ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

B.E. COMPUTER SCIENCE AND ENGINEERING
(Artificial Intelligence and Machine Learning)
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, IIChE, 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:

Percentage of marks = (OGPA/CGPA - 0.25) x 10

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

$_i$- 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

<table>
<tr><th>S.No.</th><th>Branch of Study in B.E</th><th>Honours Elective Courses from Same and Allied Departments of</th><th>Minor Engineering Courses from Other Departments of</th></tr>
<tr><td>1</td><td>Civil Engineering</td><td rowspan="2">1. Civil Engineering
2. Civil and Structural Engineering.</td><td rowspan="2">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.</td></tr>
<tr><td>2</td><td>Civil and Structural Engineering</td></tr>
<tr><td>3</td><td>Mechanical Engineering</td><td rowspan="2">1. Mechanical Engineering
2. Mechanical (Manufacturing) Engineering.</td><td rowspan="2">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.</td></tr>
<tr><td>4</td><td>Mechanical (Manufacturing) Engineering.</td></tr>
</table>

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

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

DETAILS OF COURSE CODE

S. No	Code (3rd and 4th Digits)	Details
1	ET	Common Course for the faculty
2	CE	Civil Engg. Course
3	CZ	Civil and Structural Engg. course
4	ME	Mechanical Engg. Course
5	MM	Mechanical Engg (Manufacturing). Course
6	EE	Electrical and Electronics Engg. Course
7	EI	Electronics and Instrumentation Engg. course
8	CH	Chemical Engg. course
9	CS	Computer Science and Engg. course
10	IT	Information Technology course
11	EC	Electronics and Communication Engg. course
12	AI	Computer Science and Engineering (Artificial Intelligence and Machine Learning)
13	DS	Computer Science and Engineering (Data Science)
14	YY	Code of the Program concerned (S.No 02 to S.No.13)

Code (5th and 6th Digits)	Details
HS	Humanities Theory
HP	Humanities Practical
BS	Basic Science Theory
BP	Basic Science Practical
ES	Engineering Science Theory
SP	Engineering Science Practical
PC	Professional Core Theory
CP	Professional Core Practical
PE	Professional Elective Theory
EP	Professional Elective Practical
IT	Internship /Industrial Training
OE	Open Elective Theory
PV	Project and Viva-voce

The first two digits relate to the year from which the Regulations commence 7th digit represents the semester and 8th and 9th 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
								Total Credits	**20.5**

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
								Total Credits	**20.5**

*** 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**
22AIBS301	**BS-V**	Statistical Foundations of AI	3	1	-	25	75	100	4
22ETES302	**ES-III**	Environmental Studies	3	-	-	25	75	100	3
22AIES303	**ES-IV**	Python Programming	3	-	-	25	75	100	3
22AIES304	**ES-V**	Digital Electronics	2			25	75	100	2
22AIPC305	**PC-I**	Data Structures	3	1	-	25	75	100	4
22AIPC306	**PC-II**	Principles of Artificial Intelligence	3	1		25	75	100	4
22AISP307	**ESP-V**	Digital Electronics Lab	-	-	3	40	60	100	1.5
22AICP308	**PCP-I**	Data Structures Lab	-	-	3	40	60	100	1.5
22AICP309	**PCP-II**	Artificial Intelligence Lab	-	-	3	40	60	100	1.5
						Total Credits			**24.5**

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
22AIBS401	**BS-VI**	Discrete Mathematics	3	-	-	25	75	100	3
22AIES402	**ES-VI**	Computer Organization and Architecture	3	-	-	25	75	100	3
22AIPC403	**PC-III**	Operating Systems	3	-	-	25	75	100	3
22AIPC404	**PC-IV**	Database Management Systems	3	-	-	25	75	100	3
22AIPC405	**PC-V**	Fundamentals of Machine Learning	3	-	-	25	75	100	3
22AIPC406	**PC-VI**	Object Oriented Programming	3	-	-	25	75	100	3
22ETHS407	**HS –IV**	Universal Human Values	2	1	-	25	75	100	3
22AICP408	**PCP-III**	Database Management Systems Lab	-	-	3	40	60	100	1.5
22AICP409	**PCP-IV**	Machine Learning Lab	-	-	3	40	60	100	1.5
22AICP410	**PCP-V**	Object Oriented Programming Lab	-	-	3	40	60	100	1.5
						Total Credits			**25.5**
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**
22AIPC501	**PC-VII**	Image and Speech Processing	3	-	-	25	75	100	3
22AIPC502	**PC-VIII**	Neural and Fuzzy Computing in AI	3	-	-	25	75	100	3
22AIPC503	**PC-IX**	Computer Networks	3	-	-	25	75	100	3
22AIPC504	**PC-X**	Knowledge Engineering and Inference	3			25	75	100	3
22AIPE505	**PE-I**	Professional Elective I	3	-	-	25	75	100	3
22AIPE506	**PE-II**	Professional Elective II	3	-		25	75	100	3
22YYOE507	**OE-I**	Open Elective - I	3	-	-	25	75	100	3
22AICP508	**PCP-VI**	Image and Speech Processing Lab	-	-	3	40	60	100	1.5
22AICP509	**PCP-VII**	Computer Networks Lab	-	-	3	40	60	100	1.5
22AICP510	**PCP-VIII**	Neural Computing Lab	-	-	3	40	60	100	1.5
22ETIT511	**IT-I**	Industrial Training / Rural Internship/Innovation / Entrepreneurship	**Four** weeks during the summer vacation at the end of **IV Semester**				100	100	**4.0**
						Total Credits			**29.5**

SEMESTER VI									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
22AIPC601	**PC-XI**	Deep Learning for Visual Computing	3	-	-	25	75	100	3
22AIPC602	**PC-XII**	Embedded Systems and Internet of Things (IoT)	3	-	-	25	75	100	3
22AIPE603	**PE-III**	Professional Elective - III	3	-	-	25	75	100	3
22AIPE604	**PE-IV**	Professional Elective - IV	3	-	-	25	75	100	3
22AIPE605	**PE-V**	Professional Elective -V	3	-	-	25	75	100	3
22YYOE606	**OE-II**	Open Elective - II	3	-	-	25	75	100	3
22AICP607	**PCP-IX**	Deep Learning Tools Lab	-	-	3	40	60	100	1.5
22AICP608	**PCP-X**	Embedded Systems and Internet of Things (IoT) Lab	-	-	3	40	60	100	1.5
						Total Credits			**21**
Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming VII Semester.									

SEMESTER VII									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
22ETHS701	**HS -V**	Social and Ethical Issues in AI	2	-	-	25	75	100	2
22AIPC702	**PC-XIII**	Evolutionary Optimization Algorithms	3	-	-	25	75	100	3
22AIPE703	**PE-VI**	Professional Elective-VI	3	-	-	25	75	100	3
22AIPE704	**PE-VII**	Professional Elective-VII	3	-	-	25	75	100	3
22AIOE705	**OE-III**	Open Elective - III	3	-	-	25	75	100	3
22AICP706	**PCP-XI**	Optimization Techniques Lab	-	-	3	40	60	100	1.5
22AIIT707	**IT-II**	Industrial Training / Rural Internship/Innovation / Entrepreneurship	**Four** weeks during the summer vacation at the end of **VI Semester**				100	100	**4.0**
						Total Credits			**19.5**

SEMESTER VIII									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
22AIOE801	**OE-IV**	Open Elective – IV	3	-	-	25	75	100	3
22AIOE802	**OE-V**	Open Elective – V	3	-	-	25	75	100	3
22AIPV803	**PV-I**	Project Work and Viva-Voce	-	**PR** 10	**S** 2	40	60	100	**6**
						Total Credits			**12**

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

PE – PROFESSIONAL ELECTIVES

1. Expert System Architecture
2. Multimedia Signal Processing
3. Decision Support Systems
4. NLP with Deep Learning
5. Advanced Java Programming
6. Speech Synthesis
7. AI – Hardware and Software Infrastructure
8. AI Marketing and ML Tools
9. Emotional Analytics in AI
10. Cognitive and Computational Approaches to Machine Vision
11. Data Analytics and Visualization
12. Virtual Reality
13. AI in Cyber security
14. Biometric Security Technology – AI
15. Information Retrieval and web search
16. Vision Systems and Robotics
17. Agent based Modeling and Simulation
18. Recommender Systems
19. Artificial Super Intelligence
20. AI – Challenges and Strategies
21. Deductive and Inductive Reasoning

OE - OPEN ELECTIVES

1. Internet of Things
2. Artificial Intelligence and Knowledge Engineering
3. Machine Learning
4. Natural Language Processing
5. Expert Systems
6. Computer Vision
7. Robotics
8. Mining Massive Datasets
9. Deep Generative Models
10. Java Full Stack Development
11. Big Data Analytics
12. Machine Learning with Application to Objects Recognition [Naan Mudhalvan]

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

LIST OF HONOURS ELECTIVE COURSES

S. No.	Course Code	Course Name	Credits
1.	22AIHESCN	Computational Neuroscience	4
2.	22AIHESCN	Robot Learning and Sensorimotor Control	4
3.	22AIHESCN	Human Computer Interaction (or) Enterprise Deep learning	3
4.	22AIHESCN	Stochastic Process and Queuing Theory	3
5.	22AIHESCN	CNN for Visual Recognition	3
6.	22AIHESCN	Machine Learning for Predictive Data Analytics	3

LIST OF MINOR ENGINEERING ELECTIVE COURSES

S. No.	Course Code	Course Name	Credits
1	22AIMISCN	Principles of Artificial Intelligence	4
2	22AIMISCN	Fundamentals of Machine Learning	4
3	22AIMISCN	Haskell Programming	3
4	22AIMISCN	Expert System Architecture (or) NLP with Deep Learning	3
5	22AIMISCN	Cognitive and Computational Approaches to Machine Vision	3
6	22AIMISCN	Vision Systems and Robotics	3

ONE CREDIT COURSES

1. Map Reduce Programming with Hadoop Lab
2. Data Visualization Lab
3. Mobile Application Development Laboratory
4. Security Lab
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, 36th Edition, 2010

REFERENCE BOOKS

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th publishers, Reprint,2002.
2. Erwin kreyszig,"Advanced Engineering Mathematics", 9th Edition, JohnWiley &Sons,2006.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi,11th 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: mono-chromaticity, 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, CO2), 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, Atomic radius, 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, 2nd 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., 7th 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 - H2-O2 fuel cell.

UNIT IV: POLYMERS AND NANO MATERIALS

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

UNIT V: ENGINEERING MATERIALS AND SPECTROSCOPIC TECHNIQUES

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

TEXT BOOKS

1. Jain, P.C. and Monica Jain (2010) "Engineering Chemistry" DhanpatRai& Sons, New Delhi.
2. Dara, S.S. and Umare, S.S. (2014) "Text Book of Engineering Chemistry" S. Chand & Co. Ltd., New Delhi.
3. Gopalan, R., Venkappaya, D. and Nagarajan, S. (2008) "Engineering Chemistry" Tata McGraw Publications Ltd., New Delhi.
4. Puri, B.R., Sharma, L.R. and Pathania, M.S. (2013) "Principles of Physical Chemistry" Vishal Publication Company, New Delhi.
5. Sharma, Y.R. (2010) "Elementary Organic Spectroscopy, Principle and Chemical Applications" , S. Chand Publishers, New Delhi.
6. Asim K Das and Mahua Das (2017) "An Introduction to Nanomaterials and Nanoscience" CBS Publishers & Distributors Pvt. Ltd., New Delhi.

COURSE OUTCOMES

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

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

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

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

COURSE OBJECTIVES

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

UNIT I: FUNDAMENTALS OF PROGRAMMING

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

UNIT II: EXPRESSIONS AND CONTROL STRUCTURES

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

UNIT III: ARRAYS

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

UNIT IV: FUNCTIONS

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

UNIT V: FILES AND STRUCTURES

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

TEXT BOOKS

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

REFERENCE BOOKS

1. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, Prentice Hall ofIndia.

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 சமண 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 திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III: **நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:** **3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், 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, கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு 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 Just icein Sangam Literature –Management Principles inThirukural –Tamil Epics andImpact of Buddhism&Jainismin TamilLand –Bakthi Literature Azhwars and Nayanmars.- Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

2. Heritage - Rock art paintings to modern art - Sculpture: Hero stone to modern sculpture – Bronzeicons –Tribes and their handicrafts-Art of templecar making –Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.
3. Folk and Martial arts - Therukoothu, Karagattam, VilluPattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.
4. Thinai 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)(Publishedby: 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 Flourescent Lamp (18W)
14. Study of various categories of Fuses and Insulators
15. Study and test the operation of Automatic Iron Box
16. Testing the buck/boost functions of the domestic stabilizer

COURSE OUTCOMES

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

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

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

SEMESTER II

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

COURSE OBJECTIVES

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

UNIT I: VOCABULARY BUILDING

The concept of Word Formation
Root words from foreign languages and their use in English
Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Count and uncount nouns.
Synonyms, antonyms, and standard abbreviations.
Language development - Wh questions asking and answering yes or no questions.

