to express complex analytics easily, quickly, and succinctly.
2. Solve the difficulties relating to performing data analysis in practice and find solutions to working with messy data, large data, communicating results, and facilitating reproducibility.
3. Starting with the basics of R and statistical reasoning, into an advanced predictive analytics.

### Mapping of Course Outcomes with Programme Outcomes

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

22DSCP608	CLOUD COMPUTING LAB	L	T	P	C
		0	0	3	1.5

### Course Objectives :

- To learn how to create a warehouse application in cloud environment.
- To learn Apex Programming language for creating cloud applications.
- To study and implement SOAP web services and para - virtualization.
- To create, install, configure and manage Hadoop services.

### LIST OF EXERCISES

1. Introduction to cloud computing.
2. Creating a Warehouse Application in Salesforce.com.
3. Creating an Application in Salesforce.com using Apex programming Language.
4. Implementation of SOAP Web services in C#/JAVA Applications.



5. Implementation of Para-Virtualization using VM Ware's Workstation/ Oracle's Virtual Box and Guest O.S.
6. Installation and Configuration of Hadoop.
7. Create an application (Ex: Word Count) using Hadoop Map/Reduce.
8. Case Study: PAAS(Facebook, Google App Engine)
9. Case Study: Amazon Web Services.

### Course Outcomes :

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

1. Design and create warehouse application.
2. Have practical knowledge on SOAP and para virtualisation.
3. Use Paas services Facebook, Google App Engine and AWS.

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

22ETHS701	ETHICS IN DATA ANALYTICS				L	T	P	C
					2	0	0	2

### Course Objectives :

- To understand engineering ethics, moral and legal issues.
- To use data science to reduce risk for peace and prosperity.
- To understand the moral and ethical dimensions in data analysis.
- To discuss how data is appropriately used and how to address misuse.

### 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 Ethics Experiments & Examples

Engineers as responsible – Experimenters – Research Ethics – Codes of Ethics – Industrial Standards. A well Balanced Outlook on Law – The Challenger Case Study. 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 – III Loyalty and Intellectual Property**

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination. Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

**UNIT – IV Good Data Science**

Ethics and Data Science – Doing Good data Science - Five Cs – Consent, Clarity, Consistency and trust, Control and transparency, Consequences – Implementing Five C’s.

**UNIT – V Future with Data Science Ethics**

Ethics and Security Training - Developing Guiding Principles - Building Ethics into a Data-Driven Culture - Regulation - Building Our Future - Case studies.

**Text Books :**

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, New York, 2005.
2. DJ Patil, Hilary Mason, Mike Loukides, “Ethics and Data Science”, O’Reilly Media, Inc., July 2018. ISBN: 9781492043898

**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.
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, 2001.
5. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, 2003.
6. Viktor Mayer-Schönberger, Kenneth Cukier, “Big Data: A Revolution That Will Transform How We Live, Work, and Think”, Houghton Mifflin Harcourt, 2013
7. Bruce Schneier, “Data and Goliath: The Hidden Battles to Collect Your Data and Control Your World”, W.W. Norton, Feb-2016.
8. Marc Goodman, “Future Crimes: Everything Is Connected, Everyone Is Vulnerable and What We Can Do About It”, Penguin Random House, 2016

**Course Outcomes :**

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

1. Understand data, legal and ethical and technological aspects
2. Understand the Risk analysis in Ethics.
3. Understand the relationship between the data and fair practices.
4. Learn the importance of decisions for public good.
5. Achieve data driven culture.

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

22DSPC702	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

### Course Objectives :

- To understand the fundamental concepts of Internet of Things.
- To introduce network and communication protocols of IoT.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real world scenario

### 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, Challenges and applications of IoT

Network and communication aspects: Wireless medium access issues-MAC protocol survey, Survey routing protocols – Sensor deployment & Node discovery – Data aggregation & dissemination - Design challenges- Development challenges-Security challenges- Other challenges- Applications of IoT- Home automation, Industry applications, Surveillance applications- Other IoT applications

### UNIT –III Microcontrollers

Architecture of 8031/ 8051- Introduction to 16 bit Microcontroller- Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation.

### UNIT – IV Raspberry PI with Python and Arduino

Introduction to Python – Building IoT with RASPERRY Pi – IoT Systems-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.

### UNIT –V Development of 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 Madiseti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”, Orient Blackswan Pvt., Ltd., NewDelhi,2015.
2. Walteneus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks :Theory and Practice",A John Wiley and Sons, Ltd.,Publication,2010.

#### References :

1. Jeeva Jose, “Internet of Things”,(ISBN:978-93-86173-591)KBPHouse,1<sup>st</sup> edition,2018.
2. Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education, 2017.
3. Cuno Pfister, “Getting Started with the Internet of Things”, O Reilly Media, 2011.

### COURSE OUTCOMES:

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

1. Understand the concepts of Internet of Things.
2. Analyze basic protocols in wireless sensor network.
3. Design IoT applications in different domain and be able to analyze their performance.
4. Implement basic IoT applications on embedded platform.
5. Explore IoT using Rasperry Pi and Arduino.

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

22DSCP706	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 of various sensors in IoT.
- To know how to use various tools in IoT for designing applications.
- To develop simple IoT applications

**LIST OF EXERCISES**

1. Alphanumeric LCD interface using 8051.
2. Study of ARM evaluation system.
3. Flashing of LEDs using ARM (LPC48).
4. Interfacing keyboard and LCD using ARM (LPC48).
5. Temperature sensor interface using ARM (LPC48).
6. Identifying Moisture content in Agricultural Land.
7. Fire Alarm Indicator.
8. Basic Home Automation.
9. How to Control PWM Signals.
10. Designing a Calculator using NumPi.
11. Designing Game using PyGame.
12. Designing frontend GUI using TKinter.
13. Identification of Earthquake.
14. Implementation of sorting mechanism.
15. Accessing GPIO using Google Assistance.
16. Uploading data to cloud and monitoring in cloud.
17. Connecting social media (twitter).

**Course Outcomes :**

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

1. Comprehend the basic elements of Microcontroller Programming.
2. Use Raspberry Pi3 in Peripheral and in Trouble shooting.
3. Evaluate networking technologies for application within IoT.

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

22ETIT707	SEMINAR/INDUSTRIAL TRAINING	L	TR	S	C
		0	1	2	4

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

### Course Objectives :

- To work/train on a technical topic/field work related to Data Science to acquire the ability of written/oral presentation and to have a practical knowledge in carrying out the Data Science related problems.
- To acquire the ability of writing technical papers for Conferences.
- To train and develop skills in solving problems during execution of the problems related to Data Science.
- To make the students to get hands on working experience in reputed concerns.

The students will work for two periods per week guided by student counsellor. 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 Data Science 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 counsellor 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 Data Science 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. Face the audience and to interact during group discussion in the corporate interviews confidently.
2. Acquire the ability to work in the actual environment and to use the technical resources.
3. Apply prior acquired knowledge in problem solving and to demonstrate the use, interpretation and application of an appropriate international Data Science standard in a specific situation.
4. Analyze a given Data Science problem and to identify and implement appropriate problem solving methodology to propose a meaningful solution.
5. Present the solution acquired in the form of written and oral 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	-	-

22DSPV803	PROJECT WORK AND VIVA VOCE	L	PR	S	C
		0	10	2	6

**Course Objectives:**

- To develop the ability to identify a problem.
- To perform a literature review.
- To implement the problem and to analyze the results.
- To train the students in preparing project reports and to face reviews and viva voce examination.

**Course Outcomes:**

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

1. Takeup any challenging practical problems and find solution by formulating proper methodology.
2. Carry out any experiment based on Computer software and Hardware available.
3. Present the conclusions with understandability using appropriate tables and graph in the form of report.
4. Analyze any short coming while implementing a technical problem and to handle the same.
5. Implement any research problem in current thrust area using the gained practice knowledge.

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**

22DSPESCN	DISTRIBUTED SYSTEMS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To understand the fundamentals of Distributed System.
- To introduce the concepts of peer to peer systems and distributed system models.
- To understand the components and support required for distributed system.
- To understand the process management and resource management in distributed 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”, Pearson Education, 5<sup>th</sup> Edition, 2012.
2. Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.

**References :**

1. Tanenbaum A.S., Van Steen 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 knowledge on foundations of Distributed System.
2. Familiarize the idea of peer to peer services and file system.
3. Familiarize the components and support required for distributed system.
4. Acquire Knowledge on remote method invocation and objects.
5. Gain 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
<b>CO1</b>	2	-	-	-	-	-	-	-	-	-	-	-
<b>CO2</b>	2	1	-	1	-	-	-	-	-	-	-	-
<b>CO3</b>	2	1	1	1	-	-	-	-	-	-	-	-
<b>CO4</b>	2	-	-	1	-	-	-	-	-	-	-	-
<b>CO5</b>	1	-	-	-	-	-	1	-	-	-	-	-

<b>22DSPE SCN</b>	<b>DATA ENGINEERING</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives :**

- The objective of this course is to introduce data engineering and role of data engineers.
- Familiarize students with the basic and advanced techniques of data engineering, data modeling and data acquisition.

- To learn key techniques of the data modeling framework and Big data tools.
- To learn categories of API and data science projects using API.

### **UNIT - I Introduction**

Data Scientist vs Data Engineer vs Data Analyst – Definition of Data Engineering?– Explaining the Data Pipeline, Data Warehouse and Data Engineer Role – Explaining Data Engineering and Data Warehouse- Building Data Warehouse: Understanding the Data Pipeline – Beyond Data Warehousing: Big Data Engineering – The Role of Data Engineer –The Hierarchy of Analytics –Building Data Foundations & Warehouses – ETL: Extract, Transform, and Load – Choosing ETL Frameworks – Two Paradigms: SQL vs. JVM – Centric ETL.

### **UNIT - II Data Acquisition and Data Modelling**

Data Acquisition – Data Gathering and Preparation – Data Cleaning – Storage – Data Modeling, Normalization and Star Schema – Data Partitioning by Datestamp– Backfilling Historical Data – Defining the Directed Acyclic Graph (DAG) – Operators: Sensors, Operators and Transfers – ETL Best Practices to follow.

### **UNIT - III Data Engineering Frameworks and Big Data Tools**

A Common Scenario – From Pipelines To Frameworks – Design Patterns For Data Engineering Frameworks – Incremental Computation Framework – Backfill Framework – Global Metrics Framework – Experimentation Reporting Framework – Data Warehousing / Big Data Tools – Hadoop and MapReduce– Hive and PIG– Apache Spark

### **UNIT - IV Categories of API**

Overview – Categories of API – Difference between an API and a Library – Walk through an example – 5 APIs – Facebook API – Google Map API – Twitter API – IBM Watson API – Quandl API

### **UNIT - V Data science projects using API**

Data science projects using API – Social Media Sentiment Analysis – Introduction to Sentiment Analysis – Sentiment Analysis Use Cases – Sentiment Classification – Challenges of Sentiment Analysis– Opinion Mining – Applications – Challenges – Stock Prediction

### **Text Books :**

1. Laura La Bella, “Becoming a Data Engineer” The Rosen Publishing Group, Inc, 2017.
2. Brian Shive, “Data Engineering: A Novel Approach to Data Design”, Technics Publications, October 2013, ISBN: 9781935504603

### **References :**

1. Robert Chang, “A Beginner’s Guide to Data engineering — Part I, Data Engineering: The Close Cousin of Data Science”.

2. Robert Chang, “A Beginner’s Guide to Data Engineering — Part II,Data Modeling, Data Partitioning, Airflow, and ETL Best Practices”.
3. “A Beginner’s Guide to Data Engineering — The Series Finale, From ETL Pipelines to Data Engineering Frameworks”.
4. <https://www.altexsoft.com/blog/datascience/what-is-data-engineering-explaining-data-pipeline-data-warehouse-and-data-engineer-role/>
5. <https://www.analyticsvidhya.com/blog/2016/11/an-introduction-to-apis-application-programming-interfaces-5-apis-a-data-scientist-must-know/>
6. <https://data-flair.training/blogs/data-scientist-vs-data-engineer-vs-data-analyst/>
7. <https://blog.algorithmia.com/introduction-sentiment-analysis>

### Course Outcomes :

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

1. Acquire Knowledge on principles of data engineering
2. Study the data engineering design process to acquire data and develop data modeling methods for their evaluation
3. Explain data engineering frameworks and Big data tools
4. Understand the Categories of API
5. Learn and Understand data science projects using API

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	1	-	-	-	-	-	-	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	-
CO4	2	2	-	1	-	-	-	-	-	-	-	-
CO5	1	2	1	-	-	-	1	-	-	1	-	2

22DSPESCN	SCALA PROGRAMMING	L	T	P	C
		3	0	0	3

### Course Objectives:

- To get a solid understanding of the fundamentals of the language, the tooling, and the development process
- To understand the principles of functional programming
- To write purely functional programs using recursion, pattern matching, and higher-order functions
- To Combine functional programming with objects and classes

**UNIT - I Basics of Scala**

Introduction to Scala - Evolution of Scala - Features - The Scala Interpreter - Keywords, Identifiers, Comments, Data types, Variables, Constants, Control Statements, Decision making and Looping Statements - Working with Arrays, Functions - Normal and Higher Order functions, Currying - Procedures, Lazy values, Exceptions, Maps and Tuples.

**UNIT – II OOP concepts**

Classes - Simple classes and Parameterless Methods, Properties with Getters and Setters, Properties with only Getters, Object - Private Fields, Bean properties, Auxiliary Constructors, The Primary Constructor, Nested Classes. Objects - Singletons, Companion objects, Objects extending a class or Trait, The apply method, Application objects, Enumerations.

**UNIT – III Packages and Imports**

Packages - Scope Rules, Chained Package Clauses, Top-of-file Notation, Package objects, Visibility. Imports – Implicit Imports, Renaming and Hiding members.

Inheritance - Extending a class, Overriding methods, Type checks and casts, protected fields and methods, super class construction, overriding fields, Anonymous subclasses, abstract classes and fields, Construction order, inheritance hierarchy, object equality, Value classes.

**UNIT – IV: Files and Input - Output**

Reading characters lines, tokens and numbers - Reading binary and text files - Traits and Type Conversions - Using Collections, Working with Lists-Pattern matching.

**UNIT – V: Using Scala**

Extractors – Annotations – Concurrent programming – Combining Scala and Java – GUI programming.