UNIT II: BASIC WRITING SKILLS

Sentence Structures
Use of phrases and clauses in sentences
Importance of proper punctuation
Creating coherence and Techniques for writing precisely
Organizing principles of paragraphs in writing

UNIT III: NATURE AND STYLE OF SENSIBLE WRITING

Describing and Defining
Classifying and Providing examples or evidence
Writing introduction and conclusion
Comprehension
Precise Writing

UNIT IV: WRITING PRACTICES & ORAL COMMUNICATION

Listening to lectures and making notes
Mechanics of presentation, asking and giving instruction
Essay Writing -Writing analytical essays and issue based essays
Dialogue writing and conversation
Letter writing -Formal and informal

UNIT V: GROUP DISCUSSION AND JOB APPLICATION

Characteristics and practices of group discussion
Job application
Resume preparation
Writing reports -minutes of a meeting, accident, survey E-mail -etiquette

TEXT /REFERENCE BOOKS

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

COURSE OUTCOMES

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

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

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

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

COURSE OBJECTIVES

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

UNIT I: MULTIVARIABLE CALCULUS (INTEGRATION)

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

UNIT II: VECTOR CALCULUS (INTEGRATION)

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

UNIT III: ORDINARY DIFFERENTIAL EQUATIONS

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

UNIT IV: COMPLEX VARIABLE (DIFFERENTIATION)

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

UNIT V: COMPLEX VARIABLE (INTEGRATION)

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

TEXT BOOKS

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

REFERENCE BOOKS

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson,Reprint,2002.
2. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", 9thEdn., Wiley India, 2009.
3. S. L. Ross, "Differential Equations", 3rd Ed., Wiley India,1984.
4. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th Ed., Mc-Graw 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'stheorems.
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**
CO1	**3**	**2**	**2**									**2**	**3**	**2**	**2**
CO2	**3**	**2**	**2**									**2**	**2**	**3**	**2**
CO3															
CO4															
CO5															

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
CO1	3	2	2									2	3	2	2
CO2	3	2	2									2	2	3	2
CO3	3	2	2			2						2	2	2	3
CO4															
CO5															

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

அலகு I: நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் 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 – மாமல்லபுரச் 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 குமுழித் 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 Thoompu 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.

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

COURSE OBJECTIVES

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

LIST OF EXPERIMENTS

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

COURSE OUTCOMES

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

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

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

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

COURSE OBJECTIVES

- To list the water quality standards.
- To assess the composition of an alloy.
- To appreciate the practical significance of acidimetry, alkalimetry,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 immiscibleliquids
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 soapnification of oil.
3. Calculate the quantity of adsorbate adsorbed by charcoal.
4. Determine the impurity from Pharmacheutical 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 though drawing
- To develop the skills to read manufacturing and construction drawings used in industry
- To develop a working knowledge of the layout of plant and equipment
- To develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricators

UNIT I: INTRODUCTION TO ENGINEERING DRAWING

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

UNIT II: ORTHOGRAPHIC PROJECTIONS

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

UNIT III: PROJECTIONS OF REGULAR SOLIDS

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

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

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

UNIT V: ISOMETRIC PROJECTIONS

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

OVERVIEW OF COMPUTER GRAPHICS COVERING

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

CUSTOMIZATION & CAD DRAWING

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

ANNOTATIONS, LAYERING & OTHER FUNCTIONS

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

TEXT/REFERENCE BOOKS

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

COURSE OUTCOMES

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

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

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

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E. COMPUTER SCIENCE AND ENGINEERING (Artificial Intelligence and MachineLearning)

(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 (Artificial Intelligence and Machine Learning)

PROGRAMME OUTCOMES (PO)

After the successful completion of the B.E Computer Science & Engineering (Artificial Intelligence and Machine Learning) degree programme the students will be ableto :

Sl. No.	Programme Outcomes
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3	**Design/Development of Solutions:** 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	**Conduct Investigations of Complex Problems:** 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	**Modern Tool Usage:** 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	**The Engineer and Society:** 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	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** 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	**Project Management and Finance:** 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	**Life-long Learning:** 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 (Artificial Intelligence and Machine Learning)

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO	PEO Statements
PEO1	To prepare graduates with potential to get employed in the right role and/or become entrepreneurs to contribute to the society.
PEO2	To provide the graduates with the requisite knowledge to pursue higher education and carry out research in the field of Computer Science and Engineering.
PEO3	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.
PEO4	To train the graduates to communicate effectively, work collaboratively and exhibit high levels of professionalism and ethical responsibility.

B.E.COMPUTER SCIENCE & ENGINEERING (Artificial Intelligence and Machine Learning)

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSOs	Programme Specific Outcome
PSO1	Acquire the ability to understand **basic sciences, humanity sciences, basic engineering sciences and fundamental core courses** in Machine Learning, Deep Learning and Artificial Intelligence in terms of real world problems to meet the challenges of the future.
PSO2	Learn **specialized courses** in **Machine Learning, Deep Learning and Artificial Intelligence** to develop intelligent systems for solving problems from inter-disciplinary domains and for applying typical practices and approaches to deliver quality products intended for business and industry requirements.
PSO3	Apply **innovative tools and techniques** to solve problems in the areas related to **Machine learning, Deep Learning, and Artificial Intelligence** essential for employing current techniques to model real world problems in software development and to create pioneering career paths for pursuing higher studies, research and to be an entrepreneur.

B.E.COMPUTER SCIENCE & ENGINEERING (Artificial Intelligence and Machine Learning) - CONSISTENCY OF PEOS WITH MISSION OF THE DEPARTMENT

PEO Statements	Mission Statements			
	M1	M2	M3	M4
PEO1: 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
PEO2: 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
PEO3: 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
PEO4: 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 (Artificial Intelligence and Machine Learning) - MAPPING OF PEOs WITH POs

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

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

22AIBS301	STATISTICAL FOUNDATIONS OF AI	L	T	P	C
		3	1	0	4

Course Objectives :

- To introduce Probability Theory which is helpful in investigating the important features of the Random experiments.
- To get knowledge about the basic concepts of random variables and its properties.
- To introduce certain probability distribution which is useful in constructing probabilistic models for observed phenomena.
- To learn various hypothesis testing methods.

UNIT – I Random Variables

Discrete random variables - probability distributions and probability mass functions - cumulative distribution functions - mean and variance - moment generating function. Continuous random variables - probability distributions and probability density functions - cumulative distribution functions - mean and variance-moment generating function.

UNIT – II Two Dimensional Random Variables

Probability function of two random variables - Joint probability density function - cumulative distribution functions - properties - margin probability distribution - conditional probability distribution - independent random variables - expected values of a two dimensional random variable- covariance and correlation.

UNIT – III Probability Distributions

Univariate Discrete distributions: Binomial, Poisson and Geometric distributions. Continuous distributions: Uniform, Normal and Exponential distributions. Convergence Concepts and Central Limit Theorem.

UNIT – IV Test of Hypothesis

Parameters and Statistics - Critical region and level of significance - one tailed and two tailed tests - Null hypothesis and Alternate hypothesis - Z test for 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.

UNIT – V Analysis of Variance

Design of Experiment - Basic principles of experimental design - Analysis of Variance (ANOVA) - Analysis of Variance for one way classification - completely randomized design - Analysis of Variance for Two Way Classification - Randomized block design.

Text Books:

1. Veerarajan. T, Probability, Statistics and Random processes, Tata McGraw –Hill publishing company limited, New Delhi 2014.
2. Kandasamy. P, Thilagavathy K and Gunavathy. K , Engineering mathematics, Volume II, S. Chand & co Ltd, New Delhi 2006.

References :

1. Ramana .B.V, Higher Engineering Mathematics, Tata McGraw Hill, 2016.
2. C B Gupta, S R Singh, Mukesh Kumar, Engineering Mathematics, 1st Edition, McGraw Hill,2015
3. N.P.Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publication, 2012.
4. Erwin Kreyszig, Advanced Engineering Mathematics,John Wiley & Sons, 2010.

Course Outcomes :

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

1. Acquire basic concepts about the random variables.
2. Investigate the important features of the random experiments.
3. Utilize probability distribution in many engineering applications.
4. Perform various tests for testing hypothesis.
5. Analyze the characteristics of data.

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

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

Course Objectives:

- To make the students conversant with basic principles of natural resources, forest resources, ecosystem and bio-diversity.
- To get knowledge about pollution and its control.
- To understand the structure and function of an Eco-system.
- To study the role of information technology in human health.

UNIT - I Introduction

Multidisciplinary nature of environmental studies - Definition, scope and importance - Need for public awareness. Natural resources - Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern

agriculture, fertilizer-pesticide problems, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of an individual in conservation of natural resources- Equitable use of resources for sustainable lifestyles.

UNIT – II Concept of an Ecosystem

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

UNIT – III Bio Diversity

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

UNIT – IV Types of Pollution

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

UNIT – V Environment and Human Health

Population growth, variation among nations - Population explosion – Family Welfare Programme - Environment and human health - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health -Case Studies.

Text Books :

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

References :

1. Environmental Studies, Rajagopalan, Oxford University Press, 2005.
2. De A.K., Environmental Chemistry, Wiley Eastern Ltd. New Age International Limited, 3rd Edition, 2003.
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 2001.
4. 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**	**-**	**-**	**-**	**-**	**-**

22AIES303	**PYTHON PROGRAMMING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

UNIT – I Introduction

Elementary Programming, Selections and Loops: History of Python – Getting Started with Python – Programming Style – Writing a Simple Program – Reading Input from the Console – Identifiers – Variables, Assignment Statements, and Expressions – Simultaneous Assignments – Named Constants – Numeric Data Types and Operators – Type Conversions and Rounding–

Introduction – Boolean Types, Values, and Expressions – if Statements – Two-Way if-else Statements – Nested if and Multi-Way if-elif-else Statements – Logical Operators – Conditional Expressions – Operator Precedence and Associativity – Detecting the Location of an Object Case Study: Computing Body Mass Index – The while Loop – The for Loop – Nested Loops – Keywords break and continue – Case Studies: Displaying Prime Numbers and Random Walk.

UNIT - II Python Function

Mathematical Functions, Strings and User Defined Functions: Simple and Mathematical Python Built–in Functions – Strings and Characters – Introduction to Objects and Methods – Formatting Numbers and Strings – Drawing Various Shapes Drawing with Colors and Fonts – Defining a Function – Calling a Function – Functions with/without Return Values – Positional and Keyword Arguments – Passing Arguments by Reference Values – Modularizing Code – The Scope of Variables – Default Arguments – Returning Multiple Values –Function Abstraction and Stepwise Refinement – Case Study: Generating Random ASCII Characters.

UNIT - III Class and Object

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

UNIT - IV Files and Exception Handling

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

UNIT - V Database and GUI

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

Text Books :

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

References :

1. Jennifer Campbell, Paul Gries, Jason montajo, Greg Wilson, "Practical Programming An Introduction To Computer Science Using Python" The Pragmatic Bookshelf ,2009.
2. Wesley J Chun "Core Python Applications Programming", PrenticeHall,2012.
3. JeevaJose,"TamingPythonbyProgramming",KhannaPublishingHouse,1st edition,2017.
4. J.Jose,"IntroductiontoComputingandProblemSolvingwithPython",Khanna Publications,1st edition,2015.
5. Reema Thareja, "Python Programming", Pearson,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**
CO1	1	-	1	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	1	-	-	-	-	-	-	-
CO3	1	2	-	-	1	-	-	-	-	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	-	-
CO5	1	2	3	1	2	-	-	-	1	-	-	2

22AIES304	**DIGITAL ELECTRONICS**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

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 explain sequential logic, memory circuits and systems.
- To study about analog to digital convertors.

UNIT – I Digital Circuits-Introduction

Digital signals - digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations - Boolean algebra - examples of IC gates - number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic codes - error

detecting and correcting codes - characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

UNIT –II Standard Representation for Logic Functions

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

UNIT – III Flip Flops and Counters

A 1-bit memory, the circuit properties of Bi stable latch, the clocked SR flip flop, JK,T and Dtype 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 ICs- asynchronous sequential counters- applications of counters.

UNIT – IVADC and DAC Converters

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

UNIT – V Memory Organization

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

Text Books :

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

References :

1. A.Kumar, Fundamentals of Digital Circuits, Prentice Hall India, 2016.
2. Rishabh Anand,Digital Electronics, 2nd Edition, Khanna Publishing House, 2014.
3. Floyd, Electron Devices, 5th Edition,Pearson Asia, 2013.
4. Donald P Leach, Albert Paul Malvino, Goutan Saha, Digital Principles and Applications, 7thEdition, 2010.
5. Rashid, Microelectronic circuits, Thomson Publications, 2010.

Course Outcomes:

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

1. Understand the working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
4. Be able to use PLDs to implement the given logical problem.
5. Knowledge about the Memories.

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

22AIPC305	**DATA STRUCTURES**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Course Objectives:

- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques.
- To understand basic concepts about stacks, queues, lists, trees and graphs.
- To enable them to write algorithms for solving problems with the help of fundamental data structures.

UNIT –I Basic Terminologies

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

UNIT – II ADT Stack and its operations

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

UNIT –III Linked Lists

Singly linked lists-Representation in memory-Algorithms of several operation- Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and

Queue- Header nodes-Doubly linked list: operations on it and algorithmic analysis-Circular Linked Lists- all operations their algorithms and the complexity analysis.

UNIT –IV Trees

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

UNIT –V Sorting and Hashing

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

Text Books :

1. Mark Allen Weiss, Algorithms, Data Structures, and Problem Solving with C++, Illustrated Edition, 4th Edition, Addison-Wesley Publishing Company, 2014.
2. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures, Illustrated Edition,Computer SciencePress,1983.

References :

1. RS Salaria, Data Structures, 5th edition, Khanna Publishing House, 2017.
2. G.A.V. Pai, Data Structures and Algorithms, McGraw Hill, 2017.
3. RB Patel, Expert Data Structures with C++, 2nd edition,Khanna Publications, 2012.
4. Yashwant Kanetkar, Data Structures through, 2nd edition,BPB Publications, 2009.

Course Outcomes:

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

1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. Design and implement search algorithms.
3. Implement and analyze the same to determine the time and computation complexity.
4. Compare the performance of various algorithms in term of Space and Time complexity.
5. Implement Graph search and traversal algorithms and determine the time and computation complexity.

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

22AIPC306	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	1	0	4

Course Objectives:

- The primary objective of this course is to introduce the basic principles, techniques and applications of Artificial Intelligence.
- To become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- To Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- To explore the current scope, potential, limitations, and implications of AI Based systems.

UNIT – I Introduction to AI

Problems, Problem Spaces and Search: Defining the Problem as a State space Search, Production Systems, Problem Characteristics, Production system characteristics, Issues in the Design of Search Programs. Heuristic Search Techniques: Generate-and-test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

UNIT – II Knowledge Representation

Using Predicate Logic, Representing Simple Facts in logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution - Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Matching, Control Knowledge.