**Text Books :**

1. Martin Odersky, “Lex Spoon and Bill Venner, Programming in Scala”, Artima Press, Third Edition, 2016.
2. Cay S. Horstmann, “Scala for the Impatient”, Addison Wesley, Second Edition, 2017.

**References :**

1. VenkatSubramaniam, “Programming Scala”, The Pragmatic Bookshelf, First Edition, 2009.
2. Dean Wampler and Alex Payne, ”Programming Scala”, O’Reilly, First Edition, 2009.
3. Alvin Alexander, Learning Functional Programming in Scala, O’Reilly, First Edition, 2017.
4. Alvin Alexander, “Scala Cookbook”, O’Reilly, First Edition, 2013.
5. Bhim P Upadhyaya, “Programming with Scala, Language Exploration”, Springer, First Edition, 2017.

**Course Outcomes :**

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

1. Master the basics of programming language Scala.
2. Understand the OOP concepts of Scala.
3. Obtain knowledge on Packages imported in Scala.
4. Study operations in files.
5. Perform Concurrent and GUI programming with Scala.

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	1	2	1	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	2	1	1	1	-	-	-	-	-	-	-	-
CO5	1	1	1	-	-	-	1	-	-	1	-	2

22DSPE SCN	NOSQL DATABASES	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To learn various NoSQL systems and their features.
- To compare NoSQL databases with each other in relational systems.
- To understand the impact of the cluster on database design.
- To know how to define objects, load data, query data and performance tune Graph NoSQL databases.

**UNIT - I Introduction to NOSQL**

Overview and History of NoSQL Databases - Definition of the Four Types of NoSQL Database - The Value of Relational Databases - Getting at Persistent Data – Concurrency – Integration - Impedance Mismatch - Application and Integration Databases - Attack of the Clusters - The Emergence of NoSQL - Comparison of relational databases to new NoSQL stores – MongoDB – Cassandra – HBASE - Neo4j.

**UNIT – II Data Models**

RDBMS approach - Challenges NoSQL approach - Key-Value and Document Data Models–Column Family Stores - Aggregate-Oriented Databases -Replication and sharding -MapReduce on databases - Distribution Models - Single Server –Sharding - Master-Slave Replication - Peer-to-Peer Replication - Combining Sharding and Replication.

**UNIT - III Document Database**

NoSQL Document databases using MongoDB -Introduction to Document Databases - Features Consistency - Transactions, Availability - Query Features – Scaling - Document Databases Terminology - Event Logging - Content Management Systems - Blogging Platforms - Web Analytics or Real-Time Analytics - E-Commerce Applications - Designing for Document Databases - Complex Transactions Spanning Different Operations - Queries against Varying Aggregate Structure.

**UNIT - IV Key Value Database**

NoSQL Key/Value databases using Riak -Introduction to Key-Value Databases -Key-Value Store Features Key value Databases Terminology -Storing Session Information - User Profiles – Preferences - Shopping Cart Data -Relationships among Data - Multioperation Transactions - Query by Data - Operations by Sets -Designing Key value Databases.

**UNIT - V Column and Graph Database**

Introduction to Column Family Database - Features Column Family Database Terminology - Event Logging - Content Management Systems - Blogging Platforms – Counters - Expiring Usage -Designing for Column Family Databases - Introduction to Graph Databases - Features Consistency – Transactions – Availability - Query Features – Scaling -Graph Database Terminology -Designing for Graph Databases -Connected Data – Routing – Dispatch - Location-Based Services.

**Text Books :**

1. Dan Sullivan, “NoSQL for Mere Mortals”, Addison – Wesley, Pearson Education, 2015.
2. Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence “, Addison - Wesley, 2012.

**References :**

1. Luc Perkins, Eric Redmond and Jim R. Wilson, “Seven Database in Seven Weeks : A Guide to Modern Databases and the NoSQL Movement”, The Pragmatic Bookshelf, 2<sup>nd</sup>Edition,2012.
2. Aaron Ploetz, Devram Kandhare, Sudarshan Kadambi and Xun (Brian) Wu “Seven NoSQL Databases in a Week: Get up and running with the fundamentals and functionalities of seven of the most popular NoSQL databases”,packt Publishing, 2018.
3. Gaurav Vaish, “Getting Started with NoSql”,Packt Publishing, 2013.
4. Adam Flower,”NoSQL for Dummies”, John Wiley & Sons Inc, 2015.

**Course Outcomes :**

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

1. Compare and Contrast NoSQL databases with each other and Relational Database Systems.
2. Knowledge of Replication, distribution, sharding, and resilience in a NoSQL database.

3. Demonstrate the knowledge of Document Databases.
4. Knowledge of Key-Value databases in NoSQL database.
5. Demonstrate the knowledge of Column Databases and Graph Database.

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	2	1	-	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	-	-	-	-	-
CO4	2	1	1	1	-	-	-	-	-	-	-	-
CO5	1	1	-	-	-	-	-	-	-	-	-	2

22DSPESC N	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 CRUD 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.
2. Santosh Kumar K, “Spring and Hibernate”, Mc.Graw Hill Education, 2<sup>nd</sup> Edition, 2013.
3. 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

22DSPESCN	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

### Course Objectives :

- To provide the Knowledge of Optimization techniques and approaches.
- To apply mathematical and computational needed for the practical utility of optimization techniques.
- To learn the various Genetic Algorithms.
- To teach about decision and replacement models.

### UNIT - I Linear Programming Problem

Introduction to Operations Research – Linear Programming - Mathematical Formulation – Graphical method – Simplex method – Penalty methods: M-method, Two Phase method – Duality.

### UNIT - II Transportation Problem

Introduction-Formulation-Solution of the transportation problem (Min and Max):Northwest Corner rule, row minima method, column minima method, least cost method, Vogel's approximation method –Optimality test :MODI method.

### UNIT - III Assignment and Sequencing Models

Assignment problems–Applications-Minimization and Maximization: Sequencing– Problem with Njobs and 2 machines–njobs and 3 machines problem–njobs and m machines problem.

### UNIT - IV Genetic algorithms

Basic concepts – working principle – encoding – different methods – fitness function – reproduction different methods. Genetic modeling – inheritance – Crossover mutation – convergence of genetic algorithm – Ant Colony Optimization algorithm – Particle Swarm Optimization.

**UNIT - V Game theory and Replacement models**

Game theory: Competitive games – Useful terminology – Rules for game theory–Two person zero sum game – Property of dominance – Graphic solution –Algebraic method. Replacement models: Replacement of items that deteriorate with time: No changes in the value of money,changes in the value of money – Items that fail completely: Individual replacement and group replacement policies.

**Text Books :**

1. Hamdy A Taha, “Operations Research: An Introduction”, Pearson Education, Inc., 9<sup>th</sup> edition 2014.
2. KantiSwarup, Gupta P.K., and Man Mohan, “Operations Research”, S.Chand& Sons, 18<sup>th</sup> edition, 2015.

**References :**

1. Hira D S and Gupta P K, “Operations Research, Revised edition”, S.Chand & Sons, 2014.
2. Manohar Mahajan, “Operations Research”, Dhanpat Rai & Co., 2013.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, “Neural Network, Fuzzy Logic and Genetic Algorithms”, Synthesis and Applications, PHI, 2003.
4. SingiresuS. Rao, “Engineering Optimization: Theory and Practice”, John Wiley and Sons, 2009.

**Course Outcomes :**

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

1. Illustrate the use of operations research models in Linear Programming problems.
2. Solve transportation and assignment problem for a wide range of applications.
3. Solve assignment and sequencing problems.
4. Analyze genetic algorithms and apply them for optimization.
5. Explain the concepts of game theory and replacement models.

**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	-	1	-	2	-	-	-	-	-	-	-
<b>CO4</b>	1	-	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	1	1	1	1	-	-	-	-	-	-	-	-

22DSPESCN	EXTRACT TRANSFORM & LOAD (ETL) TOOLS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To understand the Requirements and Architecture of ETL tools
- To analyze ETL basics, best practices and standards
- To acquaint the concepts in ETL data validation
- To learn about ETL scheduling

**UNIT - I Requirements, Realities, and Architecture**

Requirements - Business Needs - Compliance Requirements - Data Profiling - Security Requirements. Architecture- ETL Tool versus Hand Coding - The Back Room - Preparing the Data - The Front Room – Data Access - The Mission of the Data Warehouse - The Mission of the ETL Team.

**UNIT – II ETL Data Structures**

Data Structures in the ETL System - Flat Files - XML Data Sets - Relational Tables - Independent DBMS Working Tables - Third Normal Form - Entity/Relation Models - Non relational Data Sources-Dimensional Data Models - Fact Tables - Dimension Tables - Atomic and Aggregate Fact Tables-Surrogate Key Mapping Tables.

**UNIT - III Data Flow**

The Logical Data Map - Components of the Logical Data Map - Using Tools for the Logical Data Map - Collecting Business Rules in the ETL Process - Integrating Heterogeneous Data Sources - Transferring Data between Platforms - Handling Mainframe Data - Flat Files - XML Sources - Web Log Sources - W3C Common and Extended Formats - Name Value Pairs in Web Logs - ERP System Sources.

**UNIT – IV Dimension Tables and Fact Tables**

The Basic Structure of a Dimension - Dimensions - Date and Time Dimensions - Big Dimensions - Small Dimensions - One Dimension or Two - Dimensional Roles - Delivering Fact Tables - The Basic Structure of a Fact Table - Preparing for Loading Fact Tables - Loading the Data - Inserting Facts - Updating and Correcting Facts - Negating Facts - Updating Facts - Deleting Facts - Fact less Fact Tables - Multiple Units of Measure in a Fact Table - Late Arriving Facts

**UNIT - V Scheduling and Support**

ETL Scheduling - Scheduling Tools – Monitoring the ETL System - Measuring ETL Specific Performance – ETL System Security. Metadata - Defining Metadata - Types of Metadata - ETL Generated Metadata. Popular ETL tools: Features of Improvado - Skyvia - HEVO - Informatica - Power Center - IBM - Infosphere Information Server - Oracle Data Integrator.

**Text Book :**

1. Kimball R, Caserta J. “The data warehouse ETL toolkit: practical techniques for extracting, cleaning, conforming, and delivering data”, John Wiley & Sons, 1st Edition, 2011 Apr 27.

**References :**

1. Côté, Christian, Michelle Kamrat Gutzait, and Giuseppe Ciaburro, “Hands-on data warehousing with Azure Data Factory: ETL techniques to load and transform data from various sources, both on-premises and on cloud”, Packt Publishing Ltd, 2018.
2. Casters, Matt, Roland Bouman, and Jos Van Dongen, “Pentaho Kettle solutions: building open source ETL solutions with Pentaho Data Integration”, John Wiley & Sons, 2010.
3. <https://www.softwaretestinghelp.com/best-etl-tools/>

**Course Outcomes :**

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

1. Understand the requirements and architecture of ETL tools.
2. Understand the ETL data structures.
3. Learn how to handle main frame data.
4. Understand about dimensions and fact tables.
5. Understand the features of recent ETL tools.

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>	-	-	1	1	-	-	-	-	-	-	-	-
<b>CO3</b>	1	-	-	-	-	-	-	-	-	-	-	-
<b>CO4</b>	1	-	1	1	-	-	-	-	-	-	-	-
<b>CO5</b>	-	1	-	-	-	-	-	-	-	-	-	-

22DSPESCN	BUSINESS INTELLIGENCE	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To understand the types of Business Intelligence and business intelligence life cycle.
- To familiarize business intelligence environment and models
- Provide the context that influences performance metrics.
- Focus on business Data Design
- An exceptional BI system provides the foundation for better decision making

**Unit - I Introduction**

History and Evolution - Business Intelligence (BI) Segments - Difference between Information and Intelligence - Defining Business Intelligence Value Chain - Factors of Business Intelligence System - Real time Business Intelligence -Business Intelligence Applications - Business Intelligence Types: Types of Business Intelligence Tools - Modern Business Intelligence - The Enterprise Business Intelligence - Information Workers.

**Unit - II Business Intelligence Life Cycle**

Enterprise Performance Life Cycle (EPLC) - Framework Elements - Life Cycle Phases - Human Factors in BI Implementation - BI Strategy - Objectives and Deliverables - Transformation Roadmap - Building a transformation roadmap - BI Development Stages and Steps - Parallel Development Tracks - BI Framework

**Unit - III Business Intelligence Essentials**

Creating Business Intelligence Environment - Business Intelligence Landscape - Business Intelligence Platform-Dynamic roles in Business Intelligence - Roles of Business Intelligence in Modern Business - Challenges of BI - Business Intelligence User Model: Introduction - Business Intelligence Opportunity Analysis Overview - Content Management System - End User Segmentation-Basic Reporting and Querying - Online Analytical Processing - OLAP Techniques.

**UNIT - IV Business and Technical Needs**

The Business Demand for Data, Information and Analytics - Business and Technical Needs - Justifying BI: Business and Technical Needs - Defining Requirements-Business, Data and Quality - Data Design: Foundational Data Modelling - Dimensional Modelling.

**UNIT - V Data Design**

Business Intelligence Dimensional Modelling - Business Intelligence Design – Business Intelligence Applications - BI Design and Development - Organization People, Process and Politics – Project Management.

**Text Books :**

1. Efraim Turban, Ramesh Sharda, DursunDelen, “Decision Support Cambridge and Business Intelligence Systems”, 9 th Edition, Pearson 2013.
2. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann/Elsevier Publishers, 2013.

**References :**

1. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015.
2. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2015.

3. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.
4. David Loshin Morgan Kaufmann, "Business Intelligence: The Savvy Manager's Guide", Second Edition, 2012.

### Course Outcomes :

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

1. Link Big Data with Business Intelligence.
2. Provides practical guidelines for building successful BI solutions.
3. Describes best practices and pragmatic approaches for BI.
4. Communicate effectively in a variety of modes and contexts.
5. Build and enhance Business Intelligence capabilities by adapting the Appropriate Technology.