UNIT – III Slots and Filler Structures

Weak slot and-filler structures: Semantic Nets, Frames, Strong slot-and-filler structures: Conceptual dependency, Scripts. Symbolic reasoning under uncertainty, Nonmonotonic reasoning, Statistical reasoning.

UNIT – IV Game Playing

Min Max search Procedure, adding alpha beta cutoffs, additional refinements, iterative deepening. Goal stack planning, non linear planning, hierarchical planning, representation for planning, partial order planning algorithm, Understanding: What makes understanding hard, understanding as constraint satisfaction, Learning Concepts : rote learning, learning by taking advices, learning by problem solving, learning from examples, learning by analogy, explanation based learning, neural nets, genetic algorithms.

UNIT – V Natural Language Processing

Syntactic processing, semantic analysis, discourse and programmatic processing, statistical natural language processing, spell checking, Introduction to Expert Systems ,Architecture of expert systems, Roles of expert systems - Knowledge Acquisition –Meta knowledge, Heuristics. Expert systems Case Studies - MYCIN, DART, XOON.

Text Books :

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson, 2017.
2. Dan W Patterson, Introduction to Artificial Intelligence and Expert Systems, 1st Edition, PHI.,2015

References :

1. Patrick Henry Winston, Artificial Intelligence, Pearson Education, 2003.
2. G. Luger, W. A. Stubblefield, Artificial Intelligence, Third Edition, Addison-Wesley, 2007.
3. Elaine Rich & Kevin Knight, Artificial Intelligence, 3rd Edition, Tata McGraw Hill Edition,Reprint, 2008.
4. Russel and Norvig, Artificial Intelligence, Pearson Education, PHI, 2009

Course Outcomes:

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

1. Understand basic principles of AI in solutions that require problem solving, inference, knowledge representation and learning.
2. Understand knowledge representation using logic and rules
3. Analyze various AI techniques in expert systems, artificial neural networks and other machine learning models.
4. Apply Min-Max Search procedures, iterative deepening, and Learning in game playing
5. Analyze the main approaches to natural language processing and expert systems.

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

22AISP307	**DIGITAL ELECTRONICS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

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 estimate gain and efficiency in power amplifier.

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.
3. Demonstrate an ability to listen and answer the viva questions related to programming skills needed for solving real-world problems in Computer Science and Engineering.

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

22AICP308	**DATA STRUCTURES LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To learn how the choice of data structures and algorithm design methods impacts the performance of programs.
- To learn object-oriented design principles and gain experience writing programs in C++.
- To study specific data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs.
- To study specific algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking, and branch and bound.

LIST OF EXERCISES

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

Course Outcomes:

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

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

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

22AICP309	**ARTIFICIAL INTELLIGENCE LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To learn Python Programming and Key Python Libraries related to AI.
- To formulate Real World Problems for AI.
- To study specific algorithm design methods related to game playing.
- To understand the process involved in computing with natural language specifically: Texts and Words.

LIST OF EXERCISES

1. Write a program to implement Breadth First Search Traversal.
2. Write a program to implement Water Jug Problem.
3. Write a program to remove punctuations from the given string.
4. Write a program to sort the sentence in alphabetical order.
5. Write a program to implement Hangman game using python.
6. Write a program to implement Tic-Tac-Toe game using python.

7. Write a program to remove stop words for a given passage from a text file using Natural Language Toolkit (NLTK).
8. Write a program to implement stemming for a given sentence using NLTK.
9. Write a program to implement Lemmatization using NLTK.
10. Write a program for Text Classification in a given sentence using NLTK.

Course Outcomes:

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

1. Understand the problem as a state space, design heuristics and select amongst different search based techniques to solve them.
2. Analyze the design heuristics and apply different game based techniques to solve game playing problems.
3. Apply Text Classification techniques used in NLP.

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

22AIBS401	**DISCRETE MATHEMATICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To study various finite structures of Mathematics which are essential to develop the various concepts of Computer Science.
- To understand set theory and relations.
- To know the principles of Boolean Algebra.
- To introduce the graph theory.

UNIT – I Mathematical Logic

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

UNIT – II Set Theory and Relations

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

UNIT – III Lattice and Boolean Algebra

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

UNIT – IV Group and Group code

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

UNIT – V Graph Theory

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

Text Books :

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

References :

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

Course Outcomes:

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

1. Acquire the basic concepts in Mathematical Logic and theory of inferences.
2. Understand the concepts of Set theory, Relations and equivalence classes with matrix representation.
3. Familiarize Lattice theory, Boolean algebra and Group theory.
4. Design coding and encoding group codes concept.
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	-	-	-

22AIES402	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the basic structure and operation of digital computer.
- To study the two types of control Unit techniques and the concept of pipelining.
- To study the hierarchical memory system including cache memories and virtual memory.
- To study the different ways of communicating with I/O devices and standard I/O interfaces.

UNIT – I Introduction

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

UNIT – II Fundamental Concepts

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

UNIT – III Memory

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

UNIT – IV I/O Devices

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

UNIT – V Parallel Processing

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

Text Books :

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

References :

1. William Stallings, Computer Organization and Architecture – Designing for Performance, 6th Edition, Pearson Education, 2003.
2. Hayes, J.P., Computer Architecture and Organization, 3rd Edition, Tata Mc-Graw Hill, 1998.

3. Ghosh T. K., Computer Organization and Architecture, 3rd Edition, Tata McGraw-Hill, 2011.
4. Behrooz Parahami, Computer Architecture, 8th Impression, Oxford University Press, 2011.
5. Heuring, V.P. and Jordan, H.F., Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

Course Outcomes:

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

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

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

22AIPC403	**OPERATING SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce students with basic concepts of operating system its function and services.
- To teach the features of operating system and the fundamental theory associated with process, memory and file management component of operating systems.
- To provide the knowledge about UNIX operating system.
- To learn about I/O devices, file structure disk structure and disk 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 & WriterProblem, Dinning 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,9th Edition, WileyIndia Pvt Ltd, 2013.
2. William Stallings, Operating Systems – internals and design principles, 7thEdition, Prentice Hall, 2011.

References :

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

Course Outcomes:

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

1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.
3. Develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.
4. Design and implement file management system.
5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

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	-	-	-	-	-	-	-	-	-

22AIPC404	**DATABASE MANAGEMENT SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

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, 6th Edition, Tata McGraw Hill, 2010.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 6thEdition, Addision Wesley, 2010.

References :

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, Third Edition, McGraw Hill, 2002.
2. Peter Rob and Carlos Coronel, Database Systems – Design, Implementation and Management, 7th Edition, Thompson Learning, Course Technology, 2006.

3. C. J. Date, A.Kannan, S.Swamynathan, An Introduction to Database Systems, 8th Edition, Addison Wesley, 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	-	-	-	-	-	-	-	-	-	-	-

22AIPC405	**FUNDAMENTALS OF 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. R. O. Duda, E. Hart, and D.G. Stork, Pattern classification, Second edition, John Wiley & Sons, Singapore, 2012.
2. Francois Chollet, Deep Learning with Python, Manning Publications, Shelter Island, New York, 2018.

References :

1. Ethem Alpaydin, Introduction to Machine Learning, 3rdEdition, 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	-	-	-	-	-	-	-

22AIPC406	**OBJECT ORIENTED PROGRAMMING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

UNIT - I Basics of C++ Programming

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

UNIT - II OOPs in C++ Programming

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

UNIT - III Basics of Java Programming

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

UNIT - IV OOPs in Java Programming

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

UNIT - V Intermediate Java Programming

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

Text Books

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

References

1. Bjarne Stroustrup, "C++ Programming Language", 4th Edition, May 2022.
2. Herbert Schildt, "Java The Complete Reference", 11th Edition, December 2020
3. Nick Samoylov, "Learn Java Programming", 2nd Edition July 2022
4. Cay S. Horstmann, Gary Cornell, "Core Java Fundamentals", 9th 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**
CO1	1	1	3	-	-	-	-	-	-	-	-	-
CO2	2	2	2	2	-	-	-	-	-	-	-	-
CO3	1	1	3	-	-	-	-	-	-	-	-	-
CO4	2	2	2	2	1	-	-	-	-	-	-	1
CO5	2	2	2	2	1	-	-	-	-	-	-	1

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

Course Objectives :

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

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

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

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

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

2.1 Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.
2.2 Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.
2.3 Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).
2.4 Understanding the characteristics and activities of 'I' and harmony in 'I'.
2.5 Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
2.6 Programs to ensure Sanyam and Health.

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

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

3.1 Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.

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

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

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

4.1 Understanding the harmony in the Nature.
4.2 Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self- regulation in nature.
4.3 Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.
4.4 Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

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

5.1 Natural acceptance of human values.
5.2 Definitiveness of Ethical Human Conduct.
5.3 Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
5.4 Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5.5 Case studies of typical holistic technologies, management models and production systems.
5.6 Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.
5.7 Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

Text Book :

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

References :

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

Course Outcomes :

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

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

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

22AICP408	DATABASE MANAGEMENT SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To enable students to understand and use a relational database system.
- To understand the role of a database management system in an organization.
- 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).

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
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	3	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	2	-	2

22AICP409	MACHINE LEARNING LAB	L	T	P	C
		0	0	3	1.5

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

22AICP410	OBJECT ORIENTED PROGRAMMING Lab	L	T	P	C
		0	0	3	1.5

Course Objectives :

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

LIST OF EXERCISES C++ PROGRAM

1. Write a C++ program to design a class having static function names showcount() which has the property of displaying the number of objects created of the class.
2. Write a C++ program to find maximum of two numbers using friend function.
3. Write a C++ program using copy constructor to copy data of an object to another object.
4. Write a C++ program to design a class representing complex numbers and having functionality of performing addition and multiplication of two complex numbers using operator overloading.
5. Write a C++ program to design a student class representing student roll no. and a teats class (derived class of student) representing the scores of the student in various subjects and sports class representing the score in sports. The sport and test class should be inherited by the result class having the functionality to add the scores and display the final result for the student.
6. Write a C++ program to maintain the records of the person with details (Name and Age) and find the eldest among them. The program must use this pointer to return the result.
7. Write a C++ program to illustrate the use of virtual function in a class.
8. Write a C++ program showing data conversion between objects of different classes.

JAVA PROGRAM

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

5. Exception Handling Mechanism in Java
   a. Implementing Predefined Exceptions
   b. Implementing User Defined Exceptions

Course Outcomes :

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

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

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

22AIPC501	**IMAGE AND SPEECH PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To learn Digital Image and Speech fundamentals.
- To analyze simple Image processing techniques.
- To understand Image compression and Enhancement techniques.
- To learn Short-time Fourier analysis.

UNIT – I Digital Image Processing

Image Categories – Steps in Digital Image Processing – Components of an Image Processing System. Digital Image Fundamentals: Elements of Visual Perception – Electromagnetic Spectrum – Image Sensing and Acquisition – Image Sampling and Quantization - Basic Relationship between Pixels.

UNIT – II Image Enhancement in Spatial Domain

Basic Gray Level Transformations – Histogram Processing – Enhancement using Arithmetic and Logic Operations – Spatial Filtering – Smoothing Spatial Filters – Sharpening Spatial Filters – Combining Spatial Enhancement Methods.

UNIT – III Color Image Processing and Segmentation

Color Fundamentals – Color Models – Pseudo color Image Processing. Image Segmentation: Detection of Discontinuities – Edge Linking and Boundary Detection – Use of Motion In Segmentation. Basis of Wavelet Transforms. Lossless and Lossy Compression Techniques.

UNIT – IV Fundamentals of Digital Speech Processing

Discrete-Time Signals and Systems – Sampling Speech Signals - Transform Representation of Signals and Systems. Speech Production Mechanism – Acoustic Phonetics. Time-Domain Models for Speech Processing: Time-Dependent Processing of Speech – Short-Time Energy and Average Magnitude – Short-Time Average Zero-Crossing Rate – Speech Vs. Silence Discrimination – Pitch Period Estimation – Short-Time Autocorrelation Function.

UNIT – V Short-Time Fourier Analysis

Fourier Transform of Speech Signal - Linear Predictive Coding of Speech: Linear Predictive Analysis – Computation of Gain – Durbin's Recursive Solution. Man-Machine Communication: Voice-Response Systems – Speaker Recognition Systems – Speech Recognition Systems.

Text Books :

1. R.C. Gonzalez and Rafael. C. Woods, Richard E, Digital image processing, fourth edition, Pearson education, 2018.
2. L. R. Rabiner and R.W. Schafer, Digital processing of speech signals, Pearson education, 2005.

References :

1. Lizhe Tan Jean Jiang, Digital Signal Processing: Fundamentals and Applications,Third edition, Academic Press, 9th November 2018.
2. D.O'Shaughnessy, Speech communications-Human and machine, second edition, University press (India), 2001.
3. L. Rabiner and B.H. Juang, Fundamentals of speech recognition, Pearson education, 2003.
4. A.K. Jain, Fundamentals of digital image processing, Prentice-Hall of India, New Delhi, 2001.

Course Outcomes:

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

1. Discuss Digital Image and Speech fundamentals.
2. Apply Image Enhancement techniques.
3. Use Image Compression techniques in Image applications.
4. Discuss about Time domain models for Speech processing.
5. Work on Speech Recognition and Speaker Verification systems.

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

22AIPC502	NEURAL AND FUZZY COMPUTING IN AI	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide learning concepts of neural networks in the engineering perspective.
- To offer various design concepts of neural network architectures.
- To apply neural networks in solving AI problems.
- To understand fuzzy systems and its applications.

UNIT - I Introduction to Neural Network and Learning

Models of a Neuron – Neural Networks Viewed as Directed Graphs – Feedback – Network Architectures – Knowledge Representation – Artificial Intelligence and Neural Networks – Error-Correction Learning – Memory-Based Learning – Hebbian Learning – Competitive Learning – Boltzmann Learning.

UNIT – II Supervised Learning Networks

Perceptron – Perceptron Convergence Theorem – Adaline – Madaline - Back Propagation Algorithm – XOR Problem – Regularization Networks – Generalized Radial-Basis Function Networks - Optimal Hyperplane for Linearly Separable Patterns - Optimal Hyperplane for Non-separable Patterns – Support Vector Machine for Pattern Recognition – XOR Problem- Support Vector Machines for Nonlinear Regression.

UNIT – III Associative and Unsupervised Learning Networks

Associative Memory Networks – Auto Associative Memory Networks– Hetero Associative Memory Networks – Hopfield Networks - Self-Organizing Maps – Properties of Feature Maps - Learning Vector Quantization.

UNIT – IV Fuzzy Systems

Utility of Fuzzy Systems – Limitations of Fuzzy Systems – Uncertainty and Information – Fuzzy Sets and Membership – Classical Sets – Fuzzy Sets – Crisp Relations – Fuzzy Relations- Tolerance and Equivalence Relations – Fuzzy Tolerance and Equivalence Relations – Value Assignments.

UNIT – V Fuzzification and Defuzzification

Features of the Membership Function – Fuzzification – Defuzzification to Crisp Sets – λ-Cuts for Fuzzy Relations – Defuzzification to Scalars – Logic and Fuzzy Systems.

Text Books :

1. Simon Haykin, Neural Networks – A Comprehensive Foundation, 2nd edition, Pearson Prentice Hall, 2005.
2. S. N. Sivanandam and S. N .Deepa, "Principles of Soft Computing", 2nd Edition, Wiley India Pvt Ltd, 2011.
3. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3rdEdition, John Wiley & Sons Ltd, 2010.

References :

1. Raul Rojas, Neural Networks: A Systematic Introduction, Springer Science & Business Media, 2013.
2. Alianna J. Maren, Craig T. Harston, Robert M. Pap, Handbook of Neural Computing
3. Applications, Academic Press, 2014.
4. Robert Fuller, Introduction to Neuro-Fuzzy Systems, Springer Science & Business Media, 2013.
5. James J. Buckley, Esfandiar Eslami, An Introduction to Fuzzy Logic and Fuzzy Sets, Springer Science & Business Media, 2013.

Course Outcomes:

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

1. Understand several learning methods in neural networks.
2. Know various categories of neural networks and their architectures.
3. Apply neural networks in solving AI problems.
4. Learn fuzzy systems associated with different application areas.
5. Use fuzzy systems to interpret natural language.

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

22AIPC503	**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	-	-	-	-	-	-	-	-	-	-

22AIPC504	**KNOWLEDGE ENGINEERING AND INFERENCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To make the students conversant with concepts central to the creation of knowledge bases and expert systems.
- To be able to elicitate knowledge from experts by using elicitation techniques.
- To examine properties of existing systems, comparing different approaches with a case study
- To implement the expertise model as a prototype

UNIT - I Introduction to Knowledge Engineering

Data, Information and Knowledge , Skills of a knowledge Engineer – An introduction to Knowledge Based Systems, Types of Knowledge Based Systems – Expert Systems, Neural Networks, Case – Based Reasoning, Genetic Algorithms, Intelligent Agents, Data Mining.

UNIT – II Knowledge Representation

Knowledge Acquisition - Representation and Reasoning – Using Knowledge, Logic Rules and Representation, Developing Rule – Based Systems, Semantic Networks, Frames - Lifecycles and Methodologies – The Need for Methodologies, Knowledge Acquisition Design Systems – Hybrid Knowledge Based Systems.

UNIT – III Trends in Knowledge Engineering

Information Technology in Business Management - Management Sources of Information-Information Processing - Multidimensional Management Systems (MMS) - Organizational Marketing, Virtual Management (VM) - Computer-Aided Management and Communications. Issues in Knowledge Engineering: Introduction - Problem-Solving Strategies - The Systematic-Intuitive Approach - Real Time: Can Machines Think -Language and Perceptual Models, Understanding. Knowledge Networking Systems: Life in the Electronic Fast Lane-

Organizational Communications - Corporate Management -Knowledge Networking Features - Communications Networks. Real World Applications - Metal Models: Classical Examples - Mechanization of Knowledge -Future Trends in Knowledge Engineering.

UNIT – IV Inferential Knowledge and Problem Solving

State – Space Representation of a problem – Search Tree – Programs for Game – Tree Search – Graph Search – Characteristics of problem Solving Using State Representations – Discovery of an Algorithm.

Use of Heuristic Knowledge – Finding a Solution by the Decomposition of a problem – BlackBoard Model - Knowledge as a Constraint – Mutual Model.

UNIT – V Reasoning in Knowledge

Inference Using Symbolic Logic - Expressions of Rules using Symbolic Logic – Proof using Forward and Backward Reasoning – Proof using the Resolution Principle – Forms Of Questions – logical representation of a Database – Inference In Changing Situations – Other Inference methods.

Text Books :

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu and David A Schum, Knowledge Engineering Building cognitive assistants for evidence based reasoning, 1st Edition, Cambridge University Press, 2016.
2. Simon Kendal and Malcolm Creen, An Introduction to Knowledge Engineering, 2nd Edition, 2007, Springer.

References :

1. Yingxu Wang, Developments in Natural Intelligence Research and Knowledge Engineering: Advancing Applications, Fourth Volume, IGI series, 2012.
2. Makoto Nagao, Knowledge and Inference, 1st Edition, Academic Press, 1990.
3. J Hendler, H Kitano and B Nebel, Foundations of Artificial Intelligence, 1st Edition, Elsevier, 2008.
4. Thomas B Cross, Knowledge Engineering, The uses of Artificial Intelligence in Business, 2nd dition, TECHtionary.

Course Outcomes:

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

1. Keep in track with the current trends in knowledge engineering.
2. Acquire and act as per the knowledge of experts.
3. Know the inference of logical agents.
4. Communicate in a network of knowledge based systems.
5. Apply Artificial intelligence in business.

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

22AICP508	**IMAGE AND SPEECH PROCESSING LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

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. Smoothening and Sharpening filters in spatial domain.
3. Implementation of Edge detection methods.
4. Write a program to find the histogram equalization

a) For full image.

b) For part of the image.

5. Write a program to find the Fourier transform of a given image.
6. Displaying individual color components(R,G,B,Cr,CB,H,S,I) of a color image.
7. Implementation of Huffman encoding and decoding for a given image.
8. Write a program to segment the given image using watershed algorithm.
9. Implementation of morphological dilation and erosion operations for a given image.
10. Write programs to extract SIFT and SURF features for given input image samples.
11. Write a program to perform convolution and correlation of speech signals.
12. Write a program to perform simple low pass filtering and high pass filtering of speech signal.
13. Extraction of pitch and formants for a given speech signal.
14. Write a program to find short time energy and zero crossing rate of pre-processed speech signal.
15. Write a program to extract MFCC feature from sample speech signal.
16. Text dependent speaker recognition using Dynamic Time Warping.

Course Outcomes:

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

1. Work with Digital Image and Speech fundamentals using python.
2. Analyse how Image Enhancement techniques in spatial domain used in processing of images.
3. Work with applications of image and speech processing.

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

22AICP509	**COMPUTER NETWORKS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

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

22AICP510	**NEURAL COMPUTING LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives:

- To provide the most comprehensive concept of neural networks in the engineering perspective.
- To understand the important design concepts of neural architectures in different applications.
- To acquaint student with various computing algorithms in FLNN using software tools.
- To understand operation of basic elements in fuzzy logic and neural network through simulation.

LIST OF EXERCISES

1. Write a program to implement the concept of Perceptrons.
2. Write a program to simulate Back-Propagation Neural Networks.
3. Write a program to implement the Radial Basis Function Neural Networks.
4. Write a program to implement a real world application using Support Vector Machine.
5. Write a program to design a Self Organizing Map for an application.
6. Write a program to develop fuzzy membership functions and fuzzy set properties.
7. Write a program to develop logic for fuzzy relations.
8. Write a program to verify logic using fuzzy relations.
9. Write a program to design a fuzzy controller systems using fuzzy tool of Matlab.
10. Develop an application using NN/Fuzzy logic.

Course Outcomes:

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

1. Demonstrate basic concepts fuzzy logic and neural network through simulation.
2. Develop the logic given in problem statement using operations in fuzzy logic and basics of toolbox studied.
3. Develop real life applications using NN and Fuzzy Logic.

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

22AIPC601	**DEEP LEARNING FOR VISUAL COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To make the students understand the mathematical and machine learning basics of deep learning for Visual Computing.
- To understand the knowledge about deep learning.
- To give insight into various deep learning Visual Computing tools namely python, tensor flow, scala, py torch,etc,.
- To be able to setup test environment for deep learning of visual computing.

UNIT – I Applied Math and Machine Learning Basics

Linear Algebra - Probability and Information Theory - Numerical Computation - Machine Learning Basics - Modern Practical Deep Networks - Deep Feedforward Networks - Regularization for Deep Learning - Optimization for Training Deep Models - Convolutional Networks - Sequence Modeling: Recurrent and Recursive Nets - Practical Methodology – Applications.

UNIT – II Deep Learning Research

Linear Factor Models – Autoencoders - Representation Learning - Structured Probabilistic Models for Deep Learning - Monte Carlo Methods - Confronting the Partition Function - Approximate Inference - Deep Generative Models.

UNIT – III Fundamentals of Image Based Visual Computing

Data – Visualization – Discretization – Representation – Noise – Techniques – Interpolation - Geometric Intersections. Convolution - Linear Systems - Linear Filters - Implementation Details - Spectral Analysis - Discrete Fourier Transform - Polar Notation -Periodicity of Frequency Domain – Aliasing - Extension for 2D Interpretation – Duality - Feature Detection - Edge Detection – Feature Detection - Other Non-Linear Filters.

UNIT – IV Geometric Visual Computing

Geometric Transformations - Homogeneous Coordinates - Linear Transformations - Euclidean and Affine Transformations - Concatenation of Transformations - Coordinate Systems - Properties of Concatenation - Projective Transformation - Degrees of Freedom - Non-Linear Transformations. The Pinhole Camera - The Model - Considerations in the Practical Camera - Epipolar Geometry – Background - Correspondences in Multi-View Geometry - Fundamental Matrix - Essential Matrix – Rectification - Applying Epipolar Geometry.

UNIT – V Radiometric Visual Computing

Light – Radiometry - Photometry and Color - Color Reproduction - Modeling Additive Color Mixtures - Color Management - Modeling Subtractive Color Mixture – Limitations - Photometric Processing - Histogram Processing - Image Composition - Photometric Stereo Visual Content Synthesis - The Diverse Domain – Modeling – Processing – Rendering – Application - Interactive Graphics pipeline - Geometric Transformation of Vertices - Clipping and Vertex Interpolation of Attributes - Rasterization and Pixel Interpolation of Attributes - Realism and Performance – Illumination – Shading – Shadows - Texture Mapping - Bump Mapping - Environment Mapping – Transparency - Accumulation Buffer - Back Face Culling - Visibility Culling - Graphics Programming - Development of Graphics Processing Unit - Development of Graphics APIs and Libraries -The Modern GPU and CUDA.

Text Books :

1. Aditi Majumder, M. Gopi , Introduction to Visual Computing: Core Concepts in Computer Vision, Graphics, and Image Processing, CRC Press, 2018
2. Ian Good fellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016

References :

1. Jon Krohn, Beyleveld Grant and Bassens Aglaé, Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence, Addison-wesley, 2019.
2. Hyatt Saleh,Applied Deep Learning with PyTorch, Packt, 2019.
3. Pradeep Pujari, Md. and Rezaul Karim, Mohit Sewak, Practical Convolutional Neural Networks, Packt Publishing, February2018.
4. Ragav Venkatesan and Baoxin Li, Convolutional Neural Networks in Visual Computing (Data-Enabled Engineering), CRC Press, September 2017.

Course Outcomes:

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

1. Understand Deep learning for Visual Computing and able to setup development environment.
2. Perform image classification and learning.
3. Detect objects and do convolution neural network auto encoding.
4. Know about radiometric visual computing.
5. Understand Geometric visual computing.

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	-	-	-	-	-	-	-

22AIPC602	**EMBEDDED SYSTEMS AND INTERNET OF THINGS(IoT)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To familiarize the students about the trends and challenges of Embedded System.
- To impart the knowledge in RTOS and scheduling algorithms.
- To understand the concepts of Internet of Things, its network and communication protocols and to introduce Internet of Everything and its benefits.
- To develop algorithms in Rasberry Pi and Arduino

UNIT – I Introduction to Embedded Systems

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

UNIT – II Real Time Operating Systems

Prime Movers: Task states-Task table and data–Multitasking operating systems–Context switches–Kernels–Task swapping methods–Scheduler algorithms –Inter process communication mechanism-memory communication-Message passing-Signals. Overview of ARM Architecture-Programmer's model and Development Tools.

UNIT – III Introduction to IOT

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

UNIT – IV Network and Communication Aspect

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

UNIT – V Raspberry Pi with Python and Arduino

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

Text Books :

1. Marilyn Wolf, Computers as Components-Principles of Embedded Computing System Design, 4th edition, Morgan Kaufmann Publishers, 2016.
2. Vijay Madisetti, ArshdeepBahga, Internet of Things: A Hands-On Approach, Orient Blackswan Pvt. Ltd., New Delhi, 2015.

References :

1. Jeeva Jose, Internet of Things, 1st edition, KBP House,2018.
2. Shibu K.V, Introduction to Embedded System, Tata McGraw-Hill, 2009.
3. Steve Heath, Embedded Systems Design, 2nd edition, Newnes/An imprint of Elsevier, 2005.
4. Rajkamal, Embedded Systems, Architecture, Programming and Design, Tata McGraw Hill, 2003.