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	1	-	-	-	-	-	-	-	-
CO3	1	-	-	-	-	-	-	-	-	-	-	-
CO4	1	1	1	1	-	-	-	-	-	-	-	-
CO5	1	1	-	-	-	-	-	-	-	-	-	-

22DSPESCN	PROGRAMMING WITH SPARK	L	T	P	C
		3	0	0	3

### Course Objectives :

- To familiarize the students with the basic concepts and various level of analysis involved in spark and their related technologies.
- To understand the basics of Resilient Distributed Datasets programming.
- To gain knowledge on spark components.
- To acquire basic understanding on how a Machine Learning pipeline works on spark programming.

### UNIT - I Introduction to Data Analysis with Spark

Spark's Python and Scala shells - Core Spark concepts - Standalone applications - Programming with Resilient Distributed Datasets: RDD Basics - Creating RDDs - RDD operations - Passing Functions to Spark - Transformations and Actions - Working with Key-Value Pairs: Creating Pair RDDs- Transformations on Pair RDDs: Aggregations - Grouping data- Joins- Sorting Data- Actions available on Pair RDDs.

**UNIT–II Data Partitioning**

Determining an RDD's Partitioner- Operations that benefit from Partitioning- Operations that affect Partitioning- Custom Partitioners - Loading and Saving Data: File formats- File systems - Structured data with Spark SQL: Apache Hive, JSON -Databases: Java Database Connectivity, HBase, Elastic search.

**UNIT - III Advanced Spark Programming**

Accumulators- Custom Accumulators-Broadcast variables - Running on a Cluster: Spark Runtime Architecture- Packaging your Code and Dependencies - Cluster Managers - Tuning and Debugging Spark: Finding Information - Key Performance Considerations - Spark SQL: Using Spark SQL in Applications - Loading and saving data - JDBC/ODBC Server - User defined Functions -Spark SQL Performance.

**UNIT - IV Spark Streaming**

Architecture and Abstraction– Transformations: Stateless Transformations - Stateful Transformations - Output Operations - Input Sources - 24/7 Operation- Performance considerations- Batch and Window Sizes - Level of Parallelism - Garbage collection and Memory usage.

**UNIT –V Machine Learning with Spark**

MLlib – ML - Graph processing - GraphX- Graph Frames - Graph algorithms -. Spark Optimizations: Cluster-level optimizations – Memory - Disk - CPU cores- Project Tungsten - Application optimizations - Language choice - Structured versus unstructured APIs - File format choice - RDD optimizations - Data Frame and dataset optimizations.

**Text Book :**

1. Holden Karau, Andy Konwinski, Patrick Wendell, and Matei Zaharia, “Learning Spark: Lightning Fast Big Data Analytics”, O'Reilly publishing Ltd., First Edition, 2015.

**References :**

1. Shrey Mehrotra, and Akash Grade, “Apache Spark Quick Start Guide”, packt publishing Ltd.,First Edition, U.K, 2019.
2. Jillur Quddus, “Machine Learning with Apache Spark Quick Start”,packt publishing Ltd., First Edition, U.K, 2018.
3. Bill Chambers, Matei Zaharia, “Spark: The Definitive Guide: Big Data Processing Made Simple”, O'Reilly publishing Ltd., First Edition, 2018.
4. Holden Karau , Rachel Warren, “High Performance Spark: Best Practices for Scaling and Optimizing Apache Spark”,O'Reilly publishing Ltd., First Edition, U.S.A., 2017.

**Course Outcomes :**

At the end of this course the students able to

1. Understand various level of Data analysis and RDD programming with Spark.
2. Discuss the data partitioning and their supportive file formats.

3. Know the spark SQL and advanced level of spark programming.
4. Analyses the output operations and spark streaming.
5. Work on GraphX processing and MLib.

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	-	-	-	-	-	-	-

22DSPESCN	DATA SECURITY	L	T	P	C
		3	0	0	3

### Course Objectives

- To understand the significance of privacy, ethics and security in Big Data environment.
- To get knowledge about the pragmatic steps to secure data and classifying data.
- To know the Hadoop ecosystem components and understand the limitation of Hadoop.
- To learn about the concept of Hadoop with enterprise security systems and audit logging in Hadoop cluster.

### UNIT - I Data Security for Big Data

Introduction – History of Big Data – Definition of Big Data – Big Data trends – Big Data privacy – Re-identification of anonymous people – Big Data privacy – Ethics – ownership – Ethical guidelines – Big Data security – Organizational security.

### UNIT – II Security, Compliance, Auditing and Protection

Pragmatic steps to securing Big Data – Classifying Data – Protecting Big Data analytics – Big Data and compliance – Intellectual property challenge – Evolution of Big Data.

### UNIT – III Hadoop Security Design

Introduction – Definition of Hadoop – Hadoop components- Kerberos – Hadoop default security model without Kerberos – Hadoop Kerberos security implementation – Configuring Hadoop with Kerberos authentication.

### UNIT – IV Hadoop Ecosystem Security

Configuring Kerberos for Hadoop ecosystem components – Securing Hive – Securing Hive using sentry – Securing Hbase – Securing Hcatalog – Securing Pig, Securing Sqoop –



Securing Oozie– Securing Flume – Securing Hadoop sink – Securing Mahout –Securing ZooKeeper – Best practices for securing the Hadoop ecosystem components –Hadoop limitations.

### UNIT – V Data Security & Event Logging

Integrating Hadoop with enterprise security systems – Secure sensitive data in Hadoop – Security event and audit logging in Hadoop–SIEM system – setting up audit logging in a secured Hadoop cluster – Configuring Hadoop audit logs.

#### Text Books :

1. Mark Van Rijmenam, “Think Bigger: Developing a successful Big Data strategy for your Business”, Amazon, First Edition, 2014.
2. Sudeesh Narayanan, “Securing Hadoop”, Packet Publishing, 2013.

#### References :

1. FrankOhihorst John Wiley & Sons “Big Data Analytics: Turning Big Data into Big Money”, John Wiley & Sons, 2013.
2. Vijaya Lakshmi M and Radha Shankaramani, “Big Data Analytics”, Kindle Edition, 2016.
3. Ben Spivey, Joey Echeverria, “Hadoop Security Protecting Your Big Data Problem”, O’Reilly Media, 2015.
4. Sherif Sakr, “Large Scale and Big Data Processing and Management”, CRC Press,2014.

#### Course Outcomes :

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

1. Describe in data security for big data.
2. Acquire knowledge and understanding security, auditing and protection.
3. Explain the Hadoop security model.
4. Analyze the various Hadoop ecosystem components in a security perspective.
5. Correlate in Data Security and Event Logging.

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	-	-	-	-	-	-	-	-

22DSPESCN	WEB ANALYTICS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To understand the growing connectivity and complexity in the world ranging from small groups to World Wide Web.
- To gain a practical understanding of common monitoring or analysis tasks and techniques used in web analytics
- To evaluate different types of software tools, techniques, and reports that are relevant to web analytics
- To make informed decisions on how to analyze and interpret web channel data and understand the difficulties and issues involved

**UNIT - I Introduction**

Web Analytics 2.0: State of the Analytics Union - State of the Industry - Web Analytics 2.0. Clickstream analysis : Eight Critical Web Metrics - Bounce Rate - Exit Rate - Conversion Rate – Engagement - Web Metrics Demystified - Strategically-aligned Tactics. Practical solution : Web Analytics Primer - Web Analytics Report - Foundational Analytical Strategies - Everyday Clickstream Analyses - Perspectives on Key Web Analytics Challenges.

**UNIT - II Measuring success and leveraging qualitative data**

Measuring success: Five examples of actionable outcome - conversion rates - macro and micro conversions - Quantifying Economic Value - measuring success for a non-ecommerce website - Measuring B2B Websites. Leveraging qualitative data: lab usability - usability alternative – surveys - web enabled emerging user research options. Testing and experimentation: A Primer on Testing Options: A/B and MVT, Actionable Testing Ideas, Controlled Experiments, Creating and Nurturing a Testing Culture.

**UNIT - III Information retrieval**

Search engines: Search challenge – History of search engines – Architecture and components – Crawling – Indexing. Link analysis: Web graph – link-based ranking - page rank - hypertext induced topic search – Link-based analysis. Recommendation and diversification for the web: Pruning information – Recommendation systems - Result diversification. Advertising in search.

**UNIT - IV Competitive Intelligence analysis and emerging analytics**

Competitive Intelligence analysis: CI data sources, types and secrets - website traffic analysis - search and keyword analysis - segmentation analysis. Emerging analytics: measuring the new social web - Analysing offline customer experiences - Analysing mobile customer experiences - measuring the success of blogs - quantifying the impact of twitter - Analyzing Performance of Videos.

**UNIT - V Google Analytics**

Google Analytics contribution - Creating implementation plan - Working of Google analytics: Data collection and processing – Reports – Tracking code. Tracking visitor clicks, Outbound links, Non html files - Google analytics accounts and profiles: Google analytics accounts -Creating a Google Analytics Account - Profiles.

**Text Books :**

1. Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability”, John Wiley & Sons, 2009.
2. Stefano Ceri, Alessandro Bozzon, Marco Brambilla, Emanuele Della Valle, Piero Fraternali, Silvia Quarteroni, ”Web Information retrieval”, Springer,2013.

**References :**

1. Justin Cutroni, “Google Analytics”, O’Reilly, 2010.
2. Hansen, Derek, Ben Sheiderman, Marc Smith ,”Analyzing Social Media Networks with NodeXL: Insights from a Connected World”, Morgan Kaufmann, 2011.
3. Wasserman. S, Faust. K, “Social network analysis: Methods and applications”, New York: Cambridge University Press,1994.
4. Monge. P. R, Contractor. N. S, “Theories of communication networks”, New York: Oxford University Press,2003.

**Course Outcomes :**

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

1. Recognize the role of web analytics within the digital marketing landscape.
2. Measure the success rate and testing options.
3. Use the search engines for retrieving the information.
4. Understand the intelligence analysis and emerging analytics.
5. Analyze Google analytics contribution and study the working of Google analytics, accounts and profiles.

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

22DSPESCN	GPU COMPUTING	L	T	P	C
		3	0	0	3

**Course Objectives :**

The students should be made to

- Learn the architecture of Graphics Processing Units (GPUs).
- Use GPUs for traditional purposes like graphics & visualization and for general purpose computations.
- Implement some problems like prefix sum, matrix-vector multiplication etc., using CUDA C.
- Carry out parallel programming using computing paradigms such as CUDA C, OpenCL and Open ACC.

**UNIT - I Introduction**

Heterogeneous Parallel Computing - Architecture of a Modern GPU – Parallelism - Parallel Programming Languages and Models – History : Evolution of Graphics Pipelines, GPGPU- GPU Computing - Future Trends – Overview of Parallel Programming Platforms : Compute Unified Device Architecture(CUDA) C – Open CL – Open ACC – CUDA Fortran – C++ AMP - CUDA Python - MPI.

**UNIT- II CUDA C and Memories**

CUDA C : Data Parallelism - CUDA Program Structure - Vector Addition Kernel - Device Global Memory and Data Transfer - Kernel Functions and Threading - Data-Parallel Execution Model : CUDA Thread Organization - Mapping Threads to Multidimensional Data – Matrix-Matrix Multiplication - Synchronization and Transparent Scalability - Assigning Resources to Blocks, Querying Device Properties - Thread Scheduling and Latency Tolerance - CUDA Memories : Importance - CUDA Device Memory Types - Strategy for Reducing Global Memory Traffic – Tiled Multiplication – Limiting Factor.

**UNIT- III Performance Considerations and Convolution**

Performance Considerations : Warps and Thread Execution - Global Memory Bandwidth - Dynamic Partitioning of Execution Resources - Instruction Mix and Thread Granularity, Floating-Point Considerations – Convolution : 1D Parallel Convolution-A Basic Algorithm, Constant Memory and Caching - Tiled 1D Convolution with Halo Elements - A Simpler Tiled 1D Convolution—General Caching.

**UNIT- IV Prefix Sum and Matrix-Vector Multiplication**

Prefix Sum : A Simple Parallel Scan - Work Efficiency Considerations - A Work-Efficient Parallel Scan - Parallel Scan for Arbitrary-Length Inputs – Sparse Matrix-Vector Multiplication : Parallel SPMV using CSR – Padding and Transposition- Using Hybrid to Control Padding – Sorting and Partitioning for Regularization - Case Study : Advanced MRI Reconstruction, Molecular Visualization and Analysis.

**UNIT- V Parallel Programming**

Parallel Programming and Computational Thinking : Goals – Problem Decomposition – Algorithm Selection – Computational Thinking - Introduction to Open CL : Data Parallelism Model - Device Architecture - Kernel Functions - Device Management and Kernel Launch - Electrostatic Potential Map in Open CL - Parallel Programming with Open ACC : Open ACC versus CUDA C - Execution Model - Memory Model - Basic Open ACC Programs.

**Text Book :**

1. David B. Kirk and Wen-mei W. Hwu, “Programming Massively Parallel Processors - A Hands-on Approach”, Elsevier, Second Edition, 2013.

**References :**

1. Jason Sanders and Edward Kandrot, “CUDA by Example - An Introduction to General Purpose GPU Programming”, Addison-Wesley, First Edition, 2010.
2. Shane Cook, “CUDA Programming - A Developer’s Guide to Parallel Computing with GPUs”, Elsevier Inc., First Edition, 2013.
3. John Cheng, Max Grossman and TyMcKercher, ”Professional CUDA C Programming”, John Wiley & Sons, First Edition, 2014.
4. Nicholas Tilt, ”The CUDA Handbook: A Comprehensive Guide to GPU Programming”, Addison-Wesley Professional, First Edition, 2013.

**Course Outcomes :**

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

1. Learn GPU architecture, GPU computing and parallel programming platforms such as CUDA C, OpenCL, Open ACC, CUDA Fortran, CUDA Python etc.
2. Understand CUDA C program structure and CUDA memories.
3. Study CUDA performance considerations and concept of convolution.
4. Device and debug parallel programs on GPUs using CUDA C.
5. Implement basic programs using OpenCL and OpenACC.

**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	-	-	-	-	-	-	-

22DSPESCN	MINING FOR BIG DATA	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To understand the concepts of big data, components of Hadoop ecosystem, and features of Hive and Pig.
- To acquire the fundamentals of data mining and its applications in document mining.
- To gain knowledge on mining data streams and link analysis.
- To explain the algorithms for handling frequent item sets and social network graphs .