Course Outcomes :

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

1. Recognize the key features of embedded systems in terms of computer hardware and be able to discuss their functions.
2. Know the extra-functional that are imposed on embedded systems and the tools used.
3. Identify the key factors and functionalities in IOT.
4. Understand the protocols and applications of IOT through wireless medium.
5. Understand the concepts of IoT and IoE with the combination of Raspberry Pi.

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

22AICP607	DEEP LEARNING TOOLS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives :

- To learn how to create and manipulate tensors using Tensorflow tool.
- To get to know Applied Deep Learning with PyTorch.
- To create and manipulate applications for artificial intelligence in the Scala programming language.
- To learn Character-Level RNN.

LIST OF EXERCISES

1. Introduction to TensorFlow.
2. Learning about Features and Outliers.
3. Working with Training Sets and Test Sets.
4. Scala program to demonstrate example of collection list and for loop.
5. Appending and merging Lists using scala.
6. Scala List class and pattern matching
7. L2 Regularization and Correlated Features.
8. Classifying Names with a Character-Level RNN
9. Generating Shakespeare with a Character-Level RNN

Course Outcomes :

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

1. Create and manipulate tensors using Tensorflow tool and to understand tensorflow concepts.
2. Know supervised learning and working with features and labels.
3. Acquire knowledge on CNN, RNN.

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

22AICP608	EMBEDDED SYSTEMS AND INTERNET OF THINGS (IoT) LAB	L	T	P	C
		0	0	3	1.5

Course Objectives :

- To understand the working principle of Embedded System.
- To make use of various sensors in IoT.
- To know how to use various tools in IoT for designing applications.
- To get the knowledge about designing GUI, game in python.

LIST OF EXERCISES

EMBEDDED SYSTEMS

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).

IoT

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

Course Outcomes :

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

1. Comprehend the basic elements of Microcontroller and their Programming.
2. Gain knowledge of Raspberry Pi3 in Peripheral and in Trouble shooting.
3. Identify the Kits required for solving the Real World Problem and to write the Code.

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

22ETHS701	**SOCIAL AND ETHICAL ISSUES IN AI**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

Course Objectives:

- To analyze whether AI pose an existential threat to humanity.
- To check learning algorithms from acquiring morally objectionable biases.
- To study the ethical rules to be followed in using self driving cars.

- To check the accountability while building artificial moral agents.

UNIT – I Artificial Intelligence Ethics

Ethics in Machine learning and other domain-specific AI algorithms-Artificial general intelligence-machines with moral status-minds with exotic properties-superintelligence. Singularity A philosophical Analysis: Argument for a singularity-Intelligence explosion without intelligence-obstacles to singularity-negotiating singularity-internal constraints-external constaints-integration into a post-singularity world-uploading and consciousness-uploading and personal identity.

UNIT – II Super intelligent Agents

Orthogonality of motivation and intelligence-instrumental convergence. Racist AI: Rise of algorithmic decision making: contestable epistemic and normative assumptions-embodied values-algorithmic accountability as public reason-objections, limitations and challenges.

UNIT – III Killer Robots in War and Civil Society

Real world of robots at war-autonomous weapon systems-robot warriors and crimes-human oversight for avoiding problem-responsibility for robot war crimes-robot warriors and child soldiers. Future of workplace automation-interaction of automation and employment-Polarization in labor market-employment polarization to wage polarization-slowdown in growth of high-skill occupations-Polanyi's Paradox.

UNIT – IV Artificial Moral Agent Ethics

Moral agency and moral norms-moral turing test-Theoretical approaches: consequentialism-deontology-models of morality: Virtue approaches-associative learning-evolutionary approaches-role of emotions. Ethics of self driving cars: need for ethics settings-an applied trolley problem-empirical ethics-traditional ethical theories-legal literature-potential responsibility-Agency and human robot collaborations-crash avoidance strategies.

UNIT – V AI as a Positive and Negative factor in Global Risk

Anthropomorphic bias: width of mind design space-Prediction and design-understanding the power of intelligence-capability and motive: Optimization processes-aiming at the target-friendly AI-technical failure and philosophical failure-rates of intelligence increase-hardware-threats and promises-AI vs human intelligence enhancement.

Text Books :

1. Bill Hibbord,Ethical Artificial Intelligence, Machine Intelligence Research Institute, CA, 2015.
2. N. Bostrom and E. Yudkowsky,The ethics of artificial intelligence, In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, Cambridge, 2014.

References :

1. Chalmers. D.,The singularity: A philosophical analysis, Journal of Consciousness Studies, 2010.
2. Bostrom, N., The Superintelligent Will: Motivation and Instrumental Rationality in Advanced Artificial Agents, Minds & Machines, 2012.
3. Sparrow. R., Killer robots, Journal of Applied Philosophy, 2007.
4. Autor, D. H., Why Are here Still SoMany Jobs? The History and Future of Workplace Automation, The Journal of Economic Perspectives, 2015.

Course Outcomes:

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

1. Demonstrate knowledge of philosophical issues involved in ethics of AI.
2. Develop a super intelligent system without having to reveal the system itself.
3. Understand workplace automation in employment.
4. Appreciate the potential responsibility in handling ethics of artificial moral agents.
5. To build intelligent systems those are safe without any global risk.

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

22AIPC702	**EVOLUTIONARY OPTIMIZATION ALGORITHMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To learn the constrained and unconstrained optimization.
- To gain knowledge on more recent evolutionary algorithms.
- To develop biogeography techniques.
- To implement combinatorial optimization problems.

UNIT – I Introduction

Optimization: Unconstrained optimization-constrained optimization-multi-objective optimization-multimodal optimization-combinatorial optimization-hill climbing-intelligence. Genetic algorithms: Simple binary genetic algorithm-continuous genetic algorithm.

UNIT – II More Recent Evolutionary Algorithms

Simulated annealing: simple simulated annealing algorithm-cooling schedules-implementation issues. Ant colony optimization: Pheromone models-ant system-continuous optimization-other ant systems. Particle swarm optimization: Basic PSO algorithm-velocity limiting-inertia weighting and constriction coefficients-global velocity updates-fully informed particle swarm-learning from mistakes.

UNIT – III Biogeography based Optimization

Biogeography-an optimization process-biogeography based optimization-BBO extensions. Other evolutionary algorithms: Tabu search-artificial fish swarm algorithm-group search optimizer-shuffled frog leaping algorithm-firefly algorithm-bacterial foraging optimization-artificial bee colony algorithm-gravitational search algorithm-harmony search-teaching learning based optimization.

UNIT – IV Combinatorial Optimization

Traveling salesman problem-TSP initialization: nearest neighbor initialization-shortest edge initialization-insertion initialization-stochastic initialization. TSP representations and crossover-TSP mutation-evolutionary algorithm for TSP-graph coloring problem.

UNIT – V Constrained Optimization

Penalty function approaches-popular constraint handling methods-special representations and special operators-other approaches to constrained optimization-ranking candidate solutions-comparison of constraint handling methods. Multi objective optimization: Pareto optimality-goals of multi objective optimization-non pareto based evolutionary algorithms- Pareto based evolutionary algorithms-multi objective biogeography based optimization.

Text Books :

1. Mike Preuses, Multimodal Optimization by Means of Evolutionary Algorithms, Springer, 2015.
2. Dan Simon, Evolutionary Optimization Algorithms, John Wiley & Sons Inc.,2013.

References :

1. Rajesh Kumar Arora, Optimization Algorithms and Applications, CRC Press, 2015.
2. Xinjie Yu, Mitsuo Gen, Introduction to Evolutionary Algorithms, Springer publication, 2010.
3. Kalyanmoy Deb, Multi-Objective Optimization using Evolutionary Algorithms. John Weily and Sons Ltd, 2002.
4. Algorithms for Reinforcement Learning (Synthesis Lectures on Artificial Intelligence and Machine Learning), Morgan & Claypool Publisher series, 2010.

Course Outcomes:

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

1. Design constrained and unconstrained optimization problems.
2. Implement more recent optimization techniques.
3. Learn and execute the biogeography based optimization techniques.

4. Acquire knowledge about the combinatorial optimization algorithms.
5. Understand the principles of multi objective optimization techniques.

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

22AICP706	**OPTIMIZATION TECHNIQUES LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives :

- To acquire specific knowledge and skills on optimization techniques.
- To learn the feasibility methods for solving an optimization problem.
- To design algorithms that will lead to find optimized solution.
- To understand and implement optimization techniques using evolutionary algorithms.

LIST OF EXERCISES

1. Write a program to implement constrained optimization using genetic algorithm.
2. Write a program to implement un-constrained optimization using genetic algorithm.
3. Write a program to implement simple simulated annealing algorithm.
4. Write a program to implement ant colony optimization algorithm.
5. Write a program to implement particle swarm optimization algorithm.
6. Write a program to implement Tabu search.
7. Write a program to implement artificial bee colony optimization algorithm.
8. Write a program to solve traveling salesman problem using evolutionary algorithm.
9. Write a program to implement constrained optimization using penalty method.
10. Write a program to implement multi objective optimization using evolutionary algorithm.

Course Outcomes :

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

1. Understand and implement constrained and unconstrained optimization problems.
2. Implement biogeography based optimization techniques.
3. Appreciate the principles of multi objective optimization techniques.

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 Artificial Intelligence and Machine Learning to acquire the ability of written/oral presentation and to have a practical knowledge in carrying out the Artificial Intelligence and Machine Learning 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 Artificial Intelligence and Machine Learning.
- 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 Artificial Intelligence and Machine Learning 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 Artificial Intelligence and Machine Learning 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 Artificial Intelligence and Machine Learning standard in a specific situation.
4. Analyze a given Artificial Intelligence and Machine Learning 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	-	-

22AIPV803	**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

22AIPESCN	EXPERT SYSTEM ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study components of knowledge in expert system.
- To acquire knowledge and to study the stages in developing the expert systems.
- To use probability and fuzzy logic expert systems.
- To study the tools to develop expert systems.

UNIT – I Introduction

Introduction to Expert System, Definitions, Importance of Expert System, Characteristic features of Expert System, Applications of Expert System, Different categories of Expert Systems, Rule Based System Architecture, Neural Network Architecture - Knowledge Representations: Components of a Knowledge in Expert system, OAV Triplets, Semantic Networks, Frames Representation via Logic Statements, Production Systems, Clause, Properties Rule properties, Rule Conversions, Multiple Conclusions, Neural Networks via Rule Based System

UNIT – II Expert System Design

Knowledge Acquisition: Introduction Knowledge Acquisition and domain Expert, Selection of the domain, Selection of the Knowledge Engineers, Selection of the Expert, Meetings and Plans, Organization of Meetings, Documentation, Multiple domain Experts, Knowledge Acquisition –An Example, Knowledge Acquisition using Rule induction, Generating Rules from Trees, ID3 algorithm for Rule Generation - Design of Expert System: Introduction, Selecting the appropriate Problem, Stages in Developing the Expert System, Errors in Development stages, Software Engineering and Expert Systems, The Expert System Life Cycle, Expert System Design Examples- Certainty factors, Decision Trees.

UNIT – III Inference Engine

Method of Inference: Trees, Lattices and graphs, state the problem spaces, And-Or trees and goals, deductive logic and syllogisms, rules of inference, shallow and causal reasoning, Insight of Inference Engine, Search Strategies, Forward Chaining algorithm, Backward Chaining Algorithm.

UNIT – IV Reasoning under Uncertainty

Uncertainty, Types of Error, Error and Induction, Classic Probability, Temporal Reasoning and Morkov Chains, TMS, Fuzzy Logic and Natural Languages computations, Probabilistic Reasoning, probabilistic Networks, Bayesian Networks. Use of Probability and Fuzzy logic in Expert System, Rule Induction by Machine Learning

UNIT – V Expert system Tools and Architectures

Overview of Expert System Tools, Expert System Shells, rule based architecture, non production system architecture, Abstract architectures, Black Board Architecture, Reasoning under uncertainty and Truth Maintenance Systems - Case-study : A case-study on Financial planning Expert System, Sale Expert system, DENDRAL and MYCIN.

Text Books:

1. Pan W. Patterson, Introduction to artificial Intelligence & Expert Systems, PHI, 2015.
2. Joseph C. Giarratano, Expert Systems Principles and Programming, Cengage Learning, 2007.

References:

1. Giarratano.Rilev, Expert System principals and Programming, 2003.
2. Peter Jackson, Introduction to Expert Systems, Addison Wesley Publishing Company, 2002.
3. V. James P.Iginizo, Introducion to Expert Systems., Mc.Graw-Hill.inc, 1991.
4. R.I. Levine D. E. Drang, Barry Edelson, A Comprehensive Guide to AI and Expert systems,McGraw Hill, 1988.

COURSE OUTCOMES:

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

1. Identify components of knowledge in expert system.
2. Acquire knowledge and to study the stages in developing the expert systems.
3. Apply forward and backward chaining algorithms.
4. Design probabilistic and Bayesian Networks.
5. Utilize the tools to develop expert systems.

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

22AIPESCN	**MULTIMEDIA SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To make the students conversant with basic principles of digital signal processing such as Fourier analysis, digital filters, sampling and quantization.
- To get knowledge about model-based signal processing like least square error, Wiener-Kolmogorov filters and adaptive filters.
- To develop some applications in speech.
- To create applications in music and mobile communication.

UNIT - I Basic Digital Signal Processing I

Introduction: Signals and Information - Signal Processing Methods - Applications of Digital Signal Processing - Fourier analysis and Synthesis: Introduction - Fourier Series: Representation of Periodic Signals - Fourier Transform: Representation of Non-periodic Signals - Discrete Fourier Transform - Short-Time Fourier Transform - Fast Fourier Transform (FFT) - 2-D Discrete Fourier Transform (2-D DFT) - Discrete Cosine Transform (DCT) - Some Applications of the Fourier Transform.