**UNIT – I Big Data and Hadoop Ecosystem**

Big Data - Definition- Evolution-Storing the data- Elements of Big Data Analytics- Use of big data in various sectors- Technologies for handling big data - Distributed and Parallel computing for Big data- Hadoop - Cloud computing and Big data-In-memory computing for Big Data- Hadoop Ecosystem- Hadoop distributed File System- MapReduce- Hadoop YARN-HBase- Combining HBase and HDFS-Hive-Pig and Pig Latin- Sqoop- Zookeeper-Flume- Oozie.

**UNIT – II Hive and Pig**

Exploring Hive- Hive Services- Data Types- Built-in functions- Hive DDL- Data manipulation in Hive- Data Retrieval Queries- Using JOINS in Hive- Analyzing Data with Pig- Running Pig- Introduction to Pig Latin- Pig operators-Debugging in Pig- Functions in Pig- Error Handling in Pig.

**UNIT – III Data Mining**

Data Mining- Definitions- Statistical limits on Data Mining- Finding Similar Items- Applications of Near-Neighbor Search- Shingling of Documents- Similarity- Preserving Summaries of Sets- Locality-Sensitive Hashing (LSH) for Documents- Distance Measures- Theory of locality- Sensitive Functions- Applications of LSH- Methods for high degrees of Similarity.

**UNIT - IV Mining Data Streams and Link Analysis**

Mining Data Streams- Stream Data Model- Sampling data in a stream- Filtering Streams- Counting Distinct elements in a stream- Estimating moments- Counting ones in a window- Decaying Windows- Link Analysis- Page Rank- Efficient Computation of Page Rank- Topic- Sensitive Page Rank- Link Spam.

**UNIT - V Frequent Item sets and Mining Social Network Graphs**

Frequent Item sets- Market-Basket Model- Market-Baskets and the A-Priori Algorithm- Handling larger datasets in main memory- Limited-Pass Algorithm- Counting frequent items in a stream- Mining Social Network Graphs- Social Networks as graphs- Clustering of Social Network graphs- Direct Discovery of Communities- Partitioning of Graphs- Finding overlapping Communities- Simrank.

**Text Books :**

1. DT Editorial Services, “Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization”, Wiley, 2016.
2. Jure Leskovec, AnandRajaraman, Jeffrey D. Ullaman, “Mining of Massive Datasets”, Cambridge University Press, Second Edition, 2014.

**References :**

1. David Loshin, “Big data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann, 2013.
2. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, Wiley and SAS Business Series, 2012.
3. Tom White, “Hadoop: The Definitive Guide”, O’Reilly, Third Edition, 2012.
4. E.Capriolo, D. Wampler, and J. Rutherglen, “Programming Hive”, O’Reilly, 2012.
5. Lars George, “HBase: The Definitive Guide”, O’Reilly, 2011.
6. Alan Gates, “Programming Pig”, O’Reilly, 2011.

**Course Outcomes :**

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

1. Enumerate the elements of big data and describe the components of Hadoop ecosystem
2. Prepare queries using Hive and construct programs in Pig to analyze data
3. Identify and compare the distance and similarity measures suitable for data mining
4. Analyze data streams and links in the context of data mining
5. Examine algorithms for market basket analysis and social network graph mining

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	2	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	2	1	2	1	1	-	-	-	-	-	-	-
<b>CO4</b>	2	-	2	-	2	-	-	-	-	-	-	-
<b>CO5</b>	3	-	-	-	2	-	-	-	-	-	-	-

22DSPESCN	PREDICTIVE ANALYTICS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To understand the art and science of predictive analytics to define clear actions that result in improved decisions and business results.
- To learn methods for regression and classification.
- To learn, how to develop models to predict categorical and continuous outcomes, using such techniques as neural networks, decision trees, logistic regression, support vector machines and Bayesian network models.
- To also learn how to combine two or more models to improve prediction.

**UNIT - I Introduction to Predictive Analytics**

Analytics- Definition and Need- Introduction to Tools and Environment-Application of Modeling in Business Databases -Types of data and variables- Data Modeling Techniques- Missing imputations -Need for Business Modeling-Regression – Concepts-Blue property-assumptions-Least Square Estimation,-Variable Rationalization and Model Building.

**UNIT - II Linear Methods for Regression and Classification**

Overview of Supervised Learning: Linear regression models and Least Squares-Multiple regression- Multiple Outputs-Subset Selection -Ridge Regression-Lasso Regression-Linear Discriminant Analysis -Logistic regression -Perceptron Learning algorithm.

**UNIT - III Model Assessment and Selection**

Bias,Variance, and model complexity: Bias-variance trade off- Optimism of the training error rate-Estimate of in-sample Prediction Error-Effective number of Parameters-Bayesian approach and BIC-Cross- validation-Boot Strap methods-Conditional or Expected Test error.

**UNIT - IV Additive Models, Trees and Boosting**

Generalized additive model: Regression and Classification Trees- Decision trees-Neural Networks- Fitting Neural Networks- Back Propagation- Issues in training NN - Bayesian Networks-Association Rules-Random Forests and Analysis-Boosting Methods-Exponential loss and AdaBoost-Numerical Optimization via Gradient Boosting

**UNIT –V Model Evaluation and Deployment**

Introduction- Model Validation- Rule Induction Using CHAID- Automating Models for Categorical and Continuous targets- Comparing and Combining Models- Evaluation Charts for Model Comparison,-Meta Level Modeling- Deploying Model- Assessing Model Performance- Updating a Model.



**Text Books :**

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning-Data Mining, Inference, and Prediction", Springer Verlag, Second Edition, 2009.
2. Ralph Winters, "Practical Predictive Analytics", Packt Publishing, 2017.

**References :**

1. Gareth James' Daniela Witten Trevor Hastie Robert Tibshirani,"An Introduction to Statistical Learning with Applications in R", 7 th edition, 2017.
2. E.Alpaydin," Introduction to Machine Learning", Prentice Hall Of India,2010
3. Nathan Yau, "Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics", Wiley, 2011.
4. "Predictive & Advanced Analytics",IBM ICE Publication, <https://www.ibm.com/en/analytics/predictive-analytics>
5. <https://practicalanalytics.co/predictive-analytics-101/>

**Course Outcomes :**

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

1. Understand the process of formulating business objectives, data selection/collection, preparation and process to successfully design, build, evaluate and implement predictive models for a various business application.
2. Understand various predictive modelling techniques.
3. Compare the underlying predictive modelling techniques.
4. Select appropriate predictive modelling approaches to identify cases to progress with.
5. Apply predictive modelling approaches using a suitable package

**Mapping of Course Outcomes with Programme Outcomes**

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

22DSPESCN	TEXT ANALYTICS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To make the students conversant with basic principles of text processing
- To classify text and extract features
- To develop expertise in analyzing text similarity and document clustering
- To perform semantic and sentiment analysis

**UNIT- I Processing Text**

Overview of Text Analytics - Sources of Text - Text Tokenization - Issues in Tokenization - Words and their Categories - Text Normalization: Cleaning Text - Removing Special Characters - Expanding Contractions - Case Conversions - Removing Stopwords - Correcting Words - Stemming - Lemmatization - Understanding Text Syntax and Structure - Tools for text processing.

**UNIT- II Text Classification**

Text Classification - Automated Text Classification - Text Classification Blueprint - Text Normalization - Feature Extraction: Bag of Words Model, TF-IDF Model, Word Vectorization Model - Classification Algorithms: Naive Bayes, Support Vector Machines - Evaluating Classification Models - Building a Multi-Class Classification System - Applications and Uses.

**UNIT- III Text Summarization and Information Extraction**

Text Normalization - Feature Extraction - Feature Matrix - Singular Value Decomposition - Key phrase Extraction: Collocations, Weighted Tag-Based Phrase Extraction - Topic Modeling: Latent Semantic Indexing, Latent Dirichlet Allocation, Non-Negative Matrix Factorization - Automated Document Summarization: Latent Semantic Analysis - TextRank - Summarizing a Product Description.

**UNIT- IV Text Similarity and Clustering**

Information Retrieval - Feature Engineering - Similarity Measures - Unsupervised Machine Learning Algorithms - Text Similarity - Analyzing Term Similarity: Hamming Distance, Manhattan Distance, Euclidean Distance, Levenshtein Edit Distance, Cosine Distance - Analyzing Document Similarity - Clustering foundations - Document Clustering: K-means Clustering, Affinity Propagation, and Ward's Agglomerative Hierarchical Clustering - Flat Clustering.

**UNIT- V Semantic and Sentiment Analysis**

Semantic Analysis - Exploring WordNet: Understanding Synsets, Analyzing Lexical Semantic Relations - Word Sense Disambiguation - Named Entity Recognition - Analyzing Semantic Representations: Propositional Logic, First Order Logic - Sentiment Analysis: Setting Up Dependencies, Supervised Machine Learning Technique, Unsupervised Lexicon-based Technique, Comparing Model Performances.

**Text Books :**

1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your data", Apress, 2016.
2. Grant S. Ingersoll, Thomas S. Morton , Drew Farris, Taming Text: "How to Find, Organize, and Manipulate It", Manning, 1<sup>st</sup> Edition, 2013.

**References :**

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press, 2008.
2. Steven Bird , Ewan Klein , Edward Loper ," Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit", O'Reilly, 1<sup>st</sup> Edition, 2009.
3. Julia Silge and David Robinson, "Text Mining with R: A Tidy Approach", O'Reilly, 2017.
4. Benjamin Bengfort, Rebecca Bilbro, Tony Ojeda, "Applied Text Analysis with Python: Enabling Language-Aware Data Products with Machine Learning", O'Reilly, 2018.

**COURSE Outcomes :**

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

1. Normalize text for processing.
2. Build text classification systems.
3. Extract information from the text.
4. Analyze text similarity and perform document clustering.
5. Carry out semantic and sentiment analysis.

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	2	2	2	-	-	-	-	-	-	-	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-
CO5	2	2	1	1	1	-	-	-	-	-	-	-

22DSPESCN	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To explain the students the importance of recommender systems along with neighbourhood-based collaborative systems.
- To acquire the knowledge of content based recommender systems and Knowledge-based recommendations.
- To study the importance of designing the hybrid recommender systems.
- To evaluate the recommender system, and various attacks on collaborative recommender systems.
- To discuss the online consumer decision making for the next-generation web recommendations in the ubiquitous environments.

**UNIT – I**

**Introduction to Recommender Systems:** Goals of Recommender Systems - Basic Models of Recommender Systems – Domain Specific Challenges in Recommender Systems – Advanced topics and applications

**Collaborative recommendation:** User-based nearest neighbor recommendation - Item-based nearest neighbor recommendation - About ratings - Further model-based and preprocessing-based approaches - Recent practical approaches and systems

**UNIT – II**

**Content-based recommendation:** Content representation and content similarity - Similarity-based retrieval - Other text classification methods

**Knowledge-based recommendation:** Introduction - Knowledge representation and reasoning - Interacting with constraint-based recommenders - Interacting with case-based recommenders - Example applications

**UNIT – III**

**Hybrid recommendation approaches:** Opportunities for hybridization - Monolithic hybridization design - Parallelized hybridization design - Pipelined hybridization design

**Explanations in recommender systems:** Introduction - Explanations in constraint-based recommenders - Explanations in case-based recommenders - Explanations in collaborative filtering recommenders

**UNIT – IV**

**Evaluating recommender systems:** Introduction - General properties of evaluation research - Popular evaluation designs - Evaluation on historical datasets - Alternate evaluation designs

**Case study: Personalized game recommendations on the mobile Internet:** Application and personalization overview - Algorithms and ratings - Evaluation

**Attacks on collaborative recommender systems:** A first example - Attack dimensions - Attack types - Evaluation of effectiveness and counter measures – Counter measures - Privacy aspects – distributed collaborative filtering

**UNIT – V**

**Online consumer decision making:** Introduction - Context effects - Primacy/recency effects - Further effects - Personality and social psychology

**Recommender systems and the next-generation web:** Trust-aware recommender systems - Folksonomies and more - Ontological filtering - Extracting semantics from the web

**Recommendations in ubiquitous environments:** Introduction - Context-aware recommendation - Application domains

**Text Books :**

1. Charu C. Agarwal, Recommender Systems: The Textbook, Springer, 2016.

2. Dietmar Jannach, Markus Zanker, Alexander FelFernig, Gerhard Friedrich, Recommender Systems: An Introduction, Cambridge University Press, 1st Edition, 2011.

**References :**

1. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer, 1st Edition, 2013.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer, 1st Edition, 2011.
3. Gerald Kembellec, Ghislaine Chartron, Imad Saleh, Recommender Systems (Information Systems, Web and Pervasive Computing), 1st Edition, ISTE Ltd, 2014.
4. Kim Falk, Practical Recommender Systems, 1st Edition, Manning Publications, 2019.

**Course Outcomes:**

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

- to understand the concept of recommender systems along with neighbourhood-based collaborative systems.
- to illustrate the knowledge of content based recommender systems and Knowledge-based recommendation.
- to acquire the importance of designing the hybrid recommender systems.
- to evaluate the recommender system, and various attacks on collaborative recommender systems
- to perform the online consumer decision making for the next-generation web recommendations in ubiquitous environments.

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

22DSPE SCN	REAL TIME ANALYTICS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To understand the concepts of real time analytics and ingredients of real time applications.
- To explore the concepts of Data processing with Storm.
- To learn real time operating system concepts, the associated issues and techniques.
- To understand design and synchronization problems in Real Time System.

**UNIT - I Introduction**

Real time analytics: the myth and the reality - Near real time solution an architecture that works - Lambda architecture analytics possibilities - IoT thoughts and possibilities – Edge analytics - Cloud considerations for NRT and IoT – The NRT system and its building blocks – NRT high level system view – NRT technology view.

**UNIT - II Streaming Data**

Understanding Data Streams – Setting up infrastructure for Data ingestion - Streaming analytics architecture; Designing Real Time streaming architectures – Service configuration and coordination – Data flow management in streaming analysis – Processing streaming data – storing streaming data.

**UNIT –III STORM**

Overview of STORM – architecture and its components – Setting up and configuring STORM – Setting up Apache STORM - Storm in clustered mode – STORM high Availability and Failover - Integrating STORM with RabbitMQ – Building high availability of components - STORM management and maintenance – Advanced concepts in STORM.