UNIT - II Basic Digital Signal Processing II

Sampling and Quantisation: Introduction - Sampling a Continuous-Time Signal - Quantisation - Sampling Rate Conversion: Interpolation and Decimation - Digital Filters: Introduction - Linear Time-Invariant Digital Filters - Recursive and Non-Recursive Filters - Filtering Operation: Sum of Vector Products, A Comparison of Convolution and Correlation - Filter Structures: Direct, Cascade and Parallel Forms - Linear Phase FIR Filters - Design of Digital FIR Filter-banks - Quadrature Mirror Sub-band Filters - Design of Infinite Impulse Response (IIR) Filters by Pole-zero Placements - Issues in the Design and Implementation of a Digital Filter.

UNIT – III Model-Based Signal Processing

Least Square Error, Wiener-Kolmogorov Filters:Least Square Error Estimation: Wiener-Kolmogorov Filter - Block-Data Formulation of the Wiener Filter - Interpretation of Wiener Filter as Projection in Vector Space - Analysis of the Least Mean Square Error Signal - Formulation of Wiener Filters in the Frequency Domain - Some Applications of Wiener Filters - Implementation of Wiener Filters - Adaptive Filters:Introduction - State-Space Kalman Filters - Sample Adaptive Filters - Recursive Least Square (RLS) Adaptive Filters - The Steepest-Descent Method - LMS Filter.

UNIT – IV Applications of Digital Signal Processing to Speech

Speech Processing: Speech Communication - Acoustic Theory of Speech: The Source-filter Model - Speech Models and Features - Linear Prediction Models of Speech - Harmonic Plus Noise Model of Speech - Fundamental Frequency (Pitch) Information - Speech Coding - Speech Recognition - Speech Enhancement: Introduction - Single-Input Speech Enhancement Methods - Speech Bandwidth Extension - Spectral Extrapolation - Interpolation of Lost Speech Segments - Packet Loss Concealment - Multi-Input Speech Enhancement Methods - Speech Distortion Measurements.

UNIT – V Music and Mobile CommunicationApplications

Music Signal Processing and Auditory Perception: Introduction - Musical Notes, Intervals and Scales - Musical Instruments - Review of Basic Physics of Sounds - Music Signal Features and Models - Anatomy of the Ear and the Hearing Process -Psychoacoustics of Hearing - Music Coding (Compression) - High Quality Audio Coding: MPEG Audio Layer-3 (MP3) - Stereo Music Coding - Signal Processing in Mobile Communication: Introduction to Cellular Communication - Communication Signal Processing in Mobile Systems -Capacity, Noise, and

Spectral Efficiency - Multi-path and Fading in Mobile Communication - Smart Antennas – Space-Time Signal Processing.

Text Books :

1. Nurulfajar Abd Manap, Multimedia Signal Processing, First Edition, Universiti Teknikal Malaysia Melaka, 2016.
2. Saeed V. Vaseghi, Multimedia Signal Processing, First Edition, John Wiley & Sons Ltd, 2007.

References :

1. Hon Keung Kwan, Multimedia Signal Processing and Applications, Edition 1.3, dfisp.org, 2018.
2. Srdjan Stankovic, Irena Orovic, Ervin Sejdic, Multimedia Signals and Systems, Second Edition, Springer International Publishing, 2012.
3. Grgic, Mislav, Delac, Kresimir, Ghanbari, Mohammed (Eds.), Recent Advances in Multimedia Signal Processing and Communications, First Edition, Springer-Verlag Berlin Heidelberg, 2009.
4. Mandal, Mrinal Kr., Multimedia Signals and Systems, First Edition, Springer US, 2003.

Course Outcomes:

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

1. Understand the concept of Fourier analysis.
2. Utilize the basic knowledge of digital filters, sampling and quantization.
3. Investigate model-based signal processing like least square error, Wiener-Kolmogorov filters and adaptive filters.
4. Apply the digital signal processing to speech applications.
5. Employ the applications of digital signal processing to music and mobile communication.

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

22AIPESCN	DECISION SUPPORT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the decision making tasks assigned to the different levels of management.
- To describe the Decision Making Process.
- To understand the architecture of a Decision Support System (DSS).
- To examine the role of Expert Systems and Artificial Intelligence (AI) play in supporting managerial decision making.

UNIT – I Management Support Systems

An Overview: Managers and Decision-Making - Managerial Decision-Making and Information Systems - Managers and Computer Support - Computerized Decision Support and the Supporting Technologies - A Framework for Decision Support - The Concept of Decision Support Systems - Group Support Systems - Enterprise Information Systems - Knowledge Management Systems - Advanced Intelligent Decision Support Systems - Hybrid Support Systems. Decision-Making Systems, Modelling, and Support: Decision-Making: Introduction and Definitions - Systems - Models - Phases of the Decision-Making Process.

UNIT – II Decision Support Systems

DSS Configurations - Characteristics and Capabilities of DSS - Components of DSS - The Data Management Subsystem - The Model Management Subsystem - The User Interface (Dialog) Subsystem - The Knowledge-Based Management Subsystem - The User - DSS Hardware - DSS Classifications. Modelling and Analysis. Modelling - Static and Dynamic Models - Certainty, Uncertainty, and Risk - Influence Diagrams - MSS Modelling with Spreadsheets - Decision Analysis of a Few Alternatives - The Structure of MSS Mathematical Models - Mathematical Programming Optimization - Problem-Solving Search Methods. Decision Support System Development – Prototyping.

UNIT – III Knowledge Management

Introduction to Knowledge Management - Organizational Learning and Transformation - Knowledge Management Initiatives - Approaches to Knowledge Management - Information Technology in Knowledge Management - Knowledge Management Systems Implementation - Roles of People in Knowledge Management - Ensuring Success of Knowledge Management.

UNIT – IV Artificial Intelligence and Expert Systems

Knowledge Based Systems - Applications of Expert Systems - Structure of Expert Systems - Problem Areas Suitable for Expert Systems - Benefits and Capabilities of Expert Systems - Problems and Limitations of Expert Systems - Types of Expert Systems - Knowledge Acquisition, Representation, and Reasoning- Representation of Knowledge - Reasoning in Rule-Based Systems - Explanation and Meta knowledge - Inferencing with Uncertainty - Expert Systems Development - Knowledge Acquisition and the Internet.

UNIT – V Advanced Intelligent Systems

Genetic Algorithms Fundamentals - Developing Genetic Algorithm Applications - Intelligent Agents - Characteristics of Agents - Classification and Types of Agents - Internet-Based Software Agents - DSS Agents and Multi-Agents - Semantic Web - Representing Knowledge for Intelligent Agents - Web-Based Recommendation Systems - Managerial Issues of Intelligent Agents.

Text Books :

1. Turban, Decision Support and Business Intelligent Systems, 9th Edition, Pearson Education India, 2013.
2. Vicki L. Sauter, Decision Support Systems for Business Intelligence, 2nd Edition, Wiley, 2011.

References :

1. Efraim Turban, Ramesh E Sharda and Dursun Delen, Decision Support and Business Intelligent Systems, 9th Edition, Prentice-Hall of India, 2010.
2. Ramanathan Sugumaran, John Degroote, Spatial Support Syatems: Principles and Practices, 1st Edition, CRC Press, 2010.
3. V.S.Janakiraman and K.Sarukesi, Decision Support Systems, 1st Edition, Prentice-Hall of India, 2009.
4. Efraim Turban, Jay E. Aronson, Richard V. McCarthy, Decision Support Systems and Intelligent Systems, 7th Edition, Prentice-Hall of India, 2007.

Course Outcomes :

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

1. Define the purpose of a DSS.
2. Techniques and technologies that use computer resources to improve human decision making process.
3. Discuss various tools assisting IT professionals surrounding DSS.
4. Use linear programming methods to solve multivariate problems.
5. Explain key areas contributing to DSS such as knowledge acquisition, expert system and knowledge base systems.

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

22AIPESCN	NLP WITH DEEP LEARNING	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the concepts of deep learning for natural language processing (NLP).
- To study and analyse the word vector representations.
- To develop the Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN) model for NLP applications.
- To develop the Long Short-Term Memory Networks (LSTM) for NLP applications.
- To understand NLP applications such as Neural Machine Translation (NMT) and Chatbot.

UNIT – I Introduction

Introduction to Natural Language Processing (NLP) and Deep Learning (DL) –NLP libraries – Getting started with NLP - Introduction to deep learning – Types of Neural Networks – Multi Layer Perceptron – Stochastic Gradient Descent – Backpropagation - Deep Learning Libraries – Traditional approach to NLP – Deep learning approach to NLP.

UNIT – II Word Vector Representations

Word2vec- Learning Word Embeddings – classical approach to learning word representation – Word2vec – a neural network based approach to learning word representation – The skip-gram algorithm – The Continuous Bag-of-Words algorithm – Advanced Word2vec – Original skip-gram algorithm – Comparing skip-gram with CBOW– GloVe – Global Vectors representation – Document Classification with Word2vec.

UNIT – III CNN and RNN for NLP

Sentence Classification with Convolutional Neural Networks (CNN) – Introduction - Understanding CNN – Using CNN for sentence classification - Recurrent neural networks (RNN) – Understanding RNN – Backpropagation Through Time (BPTT) – Applications of RNNs – generating text with RNNs – Evaluating text results output from the RNN – Perplexity – measuring the quality of text result.

UNIT – IV LSTM for NLP

Long Short-Term Memory Networks (LSTM) – Understanding LSTM –vanishing gradient problem – Other variants of LSTMs – Applications of LSTM – Generating text – Data – Implementing an LSTM – Applications of LSTM – Image Caption Generation – Machine learning pipeline for image caption generation – Extracting features with CNNs – Implementation with VGG16 – Learning word embeddings - Preparing captions for feeding into LSTMs – Generating data for LSTMs – Defining LSTM - Evaluating results.

UNIT – V NMT and Chatbot

Sequence-to-Sequence Learning – Neural Machine Translation (NMT) – Types of Machine translation – Understanding neural machine translation – Preparing data for NMT system –

training the NMT – Inference with NMT – The BLEU score – Improving NMTs - Developing a Chatbot – Introduction to Chatbot – Conversational Bot – Chatbot: Automatic Text Generation - Training a Chatbot – Evaluating Chatbots – Turing test.

Text Books :

1. Thushan Ganegedara, Natural language Processing with TensorFlow, PACKT Publishing, 2018.
2. Karan Jain, Palash Goyal Sumit Pandey, Deep learning for Natural Language Processing: Creating Neural Networks with Python, Apress, 2018.

References :

1. Stephan Raaijmakers, Deep Learning for Natural Language Processing, MEAP, 2019.
2. Yoav Goldberg, Neural Network Methods in NLP, Morgan & Claypool Publishers, 2017.
3. Uday Lamath, John Liu, Jimmy Whitaker, Deep Learning for NLP and Speech Recognition, Springer, 2019.
4. Ian Goodfellow, Yoshua Bengio and Aaron Courville. Deep learning, The MIT Press, 2016.

Course Outcomes:

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

1. Understand the basics of NLP, Deep learning techniques, NLP libraries and Deep learning libraries.
2. Identify the word vector representations suitable for a given NLP application.
3. Build CNN model and RNN model for NLP applications such as sentence classification and text generation respectively.
4. Develop an LSTM model for NLP applications and Implementing with VGG16.
5. Understand the NLP applications such as NMT and Chatbot.

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

22AIPESCN	**ADVANCED JAVA PROGRAMMING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

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

- To impart the knowledge of Spring and Hibernate frameworks.

Unit – 1 Applets and Abstract Window Toolkit (AWT)

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

Unit – 2 Network and Database Programming

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

Unit – 3 Swing and Beans

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

Unit – 4 Applications in Distributed Environment

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

Unit – 5 Spring Framework and Hibernate Framework

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

Text Books :

1. Elizabeth Sugar Boese, "An Introduction to Programming with Java Applets", Jones and Bartlett Publishers, 3rd Edition, 2010.
2. Herbert Schildt, "Java:The Complete Reference", McGraw-Hill Publishers, 11th Edition, 2019.

3. William Grosso."Java RMI", O'Reilly Media Publication, 1st Edition, 2002.
4. Elliotte Rusty Harold, "JAVA Network Programming", O'Reilly Media Publication, 4th Edition, 2013.

Reference Books :

1. D.T. Editorial Services "Java 8 Programming Black Book", Wiley, 2015.
3. Santosh Kumar K, "Spring and Hibernate", Mc.Graw Hill Education, 2nd Edition, 2013.
4. George Reese, "Database Programming with JDBC and Java", O'Reilly Media Publication, 2nd 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**
CO1	1	2	1	-	-	-	-	-	-	-	-	-
CO2	2	2	1	2	-	-	-	-	-	-	-	-
CO3	2	2	2	2	-	-	-	-	-	-	-	1
CO4	1	1	1	2	1	-	-	-	-	-	-	1
CO5	2	1	1	2	2	-	-	-	-	-	-	1

22AIPESCN	**SPEECH SYNTHESIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To learn how to build systems that mimic human capabilities in understanding, generating and coding speech for a range of human-to-human and human-to-machine interactions.
- To investigate virtually every aspect of the unit selection method of concatenative speech synthesis.
- To show that high quality (both intelligibility and naturalness) synthetic speech could be obtained from speech synthesis systems for virtually any task application.
- To understand the problem of converting text to a complete linguistic description of associated sound and to provide a conceptual understanding of the processes involved in a complete text-to-speech synthesis system.

UNIT – I Introduction

Introduction - Text to Speech - Communication and Language- Types of communication - Human Communication - Communication Processes - The Text-to-Speech Problem:Speech and Writing - Reading Aloud - Text-to-speech System Organization – Systems - Key problems in Text-to-speech.

UNIT – II Text Segmentation and Organization

Words and Sentences - Text Segmentation - Processing Documents - Text-to-Speech Architectures - Text Decoding: Finding the words from the text - Text Classification Algorithms - Non-Natural Language Text - Natural Language Text - Natural Language Parsing.

UNIT – III Prosody Prediction from Text

Prosodic Form – Phrasing – Prominence - Intonation and tune - Prosodic Meaning and Function - Determining Prosody from the Text - Phrasing prediction - Prominence Prediction - Intonational Tune Prediction - Prosody in real dialogues..