**UNIT - IV Real Time Systems**

Concepts and Misconceptions - Multidisciplinary Design Challenges - Birth and Evolution of Real Time Systems – Basic Processor Architecture – Memory Technologies – Architecture Advancements - Peripheral Interfacing - Distributed Real-Time Architectures.

**UNIT - V Real-Time Operating Systems**

From Pseudo kernels to Operating Systems - Theoretical Foundations of Scheduling - System Services for Application Programs - Memory Management Issues - Selecting Real Time Operating Systems - Performance Analysis Techniques; Real-Time Performance Analysis - Applications of Queuing Theory- Input/Output Performance- Analysis of Memory Requirements.

**Text Books :**

1. Saurabh Gupta, ShilpiSaxena, “Practical Real Time Data Processing and Analytics”, Packt Publishing Ltd.2<sup>nd</sup> edition, 2017.
2. ShilpiSaxena, “Real – Time Analytics with Storm and Cassandra”, Packt Publishing Ltd., 2<sup>nd</sup> edition, 2015.

**References :**

1. Sumit Gupta, ShilpiSaxena, “Real – Time Big Data Analytics”, Packt Publishing Ltd, 1<sup>st</sup> edition, 2016.
2. Byron Ellis, “Real – Time Analytics, Techniques to Analyze and Visualize Streaming Data”, John Willey & Sons, Inc., 1<sup>st</sup> edition, 2014.
3. Philip A. Laplante and Seppo J. Ovaska, “Real – Time Systems Design and analysis:

Tool for the Practitioner”, IV edition IEEE papers, 2013.

- Judith Hurwitz, Alan Nugent, Dr. Fern Halper, and Marcia Kaufman, “Big Data for Dummies”, John Wiley & Sons, Inc., 2<sup>nd</sup> edition, 2013.

### Course Outcomes :

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

- To leverage the insights from Real – Time analytics.
- Perform analytics on real-time streaming data.
- Understand Storm architecture for real time processing
- Acquire knowledge about real time systems.
- Analyze performance and memory requirement for real time systems.

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

22DSPESCN	APPLIED ECONOMETRICS & TIME SERIES ANALYSIS			
	L	T	P	C
	3	0	0	3

### Course Objectives:

- To make the students learn to use econometric methods for modeling and predicting economic time series.
- To impart knowledge on the concepts of theory and methods of time series analysis.
- To know how to use time series analysis in examining financial processes and understand the methods, ideas, results and conclusions that can be met in the majority of books and articles on economics and finance.
- To know the differences between cross-sections and time series, and those specific economic problems, which occur while working with data of these types.

### UNIT - I Difference Equations

Introduction - Time-Series Models - Difference Equations and Their Solutions - Solution by Iteration - An Alternative Solution Methodology - The Cobweb Model - Solving Homogeneous Difference Equations - Particular Solutions for Deterministic Processes - The Method of Undetermined Coefficients - Lag Operators.

**UNIT – II Stationary Time-Series Models**

Stochastic Difference Equation Models - ARMA Models - Stationarity - Stationarity Restrictions for an ARMA (p, q) Model - The Autocorrelation Function - The Partial Autocorrelation Function - Sample Autocorrelations of Stationary Series - Box–Jenkins Model Selection - Properties of Forecasts - A Model of the Interest Rate Spread - Seasonality - Parameter Instability and Structural Change - Combining Forecasts.

**UNIT – III Modeling Volatility**

Economic Time Series: The Stylized Facts - ARCH and GARCH Processes - ARCH and GARCH Estimates of Inflation - Three Examples of GARCH Models - A GARCH Model of Risk - The ARCH-M Model - Additional Properties of GARCH Processes - Maximum Likelihood Estimation of GARCH Models - Other Models of Conditional Variance - Estimating the NYSE U.S. 100 Index - Multivariate GARCH - Volatility Impulse Responses.

**UNIT – IV Models with Trend**

Deterministic and Stochastic Trends - Removing the Trend - Unit Roots and Regression Residuals - The Monte Carlo Method - Dickey–Fuller Tests - Examples of the Dickey–Fuller Test - Extensions of the Dickey–Fuller Test - Structural Change - Power and the Deterministic Regressors - Tests with More Power - Panel Unit Root Tests - Trends and Univariate Decompositions.

**UNIT – V Multi equation Time-Series Models**

Intervention Analysis - Autoregressive Distributed Lag and Transfer Functions - An ADL of Terrorism in Italy - Limits to Structural Multivariate Estimation - Introduction to Vector Auto Regression Analysis - Estimation and Identification - The Impulse Response Function - Testing Hypotheses - Example of a Simple VAR: Domestic and Transnational Terrorism - Structural VARs - Examples of Structural Decompositions - Overidentified Systems - The Blanchard–Quah Decomposition - Decomposing Real and Nominal Exchange Rates: An Example.

**Text Books :**

1. Enders .W, “Applied Econometric Time Series,” John Wiley & Sons, Fourth Edition, 2014.
2. Terence C. Mills, Raphael N. Markellos, “The Econometric Modelling of Financial Time Series”, Cambridge University Press, Third Edition, 2008.

**References :**

1. Kocenda, Evzen, Cerny, Alexandr “Elements of Time Series Econometrics: an Applied Approach”, Karolinum Press, 2015.
2. Richard A. Ashley, “Fundamentals of Applied Econometrics”, Wiley, 2012.
3. Helmut Lutkepohl, Markus Kratzig, Peter C. B. Phillips, “Applied Time Series Econometrics”, Cambridge University Press, 2004.
4. K. D. Patterson, “An Introduction to Applied Econometrics: A Time Series Approach, Macmillan”, 2000.



**Course Outcomes :**

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

1. Understand and solve difference equations.
2. Use stationary time-series models for solving real world problems.
3. Exhibit the knowledge in modeling volatility.
4. Analyze the Deterministic and Stochastic models.
5. Apply multi equation time-series models.

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	-	-	-	-	-	-	-	-
CO4	1	-	-	-	2	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-

22DSPESCN	SOCIAL MEDIA ANALYTICS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To gain an understanding of social media analytics concepts, techniques, and tools.
- To understand how social media data is obtained, analyzed and visualized.
- To prepare social media analytics reports to inform executives/senior managers thereby impacting social media policy.
- To understand how managers can make better strategic decision based on social media analytics.

**UNIT - I Introduction**

Social Media Analytics Overview - grading and attendance policies - Business Social Media Analytics: Definition, Benefits, and Challenges. Foundations of Media Analytics. The Case for Measurement- Goal Setting, Goal Alignment, and Objectives

**UNIT – II Social Media Text Analytics**

Introduction - Netlytic Text Analytics - Sentiment Analysis Collecting social media data using APIs, collecting tweets by hash tags, user, or keyword - Social Media Network Analytics -Collecting social media data through web scrawling, collecting web contents.

**UNIT – III User Generated Content and Social Listening**

Big Data analytics and sentiment analysis - Social Media ROI & SWOT Analysis - Text Mining of User-Generated Content (UGC).Social Media Marketing and Analytics.Trends in social and digital marketing Paid/Earned/Owned media and Inbound/Outbound.

**UNIT – IV Web Analytics**

Introduction- Google analytics- Google Analytics Accounts – How to set up Google Analytics Account?- Customer Relationship Management (CRM) analytics, Analysis vs intuition, the "Digital" Marketing Mix, Web Metrics with Google Analytics, web Analytics report.

**UNIT – V Mobile Analytics and Social Communities**

Mobile path to purchase - mobile couponing, mobile showrooming and location based advertising - Mobile advertising - cross - device synergies- mobile commerce, and mobile apps. Social communities and Facebook Analytics.

**Text Book :**

1. Matthew A. Russell, “Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More”, O’ Reilly Publication. Elsevier Inc., Second Edition, 2014.

**References :**

1. Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity” (Author) Publisher: Sybex; Wiley Publishing, Inc, First edition, 2009.
2. Jennifer Golbeck, “Analyzing the Social Web”, Publisher: Morgan Kaufmann, First Edition, 2013.
3. Marshall Spender, “Social Media Analytics: Effective Tools for Building, Interpreting and using Metrics”, McGraw-Hill Education, First edition, 2013.
4. Krish Krishnan Shawn Rogers, “Social Data Analytics”, Morgan Kaufmann, Elsevier Inc., 2014.

**Course Outcomes:**

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

1. To understand with basic principles of social media analytics
2. To know about the social media data and analysis
3. To identify and learn the different types of web analytics.
4. To acquire knowledge about the mobile analytics and communities.
5. To understand the principles and practices of social media and web media.

**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>	1	-	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	2	-	1	1	-	-	-	-	-	-	-	-
<b>CO4</b>	1	-	-	-	2	-	-	-	-	-	-	-
<b>CO5</b>	1	-	-	-	-	-	-	-	-	-	-	-

22DSPESCN	HEALTH CARE ANALYTICS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To provide a platform for interdisciplinary researchers to learn about the fundamental principles, algorithms, and applications of intelligent data acquisition, processing, and analysis of healthcare data.
- To understand the vast number of analytical techniques for healthcare problems and their relationships with one another.
- To explain specific techniques and required combinations of tools to design effective ways of handling, retrieving, analyzing, and making use of healthcare data.
- To facilitate the development of new computing technologies for Health care analytics

**UNIT - I An Introduction to Healthcare Data Analytics**

Basics - Healthcare Data Sources and Basic Analytics - Advanced Data Analytics for Healthcare - Applications and Practical Systems for Healthcare - Resources for Healthcare Data Analytics - Healthcare Data Sources and Basic Analytics: Electronic Health Records: A Survey - History of HER - Components of HER - Coding Systems - Benefits of HER - Barriers to Adopting EHR - Challenges of Using EHR Data - Phenotyping Algorithms.

**UNIT – II Biomedical Image Analysis**

Biomedical Imaging Modalities - Object Detection - Image Segmentation - Image Registration - Feature Extraction - Mining of Sensor Data in Healthcare: A Survey - Challenges in Healthcare Data Analysis - Sensor Data Mining Applications - Nonclinical Healthcare Applications - Biomedical Signal Analysis: Types of Biomedical Signals - ECG Signal Analysis - DE noising of Signals - Multivariate Biomedical Signal Analysis - Cross-Correlation Analysis.

**UNIT – III Genomic Data Analysis for Personalized Medicine**

Introduction - Genomic Data Generation - Methods and Standards for Genomic Data Analysis - Types of Computational Genomics Studies towards Personalized Medicine - Genetic and Genomic Studies to the Bedside of Personalized Medicine - Natural Language Processing and Data Mining for Clinical Text : Natural Language Processing - Mining Information from Clinical Text - Challenges of Processing Clinical Reports - Clinical Applications.

**UNIT – IV Mining the Biomedical Literature**

Introduction - Resources - Terminology Acquisition and Management- Information Extraction - Discourse Interpretation - Discourse Relation Recognition - Functional Discourse Annotation - Text Mining Environments – Applications - Integration with Clinical Text Mining.- Forest Conservation Act - Issues involved in enforcement of environmental legislation.

**UNIT – V Social Media Analytics for Healthcare**

Introduction - Social Media Analysis for Detection and Tracking of Infectious Disease Outbreaks – Outbreak Detection - Analyzing and Tracking Outbreaks - Syndromic Surveillance Systems Based on Social Media - Social Media Analysis for Public Health Research – (Topic Models for Analyzing Health-Related Content - Detecting Reports of Adverse Medical Events and Drug Reactions - Characterizing Life Style and Well-Being) Analysis of Social Media Use in Healthcare.

**Text Books :**

1. Chandan K. Reddy, Charu C. Aggarwal, “HealthCare Data analytics”, CRC press, Taylor and Fransis series, 2015.
2. Amirian, Pouria, Lang, Trudie, van Loggerenberg, “Big Data in Healthcare Extracting Knowledge from Point-of-Care Machines”, Francois (Eds.), Springer ,2017.

**References :**

1. Amirian, Pouria, Lang, Trudie, van Loggerenberg, Francois, “Big Data in Healthcare Extracting Knowledge from Point-of-Care Machines”, Springer, 2017.
2. P. Amirian et al. (eds.), “Big Data in Healthcare”, Springer Briefs in Pharmaceutical Science & Drug Development”, 2017.
3. B. Shen (ed.), “Healthcare and Big Data Management, Advances in Experimental Medicine and Biology”, Springer Nature Singapore Pte Ltd., 2017.
4. Ashwin Belle, Raghuram Thiagarajan, S.M.Reza Soroushmehr, Fatemeh Navidi, “Big Data Analytics in Healthcare”, Article *in* Journal of Biomedicine and Biotechnology, January 2015.

**Course Outcomes :**

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

1. Explain the different format of data and Electronic Health Records
2. Describe the concepts of Biomedical Image and signal Analysis
3. Acquire the Knowledge about Genomic Data Analysis for Personalized Medicine
4. Apply the principles of Mining for Biomedical Literature
5. Understand the Social Media Analytics for Healthcare

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

22DSPESCN	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To understand the concepts and trends in Business Analytics.
- To understand the design problems and facilitate decision making for that problem.
- To study the visualization methods.
- To identify business analytics Application.

**UNIT-I Introduction to Business Analytics**

What Is Business Analytics-Evolution of Business Analytics-Impacts and Challenges-Scope of Business Analytics- Software Support -Data for Business Analytics -Data Sets and Databases-

Big Data - Metrics and Data Classification-Data Reliability and Validity-Models in Business Analytics-Decision Models -Uncertainty and Risk-Prescriptive Decision Models -Problem Solving with Analytics Recognizing a Problem-Defining the Problem-Structuring the Problem- Analyzing the Problem -Implementing the Solution.

**UNIT-II Visualizing and Exploring Data**

Data Visualization- Tools and Software for Data Visualization-Creating Charts in Microsoft Excel Column and Bar Charts - Data Labels and Data Tables Chart-Line Charts-Pie Charts -Data Queries: Tables-Sorting-Filtering .

**UNIT-III Prescriptive Analytics**

Linear Optimization-Building Linear Optimization Models-Identifying Elements for an Optimization Model -Translating Model Information into Mathematical Expressions-More about Constraints-Characteristics of Linear Optimization Model-Implementing Linear Optimization Models on Spreadsheets-Excel Functions to Avoid in Linear Optimization-Solving Linear Optimization Models-Using the Standard Solver-Parameter Analysis in Analytic Solver Platform.