UNIT – IV Synthesis of Prosody

Synthesis of Prosody - Intonation Overview - Intonational Behaviour - Intonation Theories and Models - Intonation Synthesis with AM models - Intonation Synthesis with Deterministic Acoustic Models - Data Driven Intonation Models – Timing - Klatt rules - The Campbell model

UNIT – V Synthesis Techniques Based on Vocal Tract Models

Synthesis Specification: The Input to the Synthesiser - Formant Synthesis - Classical Linear Prediction Synthesis - Articulatory Synthesis - Synthesis by Concatenation and Signal Processing Modification - Speech Units in Second Generation Systems - Pitch Synchronous Overlap and Add (PSOLA) - Residual Excited Linear Prediction - Sinusoidal Models - Synthesis from Cepstral Coefficients - Concatenation Issues.

Text Books :

1. K. Sreenivasa Rao, Predicting Prosody from Text for Text-to-Speech Synthesis, Springer, 2012.
2. Paul Taylor, Text-to-Speech-Synthesis, Cambridge University Press, 2009.

References :

1. K. Sreenivasa Rao, N. P. Narendra, Source Modeling Techniques for Quality Enhancement in Statistical Parametric Speech Synthesis, Springer, 2019.
2. Lawrence R. Rabiner, Ronald W. Schafer, Introduction to Digital Speech Processing, now publishers, 2007.
3. John Holmes and Wendy Holmes, Speech Synthesis and Recognition, Taylor and Francis, 2001.
4. Sadaoki Furui, Digital Speech Processing, Synthesis, and Recognition, Marcel Dekker Inc, 2000.

Course Outcomes :

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

1. Analyse the various ways of communication and to examine what is involved in performing text-to-speech synthesis.
2. Know how to extract linguistic information from the text input and how to handle control information.
3. Investigate how to predict prosody information from an impoverished text input.
4. Understand the issue of synthesising acoustic representations of prosody.
5. Analyse the second generation synthesis systems in contrast to the first generation systems.

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

22AIPESCN	**AI – HARDWARE AND SOFTWARE INFRASTRUCTURE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To learn the hardware requirements of an artificial intelligence system.
- To explore the datasets available for deep learning.
- To learn the software needed for an AI system.
- To know the packages in R-programming.

UNIT – I Introduction

Hardware Infrastructure: Chipset Architectures for Deep Learning- Central Processing Units - Graphics Processing Units- Field-Programmable Gate Arrays- Application-Specific Integrated Circuits- System-on-a-Chip Accelerators- Artificial Intelligence PC Cards-Artificial Intelligence Workstations-Network and Bus Connectivity- Storage and Memory- Cloud Infrastructure.

UNIT – II Bench Mark Datasets

Image datasets: MNIST-MS-COCO-ImageNet-Open Images-VisualQA-CIFAR-10. Text datasets: WordNet-The Wikipedia Corpus. Audio/Speech datasets: Free Spoken Digit Dataset-Free music Archive LibriSpeech, VoxCeleb.

UNIT – III Open Source Packages- Python

Basics of Python: Control Structures- Boolean logic -Numeric Data Types- Strings- Text Files- Lists- Dictionaries- Events and Event-driven Programming- Packages: Numpy-Pandas-Matplotlib- Scikit- learn.

UNIT – IV Open Source Packages-R Programming

Basics of R programming - General Properties- Data Types- Variable- Operators – Statements- Decision Making Statements - Loop statements- Array- String- Function-Data Frames Packages: RODBC- Gmodels – Class - Tm.

UNIT – V Artificial Intelligence in Data Analytics

Introduction to Hadoop-Components of Hadoop -Hadoop architecture-HDFS-YARN - Hadoop Eco Systems: Introduction to Pig, Hive, HBase-Hadoop Developer: Moving the data into Hadoop- Moving The Data out from Hadoop- Reading and Writing the files in HDFS - The Hadoop Java API for MapReduce-Mapper Class-Reducer Class-Driver Class- Writing Basic MapReduce Program In java- Understanding the MapReduce Internal Components. - Moving The Data from Web server Into Hadoop - Real Time Example in Hadoop: Market Basket Algorithms.

Text Books :

1. VanderPlas, Jake, Python data science handbook: essential tools for working with data, O'Reilly Media, Inc., 2016.
2. Alex Holmes, Hadoop in Practice, Manning Publications, 2nd Edition, 2014.

References :

1. Adler J, “R in a nutshell: A desktop quick reference”, O'Reilly Media Inc, 2012.
2. Lambert, Kenneth A, “Fundamentals of Python: first programs”, Cengage Learning, 2011.
3. www.tractica.com
4. https://www.theregister.co.uk/2018/09/26/build_own_ai/(pc cards)
5. https://www.analyticsvidhya.com/blog/2018/03/comprehensive-collection-deep-learning-datasets/

Course Outcomes :

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

1. Analyze the hardware requirements of artificial Intelligence.
2. Learn about the necessary databases for image, speech and text.
3. Learn the basics of Python language and other packages useful for data science.
4. Learn the basics of other packages of R programming.
5. Understand the basics of Hadoop, Pig, Hive and HBase and its usage in data analytics.

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

22AIPESCN	AI MARKETING AND ML TOOLS	L	T	P	C
		3	0	0	3

Course Objectives:

- Identify problems that are amenable to solution by AI methods and the concepts of machine learning.
- Discover appropriate AI methods to solve a given problem and the clustering techniques and their utilization in machine learning.
- Formalize a given problem in the language/framework of different AI methods and understand the linear learning models in machine learning.
- Design and carry out an empirical evaluation of different algorithms on problem normalization, and state the conclusions.

UNIT - I Introduction to Machine Learning

Introduction to Autonomic Marketing and Artificial Intelligence for Marketers, AI Umbrella, The Machine that Learns-Machine Learning's Biggest Roadblock, Machine Learning's Greatest Asset-Machines Are Big Babies, Strong versus Weak AI.

UNIT – II Solving the Marketing Problem

Marketing Problem-One-to-One Marketing, One-to-Many Advertising-Marketing Mix Modeling- Econometrics-Customer Lifetime Value, Seat-of-the-Pants Marketing, Marketing in a Nutshell, Market Research, Market place Segmentation-Raising Awareness, SocialMedia Engagement

UNIT– III Using AI to Persuade and Retention

The In-Store Experience, The Onsite Experience Web Analytics-Merchandising-Closing the Deal –Attribution, Growing Customer Expectations, Retention and Churn-Customer Sentiment, Customer Service, Predictive Customer Service

UNIT– IV The AI Marketing Platform

Supplemental AI-Marketing Tools from Scratch, A Word about Watson-Machine Mistakes, Human Mistakes-The Ethics of AI-Strategic Role in On boarding AI-AI to Leverage Humans-Collaboration at Work- Role as Manager-AI for Best Practices

UNIT – V Mentoring the Machine

How to Train a Dragon-What Problem Are You Trying to Solve- Make it as Good Hypothesis, The Human Advantage , The Path to the Future-Machine, Train Thyself-Intellectual Capacity as a Service-Data as a Competitive Advantage-How Far Will Machines Go, Your Bot Is Your Brand, Computing Tomorrow

Text Books :

1. Artificial Intelligence for Marketing: Practical Applications (Wiley and SAS Business Series), 2017, Jim Sterne
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill, 2003.

References :

1. Parag Kulkarni, Prachi Joshi, Artificial Intelligence –Building Intelligent Systems, PHI learning private Ltd, 2015.
2. Deepak Khemani, Artificial Intelligence, Tata Mc Graw Hill Education 2013.
3. George F. Luger, Artificial Intelligence-Structures and Strategies For Complex Problem Solving, Pearson Education / PHI, 2002.
4. Stuart Russel and Peter Norvig AI – A Modern Approach, 2nd Edition, Pearson Education 2007.

Course Outcomes :

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

1. Understand the basic concepts of AI Marketing.
2. Acquire the knowledge of real world Knowledge representation.
3. Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.
4. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.
5. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.

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

22AIPESCN	EMOTIONAL ANALYTICS IN AI	L	T	P	C
		3	0	0	3

Course Objectives :

- To be Emotionally Intelligent Human Beings enabling to manage & respond to self & others' emotions.
- To develop skills of Self Awareness, Self Management, Self Motivation, Empathy & Social Relations.
- To understand Human Psychology influencing Human Behaviour.
- To develop valuable relations with other people, by understanding underlining principles of Human Relations

UNIT – I Introduction to Emotional Intelligence (EI)

Introduction – Emotional Intelligence (EI), Emotional Quotient (EQ) and Intelligence Quotient (IQ) Historical Roots of Multiple Intelligences & EI - Power of Emotions - The Emotional Brain & Amigdala Hijack - The Emotional Sentinel – Importance of Emotions – Emotions and Brain- Application of Physiology of Emotions

UNIT – II Building Blocks of Emotional Intelligence

Ability Based Model - Perception - Employment - Comprehension - Management - Trait Model of Self-Efficacy - Mixed Model - Personal Competence (Self Awareness, Self Management & Motivation) - Social Competence (Empathy & Social Skills) - Empathy - Understanding Empathy - Importance of Empathy - Application of Self-Efficacy of EI

UNIT – III Aspects & Impact of fundamental Elements of EI

Behavioral terms - Self Awareness - Emotional Resilience – Motivation - Interpersonal Sensitivity – Influence - Intuitiveness – Conscientiousness

UNIT – IV EI Elements and its Applications

Competence terms - Self Awareness - Self Management - Self Motivation - Empathy - Social Skills - Applications in Everyday Behaviour - Education - Workplace - Case Study Discussion with Role Plays

UNIT – V Measuring Emotional Intelligence & Behavioural EQ

Initial Self-Assessment on EI Elements (Internal) - 360 degree Assessment Map - EI Behavioural Test (External) - Behavioural EQ - Measuring Behaviour EQ - DISC Test - Role Play on DISC Behaviour Identification.

Text Books :

1. The Brain and Emotional Intelligence: New Insights: Daniel Goleman HBR's 10 Must Reads on Emotional Intelligence, 2015.
2. Gil Hasson, Understanding Emotional Intelligence, Pearson,2014,

References :

1. Daniel Goleman, The emotionally intelligent leader, Harvard business review press, 2019.
2. Neilson Kite and Frances Kay, Understanding emotional intelligence, Koganpage, 2012.
3. The Language of Emotional Intelligence: The Five Essential Tools for Building Powerful and Effective Relationships: Jeanne Segal, 2008.
4. Marvin Minsky, The Emotion Machine, Commonsense Thinking, Artificial Intelligence, and the Future of the Human Mind" Simon & Schuster, 2006.

Course Outcomes :

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

1. To be emotionally intelligent human beings enabling to manage & respond to self & others' emotions.
2. To understand various existing models of emotional intelligence.
3. To understand behavioural intelligence and apply those in their professional life.
4. To develop skills of self awareness, self management, self motivation, empathy &social relations.
5. To understand underlying principles of behavioural test.

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

22AIPESCN	**COGNITIVE AND COMPUTATIONAL APPROACHES TO MACHINE VISION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

The course enables the students to:

- Understands cognitive computing and cognitive psychology basics..
- Develop algorithms that use AI and machine learning along with human interaction.
- Learn machine learning techniques for cognitive decision making.
- Learn various cognitive system applications.

UNIT – I Introduction to Cognitive Computing With AI

Cognitive Computing -Cognitive Psychology -The Architecture of the Mind -The Nature of Cognitive Psychology –Cognitive architecture –Cognitive processes –The Cognitive Modeling Paradigms -Declarative / Logic based Computational cognitive modeling – connectionist models –Bayesian models- Introduction to Knowledge-Based AI –Human Cognition on AI –Cognitive Architectures.

UNIT – II Different Modes of Computing

Turning machine-Lambda- Calculus,-Hyper Computing- Super Computing- Pan Computing and Interactive Computing- Computation of Cognitive Functioning in machines-Robotics, Human-Robotics Interaction- Hepatic.

UNIT – III Cognitive Computing with Inference and Decision Support Systems:

Intelligent Decision making -Fuzzy Cognitive Maps –Learning algorithms: Non linear Hebbian Learning –Data driven NHL -Hybrid learning –Fuzzy Grey cognitive maps – Dynamic Random fuzzy cognitive Maps.

UNIT – IV Cognitive Computing with Machine Learning

Machine learning Techniques for cognitive decision making –Hypothesis Generation and Scoring -Natural Language Processing -Representing Knowledge -Taxonomies and Ontologies -Deep Learning.

UNIT – V Applications

Cognitive Systems in health care –Cognitive Assistant for visually impaired –AI for cancer detection- Predictive Analytics -Text Analytics -Image Analytics -Speech Analytics –IBM Watson -Introduction to IBM's PowerAI Platform -Introduction to Google's TensorFlow Development Environment.

Text Books :

1. Vijay Raghvan, Venu Govindaraju, C.R. Rao, Cognitive Computing: Theory and Applications, Elsevier publications, 2016.
2. Jerome R. Busemeyer, Peter D. Bruza, Quantum Models of Cognition and Decision, Cambridge University Press, 2014.

References :

1. Emmanuel M. Pothos, Andy J. Wills, Formal Approaches in Categorization, Cambridge University Press, 2011.
2. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, 2009.
3. Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, Indianapolis, 2005.
4. 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

1. Understand and discuss what cognitive computing is, and how it differs from traditional approaches.
2. Plan and use the cognitive computing with inference and decision support systems.
3. Apply machine learning techniques in cognitive decision making.
4. Use cognitive mode of computing in machines and Robotics.
5. Develop and explore the various cognitive computing applications.

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

22AIPESCN	**DATA ANALYTICS AND VISUALIZATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To learn the data representation techniques.
- To understand the data analysis pipeline.
- To acquire knowledge on data mining techniques for analysis.
- To study the visualization and its various types.