**UNIT-IV Applications of Linear Optimization**

Types of Constraints in Optimization Models-Process Selection Models-Spreadsheet Design and Solver Reports-Solver Output and Data Visualization-Blending Models-Dealing with Infeasibility-Portfolio Investment Models-Evaluating Risk versus Reward-Scaling Issues in Using Solver-Transportation Models-Formatting the Sensitivity Report-Degeneracy-Multi period Production Planning Models-Building Alternative Models-Multi period Financial Planning Models

**UNIT-V Decision Analysis**

Formulating Decision Problems-Decision Strategies without Outcome Probabilities-Decision Strategies for a Minimize Objective- Decision Strategies for a Maximize Objective- Decisions with Conflicting Objectives-Decision Strategies with Outcome

Probabilities-Average Payoff Strategy- Expected Value Strategy-Evaluating Risk Decision Trees-Decision Trees and Risk-Sensitivity Analysis in Decision Trees-The Value of Information-Decisions with Sample Information-Bayes's Rule-Utility and Decision Making -Constructing a Utility Function-Exponential Utility Functions.

**Text Books :**

1. James R. Evans , “Business Analytics”, Pearson Education, 2<sup>nd</sup> edition, 2015.
2. U. Dinesh Kumar , “Business Analytics”, Wiley Publications, 1<sup>st</sup> edition, 2017.

**References :**

1. Ramesh Sharda , “Business Intelligence & Analytics”, Pearson Education, 10<sup>th</sup> edition 2017.
2. Albright , Winston , “Business Analytics”, Cengage Learning India Pvt Ltd, 5<sup>th</sup> edition, 2015.
3. Marc J. Schniederjans “Business Analytics Principles, Concepts and application”, Pearson Education, 1<sup>st</sup> edition, 2014.

**Course Outcomes :**

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

1. Apply the principles of Business Analytics in real world.
2. Solve problems by making optimized decision and implement the solutions.
3. Perform basic creation of charts in Microsoft excel.
4. Develop the Knowledge and interest for life-long learning and continual professional development in business environment.
5. Analyze applications of optimization models in real time scenario.

**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>	1	-	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	2	-	1	1	-	-	-	-	-	-	-	2
<b>CO4</b>	1	-	-	-	2	-	-	-	-	-	-	-
<b>CO5</b>	1	-	-	-	-	-	-	-	-	-	-	-

**OE- OPEN ELECTIVES**

22DSOESCN	SOFT COMPUTING	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To learn the various soft computing frame works.
- To be familiar with design of various neural networks.
- To be exposed to fuzzy logic.
- To learn genetic programming.

**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. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education, 2004.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

#### References :

1. Randy L. Haupt and sue Ellen Haupt "Practical Genetic Algorithms", John Willey & Sons, 2002.
2. J.-S. R. Jang, C.-T. Sun, and E. Mizutani, "Neuro-Fuzzy and soft Computing", PHI Learning, 2009.
3. Simon Haykin, "Neural Networks and Learning Machines", PHI Learning, 3rd Edn., 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. David E. 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. Apply various soft computing frame works.
2. Design various neural networks.
3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
4. Apply genetic algorithms to combinatorial optimization problems.
5. Applications of soft computing to solve problems in varieties of application domains.

**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	-	-	-	-	-	-	-



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

**Course Objectives :**

- To demonstrate the understanding of the fundamentals of Android operating systems.
- To demonstrate the skills of using Android software development tools.
- To demonstrate the ability to develop software with reasonable complexity on mobile platform.
- To demonstrate the ability to debug programs running on mobile devices.

**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 theGeocoder - 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. James C Sheusi, “Android Application Development for Java Programmers”, 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. Understand the existing state of mobile app development via researching existing apps, meeting with industry professionals, and formulating new ideas.
2. Display proficiency in coding on a mobile programming platform.
3. Understand the limitations and features of developing for mobile devices.
4. Create a complete Mobile app with a significant programming component, involving the sensors and hardware features of the phone.
5. Understand the economics and features of the app marketplace by offering the app for download.

**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	-	1	-	-	-	-	-	-	-
<b>CO2</b>	3	2	1	-	1	-	-	-	-	-	-	-
<b>CO3</b>	3	1	1	-	1	-	-	-	-	-	-	-
<b>CO4</b>	3	2	1	2	2	-	-	-	1	-	-	1
<b>CO5</b>	2	2	1	2	2	-	-	-	1	-	-	1

22DSOESCN	CYBER SECURITY	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To understand the legal and social issues in Cyber Security.
- To understand the need for Cyber security and its related threats and attacks.
- To learn methods to become secure in the cyber world and communicate on it.
- To study about the Indian IT Act 2000, amendments and IT Audit standards.

**UNIT – I Introduction to Cyber Security**

Computer Ethics - Moral and legal issues, descriptive and normative claims, Professional Ethics, code of ethics and professional conduct, Privacy - Computers and privacy issue, Digital Evidence Controls, Evidence Handling Procedures, Legal Policies, legislative background. Introduction to Cyber Security - Overview, Internet Governance – Challenges and Constraints, Cyber Threats - Cyber Warfare, Cyber Crime, Cyber terrorism and Cyber Espionage.

**UNIT – II Intellectual Property Rights, Security and Services**

Intellectual Property Rights - Copyrights, Jurisdiction Issues and Copyright Infringement, Multimedia and Copyright issues, WIPO, Intellectual Property Rights, Understanding Patents, Understanding Trademarks, Trademarks in Internet, Domain name registration, Software privacy, Legal Issues in Cyber Contracts, Authorship, Document Forgery. Security and Servers - Introduction, Basic security for HTTP Applications and Services, Securing Web Application, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.

**UNIT - III Cyber Security Vulnerabilities and Safeguards**

Cyber Security Vulnerabilities - Overview, vulnerabilities in software, System administration, Complex Network Architectures, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection. Cyber Security Safeguards - Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection and Prevention Techniques, Network based Intrusion detection Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.

**UNIT – IV Cyberspace Law and Cyber Forensics**

Cyberspace Law –Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards, Indian Cyberspace, National Cyber Security Policy 2013. Introduction to Cyber Forensics - Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, tracing memory in real time.

**UNIT – V Indian IT Act and Standards**

Indian Information Technology Act -Overview of Indian Legal System, Introduction to IT Act 2000, Indian IT Act 2008, Amendments in IT Act, IT Audit standards - ISO/IEC 27000 Series, COBIT, HIPPA, SOX, System audit, Information security audit, ISMS, Statement of Applicability, Business Continuity Plan, Disaster Recovery, Risk Analysis/Assessment.

**Text Books :**

1. Charles J. Brooks, Philip Craig and Donald Short, “Cyber Security Essentials”, SYBEX Publisher, First Edition, 2018.
2. Sunit Belapure and Nina Godbole, “Cyber Security”, Wiley India, 2011.

**References :**

1. Deborah G Johnson, “Computer Ethics”, Prentice Hall, USA, Fourth Edition, 2009.
2. Vivek Sood “Cyber Law Simplified” McGraw Hill Ltd., Fifth Edition, 2017.
3. Lester Evans, “Cyber security”, Amazon Digital Services LLC, 2018.
4. <https://meity.gov.in/content/information-technology-act-2000>.

**Course Outcomes :**

At the end of this course, the students will be able to understand of the following concepts:

1. Understand about security ethics, issues and threats.
2. Know the intellectual property rights and secure the copyrights.
3. Identify the cyber security vulnerabilities and safeguards.
4. Understand the cyberspace law and forensics.
5. Know the Indian IT, amendments act and standards.

**Mapping of Course Outcomes with Programme Outcomes**

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

22DSOESCN	BIG DATA FOR BIOINFORMATICS	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To provide an overview of the introduction and application areas of bioinformatics, with a focus on how bioinformatics data is stored and organized.
- To explain how to locate and extract data from key bioinformatics databases and also from NCBI, EMBL, DDBJ and PDB resources.
- To learn how to develop sequence Alignment and multiple sequence alignment using POA and PSSM.
- To understand the methods and approaches for prediction of protein structure.

**Unit – I Introduction to Bioinformatics**

History of Bioinformatics, Role of Bioinformatics in biological sciences-scope of bioinformatics. Introduction to internet: WWW- network basics, LAN & WAN standards. Network topologies and protocols: ftp- http. Introduction to Database: Types of database. Biological Database: Need of biological database- Sequence and Structure database – (NCB- EMBL-DDBJ-and PDB)-other databases – KEGG- PubMed-OMIM-PubChem-NCI-ZINC-Drug Bank,-Ligand. Format of Databases: GenBank and PDB flat file.

**Unit –II Protein Structure and Sequence Alignment**

Protein Structure Visualization: RasMol- PyMol- Jmol- CN3- Swiss PDB viewe- Chimera and Discovery Studio visualizer. Protein Structure Comparison: Intra-molecular Method- Intermolecular method, combined method. Protein Structure Comparison: SCOP and CATH. Pairwise Alignment: Dot Matrix Method- Dynamic programming - (Local and Global Alignment) Gap Penalties, POA Alignment. Scoring Matrices: Amino acid scoring matrices-PAM,- BLOSUM. Database Similarity Searching: BLAST. BLAST variants. BLAST output format. FASTA.

**Unit–III Multiple Sequence Alignment and Motif, Domain Prediction**

Multiple Sequence Alignment: Scoring function-exhaustive algorithms-and Heuristic algorithms. PSSM, Markov Model and Hidden Markov Model. Protein Motif and Domain Prediction: Motif and Domain Databases PROSITE. Sequence Logos and Web-logo.

**Unit –IV Gene and Promoter Prediction**

Gene Prediction in Prokaryotes: Conventional determination of Open Reading Frames (ORF)-Markov model and HMM. Gene Prediction in Eukaryotes: Ab Initio based program-Neural Networks. Promoter and Regulatory Element Prediction: Prokaryotes and Eukaryotes. Introduction to Phylogenetic: Phylogenetic Basics-Terminologies. Phylogenetic Tree construction Methods: Distant based method - (UPGMA, NJ) Character Based Method – (MP and ML)-Phylogenetic Tree Evaluation: Bootstrapping.

**Unit-V Protein Structure Prediction**

Globular Proteins: Ab-Initio-Homology Based- Neural networks method. Transmembrane Proteins: Prediction of Helical membrane-  $\beta$ -barrel membrane proteins. RNA Structure Prediction: Ab Initio approach- dot matrices. Introduction to Homology modeling: Model refinement-model evaluation-homology model databases. Threading and fold recognition, CASP.

**Text Books :**

1. David W Mount, “Bioinformatics sequence and Genome analysis, Cold Spring Harbor Laboratory Press”, Second Edition, 2013.
2. Attwood T K, D J Parry-Smith, “Introduction to Bioinformatics”, Pearson Education, 2005.

**References :**

1. Neil C. Jones and Pavel A. Pevzner, "An Introduction to Bioinformatics Algorithms", MIT Press, 2005.
2. [https://nptel.ac.in/noc/individual\\_course.php?id=noc18-bt01](https://nptel.ac.in/noc/individual_course.php?id=noc18-bt01) (YouTube videos)
3. [nptel.ac.in/courses/1006065](https://nptel.ac.in/courses/1006065) Tutorials.

**Course Outcomes :**

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

1. Describe the contents and properties of the most important bioinformatics databases.
2. Locate and use the databases in NCBI, EMBL, DDBJ and PDB resources to know the difference between databases, tools, repositories to extract specific information.
3. Explain the major steps in pairwise and multiple sequence alignment
4. Explain the methods for gene and promoter prediction.
5. Predict the secondary and tertiary structures of protein sequences.

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	-	-	-	-	-	-	-

22DSOESCN	DEEP LEARNING	L	T	P	C
		3	0	0	3

**Course Objectives :**

- To present the mathematical, statistical and computational challenges of building neural networks.
- To study the concepts of deep learning.
- To introduce dimensionality reduction techniques.
- To examine the case studies of deep learning techniques.

**UNIT - I Introduction**

Introduction to machine learning- Linear models (SVMs and Perceptron, 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. Describe the challenges in Neural networks.
2. Explain the fundamental concepts of deep learning.
3. Train deep learning networks.
4. Apply the methods for optimization in deep learning.
5. Comprehend and develop applications using the concepts of deep learning.

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

22DSOESCN	INFORMATION RETRIEVAL	L	T	P	C
		3	0	0	3

### Course Objectives :

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

### 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”, ACM Press Books, 2<sup>nd</sup> edition, 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 Gordon V. 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 its models.
2. Use an open source search engine framework and explore its capabilities.
3. Apply appropriate method of classification or clustering.
4. Design and implement innovative features in a search engine.
5. Design and implement a 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	-	-	-	-	-	-	-	-

22DSOESCN	BLOCK CHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To describe the current state of block chain technology and the potential of the technology beyond financial transactions.
- To demonstrate the concepts and features of block chain technology that might be broadly extensible to a wide variety of situations.
- To provide a conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
- To understand how blockchain technology is for the decentralization of markets.

**UNIT - I Cryptography**

Cryptography – Encryption and Decryption – Cryptographic Hash Functions – Hash Pointers and Data Structures – Digital Signatures – Cryptocurrencies – Bitcoin – Bitcoin’s Ecosystem – Predecessors – Storing Bitcoins – Software Wallets – Hardware Wallets – Exchanges – Ethereum Smart Contracts – Ethereum Ecosystem – Digital Tokens.

**UNIT – II Blockchain Technology**

The Trust Protocol – How the Worldwide Ledger Works – A Rational Exuberance for the Blockchain – Achieving Trust in the Digital Age Promise and Peril of the New Platform- The Seven Design Principles – Networked Integrity – Distributed Power – Value as Incentive – Security – Privacy – Rights preserved – Inclusion - Blockchain Technology – Trust – Types of Blockchain – Blockchain Implementations – Hyperledger.

**UNIT – III Transactions**

Transactions – Blocks - Mining and consensus - Blockchain – Bitcoin Transactions – Transaction Inputs and Outputs – Transaction Chains – Making Change – Common Transaction Forms – Constructing a Transaction – Bitcoin Mining – Mining Transactions in Blocks – Spending the Transaction – Blockchain 1.0: Currency – Technology Stack – eWallet Services and Personal Cryptosecurity - Blockchain 1.0 in Practical Use.

**UNIT –IV Block chain: Contracts**

Financial Services – Crowdfunding – Bitcoin Prediction Markets – Smart Property – Smart contracts – Blockchain 2.0 Protocol Projects, Blockchain 3.0: Justice Applications beyond Currency, Economics and Markets – Digital Identity Verification – Digital Art – Blockchain Government.

**UNIT – V Security**

Technical Challenges – Business Model Challenges – Scandals and Public Perception – Government Regulation – Privacy Challenges for Personal Records – Decentralization Trends -likely to persist – Blockchain Technical Challenges – Bugs in the Core Code –

Denial-of- Service Attacks – Security in Smart Contracts – Scaling – Sharding.

#### Text Books :

1. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015.
2. Andreas M. Antonopoulos, “Mastering Bitcoin: Programming the Open Blockchain”, O’Reilly, 2017.

#### References :

1. Joseph J. Bambara, Paul. R. Allen, KedarIyer, Rene Madsen, Solomon Lederer, Michael Wuehler, “Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions”, McGraw-Hill, 2018.
2. Don Tapscott and Alex Tapscott, “Blockchain Revolution: How the Technology behind Bitcoin and Other Cryptocurrencies is Changing the World”, Portfolio-Penguin, 2016.
3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”. Princeton University Press, 2016.
4. Antony Lewis, “The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers them”, Mango Publishers, 2018.

#### Course Outcomes :

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

1. Understand the technical foundations of digital currencies and cryptographic concepts.
2. Know the concepts, features and principles of blockchain and use the blockchain for automated tracking of all digital endeavors.
3. Analyze how the transactions are verified and recorded in a block.
4. Explore what constitutes a smart contract, its legal implications and what it can and cannot do, now and in the near future.
5. Extract knowledge on how security and privacy issues are handled within a blockchain.

**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	-	1	-	2	-	-	-	-	-	-	-
<b>CO4</b>	1	-	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	1	1	1	1	-	-	-	-	-	-	-	-

22DSOESCN	DIGITAL FORENSICS	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To explain the fundamentals and importance of digital forensics
- To know the methods for data acquisition and storing digital evidence
- To understand the various windows system artifacts useful for digital forensics
- To provide knowledge on legal aspects of digital forensics

**UNIT – I Introduction**

Forensic Fundamentals: Definition of Forensic Science – Digital Forensics – Uses of Digital Forensics - Digital Forensic Process – Key Technical Concepts: Bits, Bytes, and Numbering Schemes - File Extensions and File Signatures- Computers and DataStorage - Random Access Memory - Volatility of Data - The Difference between Computer Environments - Active, Latent, and Archival Data - The Difference between Allocated and Unallocated Space - Computer File Systems.

**UNIT – II Collecting Evidence**

Network Evidence Collection: Preparation – Network Device Evidence – Packet Capture – Evidence Collection - Documenting the Scene and the Evidence - Establishing and Maintaining the Chain of Custody - Forensic Cloning of Evidence - Dealing with Live Systems and Dead Systems - Using Hashing to Verify the Integrity of Evidence - Drafting the Examiner's Final Report.

**UNIT – III Windows System Artifacts**

Finding Deleted Data - Hibernation Files - Examining the Windows Registry - Print Spooling Evidence - Recycle Bin Operation - Metadata: Definition and use - Thumbnail Images as Evidence - Most Recently Used Lists: Creation and their forensic Value - Working with Restore Points and Shadow Copies - Examining Prefetch and Link Files.

**UNIT – IV Labs and Tools**

Laboratories - The Role and Organization of Forensic Laboratories - The Purpose of Policies and Procedures in Forensic Laboratories - The Role of Quality Assurance in Forensics - Digital Forensic Hardware and Software - Accreditation versus Certification.

**UNIT – V Legal Aspects of Digital Forensics**

The Legal Aspects of Digital Forensics - The Fourth Amendment and Its Impact on Digital Forensics - Electronic Discovery - Duty to Preserve Potential Digital Evidence in Civil Cases - Private Searches and Establishing the Need for Offsite Analysis - Overview of Electronic Communications Privacy Act - Searching Digital Evidence With and Without a Search Warrant.

**Text Books :**

1. John Sammons, “The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics”, Syngress, 1<sup>st</sup> Edition, 2012.

- Gerard Johansen, “Digital Forensics and Incident Response: An Intelligent way to respond Attacks”, Packt Publishing Ltd, 1<sup>st</sup> Edition, 2017.

### References :

- Bill Nelson, and Christopher Steuart, “Guide to Computer Forensics and Investigation”, Amelia Phillips, Cengage Learning, 4<sup>th</sup> Edition, 2010.
- Clint P. Garrison, “Digital Forensics for Network, Internet and Cloud Computing: A Forensic Evidence Guide for Moving Targets and Data”, Syngress, 2010.
- JoakimKavrestad, “Guide to Digital Forensics: A Concise and Practical Introduction” (SpringerBriefs in Computer Science), Springer; 1<sup>st</sup> Edition, 2017.
- John Sammons, “Digital Forensics: Threatscape and Best Practices”, Syngress, 1<sup>st</sup> Edition, 2015.
- Anthony T.S.Ho and Shujun Li, “Handbook of Digital Forensics of Multimedia Data and Devices”, Wiley-IEEE Press, 1<sup>st</sup> Edition, 2015.

### Course Outcomes:

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

- Explain and document the process of digital forensics analysis
- Present the evidence and conclusion of an investigation in report format
- Identify the methods for data recovery
- Analyze various digital forensics tools and techniques
- Understand the trade-offs and differences between various forensic tools

### 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	-	-	-	-	-	-	-	-

22DSOESCN	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

22DSOESCN	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
<b>CO1</b>	2	-	-	-	-	2	-	-	2	2	-	-
<b>CO2</b>	2	-	-	-	-	2	-	-	2	3	-	-
<b>CO3</b>	2	-	-	-	-	3	-	3	2	2	-	-
<b>CO4</b>	2	-	-	-	-	2	-	3	2	3	-	-
<b>CO5</b>	2	-	-	-	-	2	-	3	2	3	-	-

<b>22DSOESCN</b>	<b>NCC (Army Wing)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

**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.

**HONORS ELECTIVE COURSES**

22DSHESCN	BIG DATA TESTING TOOLS	L	T	P	C
		3	1	0	4

**Course Objectives :**

- To describe the Big Data Tools with MapReduce Concepts.
- To understand the principles of ETL Testing processes.
- To describe an approach for Testing using Hive and HQL.
- To establish the knowledge about administration and various testing on distributed environment.

**UNIT –I Introduction to Hadoop with MapReduce**

Analyzing the data with Unix Tools / Hadoop - Map and Reduce – Scaling out – Hadoop streaming – Design of Hadoop Distributed File System (HDFS) – Anatomy of MapReduce Job Run: classic MapReduce and YARN – Failures – Job Scheduling – Task Execution – MapReduce Types and Formats – MapReduce Features

**UNIT –II Big Data and ETL Testing Fundamentals**

Data Concepts - Big Data Concepts - Transactional vs. Analytical Databases vs. Big Data Stores - Big Data Concepts - Hadoop Ecosystem - Hadoop Process Big Data – Introduction to ETL - Principles of ETL Testing - Data Mapping Document - Testing methods - Testing incremental loads - Multiple Sources - Data Permutations - Test Data Sampling - Test Points - Test Plan - ETL Manual Test Creation - ETL Automated Test Creation - Transformation Types - Testing Process - Defect Types

**UNIT –III Big Data Testing using Hive and HQL**

Big Data Overview - Understanding Hadoop Architecture - Understanding the challenges of Big Data Testing - Big Data Testing Comparison Methods - One-to-One Mapping Transformation Test - HQL commands for returning data - One-to-One Mapping with Filters Transformation Test - HQL commands for filtering data - HQL commands for sorting data - Join Mapping Transformation Test - Field Merging and Splitting Transformation Test - Type Casting with Formatting Transformation Test - Translation and Lookup Transformation Test - Statistical Tests

**Unit – IV Testing on MongoDB**

Application Administration: Finding problematic operations – killing operations – preventing phantom operations-Data administration – Authentication setting –creating and deleting indexes – preheating data – compacting data – Monitoring mongoDB – Tracking Page faults - Tracking performance – Monitoring replication

**Unit - V Testing Scala and Spark Applications**

Testing in distributed environment – Challenges of testing in distributed environment - Testing Spark applications: Testing scala method –unit testing –Integration Testing -

Testing scala code - Debugging on Eclipse as scala debug – Debugging spark jobs as local and standby mode – Debugging spark applications on YARN

### Text Books :

1. Tom White, “Hadoop The Definitive Guide”, O’Reilly Publication, Third Edition, 2012.
2. Kristina Chodorow, “MongoDB: The Definitive Guide: Powerful and Scalable Data Storage”, O’Reilly Media, Inc. 2013.

### References :

1. Eric Sammer, Hadoop Operations, “A Guide for Developers and Administrators”, O’Reilly Publication, 2012.
2. Rudy Lai, Bartłomiej Potaczek, “Hands-On Big Data Analytics with PySpark: Analyze large datasets and discover techniques for testing, immunizing, and parallelizing Spark jobs”, Packt Publishing Ltd, 2019.
3. Md. Rezaul Karim and Sridhar Alla, “Scala and Spark for Big Data Analytics: Explore the concepts of functional programming, data streaming, and machine learning”, Packtpunblising Ltd., 2017.
4. Ralph Kimball, Joe Caserta, “The Data Warehouse ETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data”, John Wiley & Sons. 2011.

### Course Outcomes :

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

1. Understand a Performance of Hadoop with Map and Reduce.
2. Describe the principles of ETL Testing.
3. Recognize the Big Data Testing Comparison Methods.
4. Describe the Application Administration and Monitoring mongoDB.
5. Conclude the testing methods through the testing tools on distributed environment.

**Mapping of Course Outcomes with Programme Outcomes**

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

22DSHESCN	BIG DATA ANALYTICS TOOLS	L	T	P	C
		3	1	0	4

**Course Objectives:**

- To understand the tools and practices for working with big data
- To introduce the features of Apache Flink and Kafka
- To learn about real-time data and stream computing
- To develop applications using Neo4j

**UNIT – I Apache Flink**

Apache Flink - Consequences of Not Doing Streaming Well - Goals for Processing Continuous Event Data - Evolution of Stream Processing Technologies - First Look at Apache Flink - Flink in Production - Where Flink Fits - Stream-First Architecture - Traditional Architecture versus Streaming Architecture - Message Transport and Message Processing - The Transport Layer: Ideal Capabilities - Streaming Data for a Microservices Architecture - Beyond Real-Time Applications - Geo-Distributed Replication of Streams - What Flink Does - Different Types of Correctness - Hierarchical Use Cases: Adopting Flink in Stages.

**UNIT – II Advanced features of Apache Flink**

Handling Time - Counting with Batch and Lambda Architectures - Counting with Streaming Architecture - Notions of Time - Windows - Time Travel - Watermarks - A Real-World Example: Kappa Architecture at Ericsson - Stateful Computation - Notions of Consistency - Flink Checkpoints: Guaranteeing Exactly Once - Savepoints: Versioning State - End-to-End Consistency and the Stream Processor as a Database - Flink Performance: the Yahoo! Streaming Benchmark - Batch Is a Special Case of Streaming - Batch Processing Technology - Case Study: Flink as a Batch Processor.

**UNIT – III Introduction to Neo4j**

Neo4j - Graph data in a relational database - Graph data in Neo4j - SQL joins versus graph traversal on a large scale - Neo4j in NoSQL space - Neo4j: the ACID-compliant database - Data model for Neo4j - Domain modelling - Modelling graph data structures - Using the Neo4j API - Node labels - Traversing using the Neo4j Core Java API - Traversing using the Neo4j Traversal API - Creating the index entry - Finding the user by their email - Automatic indexing - The cost/benefit trade-off of indexing.

**UNIT – IV Application Development with Neo4j**

Introduction to Cypher - Cypher syntax basics - Updating your graph with Cypher - Advanced Cypher - Transaction basics - Transactions in depth - Integration with other transaction management systems - Transaction events - Traversal ordering - Expanding relationships - Managing uniqueness - Bidirectional traversals.

**UNIT – V Kafka**

Meet Kafka - Publish/Subscribe Messaging - Enter Kafka – Reasons to use Kafka - The Data Ecosystem – Kafka’s Origin - Producer Overview - Constructing a Kafka Producer - Sending a Message to Kafka - Configuring Producers - Serializers - Partitions - Old Producer APIs - Kafka Consumer Concepts - Creating a Kafka Consumer - The Poll Loop - Configuring Consumers - Commits and Offsets - Rebalance Listeners - Deserializers - Standalone Consumer - Older Consumer APIs.

**Text Books :**

1. Ellen Friedman and Kostas Tzoumas, “Introduction to Apache Flink - Stream Processing for Real Time and Beyond”, O’Reilly Media, Inc., First Edition, 2016.
2. AleksaVukotic, Nicki Watt, “Neo4j in Action”, Manning Publications, 2015.

**References :**

1. Neha Narkhede, Gwen Shapira, and Todd Palino, “Kafka: The Definitive Guide - Real-Time Data and Stream Processing at Scale”, O’Reilly Media, Inc., First Edition, 2017.
2. Fabian Hueske, VasilikiKalavri, “Stream Processing with Apache Flink: Fundamentals, Implementation, and Operation of Streaming Applications”, O’Reilly Media, Inc., First Edition, 2019.
3. Sylvain Roussy, Nicolas Mervaille, Nicolas Rouyer, “Neo4j - a Graph Project Story”, D-Booker Editions, 2019.
4. Mark Needham, Amy E. Hodler, “Graph Algorithms: Practical Examples in Apache Spark” and Neo4j, O’Reilly Media, Inc., 2019.
5. Prashant Kumar Pandey, “Kafka Streams - Real-time Stream Processing”, Learning Journal, 2019.

**Course Outcomes :**

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

1. Understand streaming architecture and compare with traditional architecture.
2. Analyze Flink performance.
3. Describe graph data use Neo4j.
4. Develop applications using Neo4j.
5. Explain publish or subscribe messaging through kafka.

**Mapping of Course Outcomes with Programme Outcomes**

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

22DSHESCN	DATA MANAGEMENT	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To provide an overview of the opportunities and challenges in data management.
- To discuss the technical practices for data management.
- To introduce the risk security and visibility concerns in data management.
- To impart knowledge on implementation data management.

**UNIT-I Introduction**

Data and the Enterprise – The database architecture of an information system – Data Management – problems encountered without DM – DM responsibilities – Data Management activities – Roles within DM – Benefits of DM – Relationship b/w DM and enterprise architecture.

**UNIT-II Meta Data and Master Data Management**

Data administration – Corporate data modeling – data definition and naming – Metadata – Metadata for DM – Metadata for content management – Meta data for describing data values – Master Data Management – Master data – Problems with master data – How to manage master data.

**UNIT-III Data Quality**

Data Quality – Definition issues associated with poor data quality – Causes of poor data quality – Dimensions of data quality – Data model quality – Improving data quality.

**UNIT-IV Data Governance**

Analytics platform Framework – Data Management Body of Knowledge (DMBOK) – Data governance – Definition – Need – Data steward Responsibilities – Corporate governance – Case for Big Data governance.

**UNIT-V Big Data Governance framework**

Big Data governance best practices – Data Protection – Security Architecture for Data Lake – Data structure Design – Sandbox functionality overview – Split Data Design – Big Data governance Framework program – Overview – Components – Organization – Big Data Security, Privacy and compliance, Data usage Agreement – Security operations Considerations and Policies – Information life cycle management – Quality Standards Data Quality Reporting.

**Text Books :**

1. Keith Gordan, “Principles of Data Management: Facilitating Information Sharing”, BCS Learning and Development Ltd., Second Edition, 2013.



2. Peta K. Ghavami, “Big Data Governance: Modern Data management Principles for Hadoop, NoSQL and Big Data Analytics”, Create Space Independent Publishing Platform, First Edition, 2015.

### References :

1. Judith Hurwitz, Alam Nugent, Dr.FernHalpar, Marcia Kaufman, “Big Data for Dummies”, John Wiley & Sons , 2013.
2. Gerardus blokdyk, “Enterprise Data Management”, Create Spacce Independent Publishing Platform, Third Edition, 2018 .
3. David Boddy, “Principles of Data Management”, FT Prentice Hall, Third Edition, 2005.
4. Kenneth C. Laudon, Jane P. Laudon, “Management Information System”, Pearson Education, Fifteenth Edition, 2018.

### Course Outcomes:

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

1. Identify the key issues and opportunities in Data Management and its associated applications in intelligent Business and Scientific Computing.
2. Explain the Strategies and Approaches for Data Management.
3. Describe technical practices of Data Management.
4. Describe the View of Security and Risk Management for big data.
5. Define the mechanisms for implementing Data Management.

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	1	-	-	-	-	-	-	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-
CO5	2	2	2	1	1	-	-	-	-	-	-	-

22DSHESCN	COGNITIVE COMPUTING	L	T	P	C
		3	0	0	3

### Course Objectives:

- To explore the area of cognitive computing and its implications for today’s world of big data analytics and evidence-based decision making.
- To investigate data from inside and outside the enterprise, and to identify as well as to evaluate patterns in large and unstructured data sets.
- To train the students to explore human reasoning by evaluating data in context and to present relevant findings along with the evidence.
- To learn IBM’s Watson as a cognitive system.

**UNIT - I Introduction**

Foundations of Cognitive Computing: Cognitive Computing as a new generation-Uses-Cognitive system-Gaining insights from data-AI as the foundation-Understanding cognition-Two systems of judgment and choice-Understanding Complex relationships-Elements of cognitive systems.

**UNIT – II Design Principles**

Design Principles for cognitive systems: Components-building corpus-bringing data into the cognitive system-machine learning: Finding patterns in data-supervised, unsupervised and reinforcement learning-hypotheses generation and scoring-visualization.

**UNIT – III Cognitive Systems**

NLP in support of a cognitive system: Role of NLP-Semantic web-applying NLP technologies to business problems. Big data and cognitive computing: Dealing with human generated data-defining big data-architectural foundation-analytical warehouses-Hadoop-data in motion and streaming data-Integrating big data and traditional data.

**UNIT – IV Representing knowledge in Taxonomies and Ontologies**

Representing knowledge-defining taxonomies and ontologies-explaining how to represent knowledge-models for knowledge representation. Applying advanced analytics to cognitive computing: Key capabilities in advanced analytics-using advanced analytics to create value-impact of open source tools on advanced analytics. Role of cloud and distributed computing in cognitive computing.

**UNIT – V Cognitive Applications**

Business implications of cognitive computing-IBM’s Watson as a cognitive system: Watson defined-Preparing Watson for commercial applications-Components of DeepQA Architecture. Process of building a cognitive application-cognitive healthcare application-cognitive computing in Government-Emerging cognitive computing areas.

**Text Books :**

1. Hurwitz, Kaufman, and Bowles, “Cognitive Computing and Big Data Analytics”, Wiley, Indianapolis, 2005.
2. Peter Fingar, “Cognitive Computing: A Brief Guide for Game Changers”, Meghan-Kiffer Press, USA, 2015.

**References :**

1. Jerome R. Busemeyer, Peter D. Bruza, “Quantum Models of Cognition and Decision”, Cambridge University Press, 2014.
2. Emmanuel M. Pothos, Andy J. Wills, “Formal Approaches in Categorization”, Cambridge University Press, 2011.
3. Nils J. Nilsson, “The Quest for Artificial Intelligence”, Cambridge University Press, 2009.

- Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, "Cognitive Science: An Introduction", MIT Press, 1995.

### Course Outcomes:

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

- Understand and discuss what cognitive computing is, and how it differs from traditional approaches.
- Use the recent tools associated with cognitive computing.
- Plan and execute a project that leverages cognitive computing.
- Create the business implications of cognitive computing.
- Build and explore the cognitive computing applications that are impacting the field of data science.

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	-	-	-	-	-	-	-

22DSHESCN	HIGH PERFORMANCE BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

### Course Objectives :

- To understand the competitive advantages of High performance big data analytics.
- To understand the High performance big data technologies.
- To learn high performance data analysis network infrastructures.
- To learn stream computing and gain knowledge about grid, cloud and peer to peer system usage in high performance big data analytics.

### UNIT - I The High-Performance Technologies For Big And Fast Data Analytics

Introduction - The Emergence of Big Data Analytics (BDA) Discipline - The Big Data Analytics (BDA) Challenges - The High-Performance Computing (HPC) Paradigms - The High-Performance Approaches Through Parallelism - Cluster Computing - Grid Computing - Cloud Computing - Heterogeneous Computing - Appliances for Big Data

Analytics - The Emerging Data Sources for Precise, Predictive, and Prescriptive Insights - The Big Data Analytics: The Prominent Process Steps - Real-Time Analytics - Stream Analytics - Sensor Analytics.

### **UNIT - II Network Infrastructure for High-Performance Big Data Analytics**

Network Infrastructure Limitations of Present-Day Networks - Approaches for the Design of Network Infrastructures for High-Performance Big Data - Storage Infrastructures for High-Performance Big Data Analytics:- Getting Started with Storage Area Networks (SANs) - Storage Infrastructure Requirements for Storing Big Data - Fiber Channel Storage Area Network (FC SAN) - Internet Protocol Storage Area Network (IP SAN) - Network-Attached Storage (NAS) - Popular File Systems Used for High-Performance Big Data Analytics - Introduction to Cloud Storage.

### **UNIT – III Real-Time Analytics Using High-Performance Computing**

Technologies That Support Real-Time Analytics - MOA: Massive Online Analysis - General Parallel File System (GPFS) -Machine Data Analytics Operational Analytics - Cloud Computing Centralized HPC - Requirements to Centralized HPC - HPC Remote Simulation - Architecture Models - SMP (Symmetric Multiprocessing) - Virtualization for HPC - FICON Mainframe Interface - Mainframe Mobile - Windows High-Performance Computing.

### **UNIT - IV In-Database Processing And In-Memory Analytics**

Introduction - In-Database Analytics - Integrated Systems for Big and Fast Data Analytics - Converged Infrastructure (CI) for Big Data Analytics - High-Performance Analytics: Mainframes + Hadoop - In-Memory Platforms for Fast Data Analytics-The Cloud Infrastructures for High-Performance Big and Fast Data Analytics - Big File Systems for the Big Data World - Databases and Warehouses for Big and Fast Data Analytics - Streaming Analytics.

### **UNIT -V High-Performance Grids and Clusters**

Cluster Computing - Grid Computing - Design Principles and Characteristics of High-Performance Peer-to-Peer Systems:- Peer-to-Peer System Architectures - High-Performance Peer-to-Peer Applications -Visualization Dimensions for High- Performance Big Data Analytics: Common Techniques - Data Visualization Tools and Systems

#### **Text Book ::**

1. Pethuru Raj, Anupama Raman, Dhivya Nagaraj and Siddhartha Duggirala, “High-Performance Big-Data Analytics Computing Systems and Approaches”, Springer International Publishing Switzerland, 2015.

**References :**

1. Chao Wang, "High Performance Computing for Big Data Methodologies and Applications", CRC Press, Taylor & Francis Group, 1st Edition, 2017.
2. Geoffrey Fox, Vladimir Getov, Lucio Grandinetti, Gerhard Joubert, Thomas Sterling, "New Frontiers in High Performance Computing and Big Data", IOS Press Ebooks, 2017.
3. Trovati, M., Hill, R., Anjum, A., Zhu, S.Y., Liu, L. (Eds.), "Big-Data Analytics and Cloud Computing: Theory, Algorithms and Applications" Springer, 1st ed., 2015.
4. Lucio Grandinetti, Gerhard Joubert, Marcel Kunze, Valerio Pascucci, "Big Data and High Performance Computing", IOS Press Ebooks, 2015.
5. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
6. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.

**Course Outcomes :**

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

1. Understand how to leverage the insights from high performance big data analytics.
2. Analyze various network infrastructure for high performance big data analytics.
3. Perform analytics on real-time streaming data.
4. Understand the analytics in Memory and database processing.
5. Understand the various NoSql alternative database models and to analyze of data into grid, cloud and peer to peer system.

**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	-	-	-	-	-	-	-	-	-	-	-

22DSHESCN	FINANCIAL ANALYTICS	L	T	P	C
		3	0	0	3

**Course Objectives:**

- To train students to use statistical methods for modeling and predicting financial crisis.
- To understand how to evaluate market sentiments and apply statistical models.

- To learn to improve the finance exchange strategies in foreign entries and exits.
- To identify the best working income statement portfolio with price statistics and apply binomial model for option data.

### **UNIT - I Financial Analytics**

Financial Statistics: Financial Returns-Capital Asset Pricing Model-Financial Securities-Bond Investments-Stock Investments-The Housing Crisis-The Euro Crisis-Securities - Datasets and Visualization- Adjusting for Stock Splits-Securities in Data Importing-Data Cleansing-Quoting.

### **UNIT - II Gauging the Market Sentiment**

Markov Regime Switching Model - Reading the Market Data-Bayesian Reasoning - The Beta Distribution -Prior and Posterior Distributions - Examining Log Returns for Correlation -Momentum Graphs.

### **UNIT - III Trading Strategies**

Foreign Exchange Markets- Chart Analytics - Initialization and Finalization - Momentum Indicators -Bayesian Reasoning within Positions - Entries - Exits -Profitability -Short-Term Volatility -The State Machine.

### **UNIT - IV Prediction Using Fundamentals**

Best Income Statement Portfolio -Reformatting Income Statement Growth Figures-Obtaining Price Statistics -Combining the Income Statement with Price Statistics-Prediction Using Classification Trees and Recursive Partitioning-Comparing Prediction Rates among Classifiers

### **UNIT - V Binomial Model for Options**

Applying Computational Finance - Risk-Neutral Pricing and No Arbitrage -High Risk-Free Rate Environment - Convergence of Binomial Model for Option Data - Put-Call Parity - From Binomial to Log-Normal.

### **Text Books :**

1. Mark J. Bennett , Dirk L. Hugen, “Financial Analytics with R”, Cambridge University Press,2016
2. Erich A.Helfert, “Financial Analysis: Tools and Techniques- A Guide for Managers”,McGraw Hill, 2010.

### **References :**

1. James C. Vanhorne, “Fundamentals of Financial Management”, 11th Edition,PHI Learning,2012.
2. Brigham, Ehrhardt, “Financial Management Theory and Practice”,Cengage Learning, 12th edition, 2010.
3. Prasanna Chandra, “Financial Management”, Tata,9th edition, 2012.

**Course Outcomes :**

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

1. Describe the knowledge in financial statistics in terms of capital, returns, investment, bonds and financial risks.
2. Evaluate market sentiments.
3. Explain foreign exchange marketing strategies.
4. Predict best income strategies using classification Trees and Recursive partitioning techniques.
5. Apply binomial model for option data.

**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>	1	1	-	1	-	-	-	-	-	-	-	-
<b>CO3</b>	2	1	1	1	-	-	-	-	-	-	-	2
<b>CO4</b>	1	1	1	-	2	-	-	-	-	-	-	-
<b>CO5</b>	1	1	-	-	-	-	-	-	-	-	-	-

**ONE CREDIT COURSES**

<b>22DSOCSCN</b>	<b>DEEP LEARNING TOOLS LAB</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 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.

<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>	-	-	2	-	2	-	-	-	-	-	-	-
<b>CO2</b>	-	3	3	1	3	1	-	-	-	-	-	2
<b>CO3</b>	2	2	-	-	-	-	-	-	-	2	-	2

<b>22DSOCSCN</b>	<b>IMAGE AND SPEECH PROCESSING LAB</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 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
<b>CO1</b>	3	3	3	3	2	-	-	-	-	-	-	-
<b>CO2</b>	3	3	2	2	2	-	-	-	-	-	-	-
<b>CO3</b>	2	2	-	-	-	-	-	-	-	-	-	2

22DSOCSCN	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	2	1

**Course Objectives:**

- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To know the concept of data transfer between nodes.
- To implement address resolution protocol, remote method invocation, server and client.

**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 web page.
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

22DSOCSCN	<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

22DSOCSCN	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 .

<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>	-	2	-	2	-	-	-	-	-	3	-	3
<b>CO2</b>	-	2	-	2	-	-	-	-	-	3	-	3
<b>CO3</b>	-	-	3	-	-	-	-	-	-	3	-	3
<b>CO4</b>	-	-	2	3	-	-	-	-	-	3	-	3
<b>CO5</b>	-	-	3	2	-	-	-	-	-	3	-	3