UNIT – I Data Representation

Data Objects and Attribute Types: Nominal-Binary- Ordinal-Numeric- Discrete and Continuous-Types of data: Record-Temporal-Spatial Temporal-Graph-Unstructured and Semi structured data-Basic Statistical Descriptions of Data.

UNIT – II Introduction to Data Analysis

Probability and Random Variables-Correlation- Regression-Data Analysis Pipeline: Data pre-processing- Attribute values-Attribute transformation-Sampling-Dimensionality reduction: PCA-Eigen faces-Multidimensional Scaling- Non-linear Methods-Graph-based Semi-supervised Learning-Representation Learning Feature subset selection-Distance and Similarity calculation.

UNIT – III Data Mining Techniques for Analysis

Classification: Decision tree induction-Bayes classification-Rule-based classification-Support Vector Machines-Classification Using Frequent Patterns-k-Nearest-Neighbor-Fuzzy-set approach Classifier-Clustering: K-Means-k-Medoids- Agglomerative versus Divisive Hierarchical Clustering Distance in Algorithmic Methods-Mean-shift Clustering.

UNIT – IV Visualization

Traditional Visualization-Multivariate Data Visualization-Principles of Perception-Color-Design and Evaluation -Text Data Visualization- Network Data Visualization-Temporal Data Visualization and visualization Case Studies.

UNIT – V Implementation of data analytics techniques

Implementation of various data analytics techniques such as classification clustering on real world problems using R.

Text Books :

1. Phuong Vo.T.H, Martin Czygan, Ashish Kumar, Kirthi Raman, Python: Data Analytics and Visualization, Packet Publishing Limited, 2017.
2. Andy Kirk, Data Visualization: A Handbook for Data Driven Design, 1st Education SAGE Publication, 2016.

References :

1. Simon, P., The Visual Organization: Data Visualization, Big Data, and the Quest for Better Decisions, John Wiley & Sons, 2014.
2. Peng, D., R., R Programming for Data Science, Lulu.com, 2012.
3. Han, J., Kamber, M. and Pei, J., Data Mining Concepts and Techniques, Morgan Kaufmann 3rd Edition, 2011.
4. Hastie, T., Tibshirani, Rand Friedman, J., The Elements of Statistical Learning, 2nd Edition, Springer, 2009.

Course Outcomes :

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

1. Understand data representation techniques.
2. Appreciate the data analysis pipeline.
3. Implement data mining techniques for analysis.
4. Apply multivariate data visualization on various applications.
5. Implement data analysis techniques using R.

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

22AIPESCN	VIRTUAL REALITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand geometric modelling and Virtual Environment.
- To study about Virtual Hardware and Software.
- To develop Virtual Reality and Augmented Reality applications.
- To design Virtual Environment.

UNIT-I Introduction to Virtual Reality

Virtual Reality & Virtual Environment : Introduction - Computer Graphics - Real Time Computer Graphics - Virtual Environments - Requirement - Benefits of Virtual Reality, Historical development of VR : Introduction - Scientific Landmark, 3D Computer Graphics: Introduction - The virtual world space - positioning the virtual observer - the perspective projection - human vision - stereo perspective projection - Colour theory - Simple 3D modeling - Illumination models - Reflection models - Shading algorithms - Hidden Surface Removal.

UNIT-II Introduction to Augmented Reality

Introduction: Definitions - The Promise of Augmented Reality - The Dangers of Augmented Reality - Augmented Reality Skills - Seeing Augmented Reality - The Realities, Types of Augmented Reality: Types of Augmented Reality Systems - The Taxonomy of Augmented Reality - Smart-Glasses - Watermarking Augmented Reality, Software Tools and Technologies, Technology Issues.

UNIT-III Geometric Modeling

Geometric modelling: From 2D to 3D - 3D space curves - 3D boundary representation, Geometrical Transformations: Introduction - Frames of reference - Modeling transformations - Instances - Picking - Flying - Scaling the VE - Collision detection, A Generic VR system: Introduction - The virtual environment - the computer environment - VR Technology- Model of interaction.

UNIT-IV Virtual Environment

Animating the Virtual Environment: The dynamics of numbers - Linear and Non-linear interpolation - The animation of objects - linear and nonlinear translation - shape & object inbetweening - free from deformation - particle system- Physical Simulation: Introduction - Objects falling in a gravitational field - Rotating wheels - Elastic collisions - simple pendulum – springs.

UNIT-V Hardwares & Softwares for VR

VR Hardware: Introduction - sensor hardware - Head•coupled displays -Acoustic hardware - Integrated VR systems, VR Software: Introduction - modelling virtual world - VR toolkits.

Text Books:

1. John Vince, Virtual Reality Systems, Pearson Education Asia, 2008.
2. Jon Peddie, Augmented Reality - Where We Will All Live, Springer International Publishing,2017.

References:

1. Alan B Craig, William R Sherman and Jeffrey D Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann, 2009.
2. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley Interscience, 2nd Edition, 2006.
3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, 3D User Interfaces, Theory and Practice, Addison Wesley, USA, 2017.
4. William R. Sherman, Alan B. Craig, Understanding Virtual Reality: Interface, Application, and Design, Morgan Kaufmann, 2018.

E-B OOKS:

1. http://rnsl.cs.uiuc.edu/vr/
2. www.vresources.org
3. www.vrac.iastate.edu

MOOC:

1. https://www.mooc-list.com/course/making-your-first-virtual-reality-game-coursera
2. https://www.rnooc-list.corn/course/vr-360-video-production-coursera
3. https://nptel.ac.in/syllabus/syllabus_pdf/106106138.pdf

Course Outcomes:

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

1. Design Virtual environment.
2. Explore the tools and technologies of Augmented Reality
3. Design geometric modeling of Virtual Objects.
4. Animating the Virtual Environment.
5. Implement Virtual Hardware and software.

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

22AIPESCN	AI IN CYBER SECURITY	L	T	P	C
		3	0	0	3

Course Objectives :

- To apply core knowledge of AI concepts and tools.
- To analyze a problem, identify and detect cyber security threats with AI.
- To detect network anomaly and prevent frauds with GANs.
- To evaluate AI arsenal and to prevent authentication abuse.

UNIT - I AI Core Concepts and Tools

Applying AI in cyber security: Evolution in AI-Types of machine learning-algorithm training and optimization-Know Python's libraries. Python for AI and cyber security-Python libraries for cyber security-enter Anaconda-playing with Jupyter notebooks-Installing DL libraries.

UNIT – II Detecting cyber security threats with AI

Detecting email cyber security threats with AI: Detecting spam with perceptrons-spam detection with SVM-Phishing detection with logistic regression and decision trees-spam detection with Naïve Bayes-NLP to the rescue. Malware threat detection: Malware analysis at a glance-telling different malware families apart-Decision tree malware detectors-detecting metamorphic malware with HMM-advanced malware detection with deep learning.

UNIT – III Network anomaly detection with AI and authentication abuse prevention

Network anomaly detection techniques-classifying network attacks-detecting botnet topology-ML algorithms for botnet detection. Securing user authentication: Authentication abuse prevention-account reputation scoring-user authentication with keystroke recognition-biometric authentication with facial recognition.

UNIT – IV Fraud prevention and GANs

Fraud detection algorithms-predictive analytics for credit card fraud detection-IBM Watson cloud solution-importing sample data in the cloud-evaluating quality of our predictions. GANS in a nutshell-GAN Python tools and libraries-network attack via model substitution-IDS evasion via GAN-facial recognition attacks with GAN.

UNIT – V Evaluating and testing AI Arsenal

Best practices of feature engineering-evaluating a detector's performance with ROC-split data to training and test sets-using cross validation for algorithms. Assessing AI arsenal: Evading ML detectors-challenging ML anomaly detection-testing for data and model quality-ensuring security and reliability.

Text Books :

1. Alessandro Parisi, Hands on Artificial Intelligence for Cyber security, Packt Publishing Ltd., 2019.
2. Jack Caravelli and Nigel Jones, Cybers ecurity-Threats and responses for government and business, Praeger security international, 2019.

References :

1. Brij B. Gupta, Michael Sheng, Machine learning for computers and cyber security, CRC Press, 2019.
2. Clarence Chio, David freeman, Machine Learning and Security, O'Reilly, 1st edition, 2018.
3. Soma Halder and Sinan Ozademir, Machine Learning for Cybersecurity, Packt publishing, 2018.
4. Ted Coombs, Artificial Intelligence and Cybersecurity for dummies, IBM Limitec Edition, John Wiley & Sons, 2018.

Course Outcomes:

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

1. Understand the basic concepts of AI and the necessary tools for cyber security.
2. Detect cyber security threats in AI.
3. Understand the fundamentals of Network anomaly detection with AI and authentication abuse prevention.
4. Demonstrate working knowledge fraud prevention with cloud AI solutions.
5. Ability to evaluate algorithms and to test AI arsenal.

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

22AIPESCN	**BIOMETRIC SECURITY TECHNOLOGY-AI**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

To understand the basics of Biometrics and its functionalities

- To learn the role of biometric in the organization.
- To expose the concept of IRIS and sensors.
- To expose the context of Biometric Applications.
- To learn to develop applications with biometric security.

UNIT – I Introduction

Biometrics- Introduction- benefits of biometrics over traditional authentication systems – Verification and identification – Basic working of biometric matching – Accuracy – False match rate – False non-match rate – Failure to enroll rate – Derived metrics – Layered biometric solutions -benefits of biometrics in identification systems-selecting a biometric for a

system –Applications - Key biometric terms and processes - biometric matching methods - Accuracy in biometric systems.

UNIT – II Physiological Biometric Technologies

Fingerprints - Technical description –characteristics - Competing technologies - strengths – weaknesses – deployment - Facial scan - Technical description - characteristics - weaknesses-deployment - Iris scan - Technical description – characteristics - strengths – weaknesses – deployment - Retina vascular pattern – Finger scan – Features – Components – Operation (Steps) – Competing finger Scan technologies – Strength and weakness. Types of algorithms used for interpretation

UNIT – III Behavioral Biometrics

Technical description – characteristics - strengths – weaknesses – deployment - Facial Scan - Features – Components – Operation (Steps) – Competing facial Scan technologies – Strength and weakness– Hand scan - Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics. Behavioral Biometric Technologies: Handprint Biometrics - DNA Biometrics.

UNIT – IV Iris and Other Traits

Signature and Handwriting technology - Technical description – classification – Iris Scan - Features – Components – Operation (Steps) – Competing iris Scan technologies – Strength and weakness –keyboard / keystroke dynamics- Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses-deployment.

UNIT – V Future Trends

Multi biometrics and multi factor biometrics - two-factor authentication with passwords – Voice Scan - Features – Components – Operation (Steps) – Competing voice Scan (facial) technologies – Strength and weakness. - Tickets and tokens – executive decision - implementation plan.

Text Books :

1. Ravindra Das, Adopting Biometric Technology: Challenges and Solutions Hardcover – Import, CRC Press,1st Edition, 2016.
2. Ravindra Das, The Science of Biometrics: Security Technology for Identity verification, Routledge,1st Edition 2018.

References :

1. Larbi Boubchir, Biometric Recognition and Security: Theory, Methods and Applications, ISTE Press – Elsevier, 2019.
2. Gerardus Blokdyk, Biometric Identification A Complete Guide – 2019, 5starcooks, 2019
3. Khalid saeed with Marcin Adamski, Tapalina Bhattasali, Mohammed K. Nammous, Piotr panasiuk, mariusz Rybnik and soharab H.Sgaikh, ―New Directions in Behavioral Biometrics‖, CRC Press 2017.
4. A Ghany Kareem Kamal ,An Intelligent Biometrics System, LAP Lambert Academic Publishing, 2015.

Course Outcomes:

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

1. Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
2. Understand and analyze biometric technologies in various applications and to identify the strength and weakness of the technologies.
3. Learn about the behavioral biometric technologies.
4. Identify the sociological and acceptance issues associated with the design and implementation of biometric systems such as iris, voice etc.,
5. Understand various Biometric security issues and future trends and its applications.

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

22AIPESCN	**INFORMATION RETRIEVAL AND WEB SEARCH**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To understand the basics of Information Retrieval.
- To learn the basics of Web Search.
- To understand Machine Learning Techniques for text classification and clustering.
- 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 - Goals and history of IR - The impact of the web on IR. The role of artificial intelligence (AI) in IR - The Web – The e-Publishing Era - Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT – II Modelling and Retrieval Evaluation

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 Text Classification and Clustering

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. Categorization algorithms: naive Bayes.

UNIT – IV Web Retrieval and Web Crawling

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 - Web search: Search engines-spidering –metacrawlers-directed spidering-link analysis (e.g. hubs and authorities, Google PageRank)- shopping agents.

UNIT – V 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 – Neighbourhood models.Information Extraction and Integration: Extracting data from text; XML; semantic web; collecting and integrating specialized information on the we.

Text Books :

1. Ricardo Baeza-Yates and BerthierRibeiro-Neto, ―Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, ―Recommender Systems Handbook, 1stEdition, 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.
3. Donald Metzier, Trevor Strohman, W.Bruce Croft, Search Engines: Information Retrieval in Practice, 1st Edition, Pearson, 2009.
4. David A. Grossman, Ophir Frieder, Information Retrieval: Algorithms and Heuristics, 2nd Edition, Springer, 2004.

Course Outcomes :

1. Use an open source search engine framework and explore its capabilities
2. Apply appropriate method of classification or clustering.
3. Design and implement innovative features in a search engine.
4. Design and implement a recommender system.
5. To identify challenging problems on the Web.

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

22AIPESCN	**VISION SYSTEMS AND ROBOTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To learn the basics of robotics.
- To understand the robot end effectors.
- To learn the techniques used in robot mechanics.
- To learn the fundamentals of machine vision systems and robot programming.

UNIT – I Basics of Robotics

Introduction- Basic components of robot-Laws of robotics- classification of robot-work space - accuracy- resolution –repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives.

UNIT – II Robot End Effectors

Robot End effectors: Introduction- types of End effectors- Tools as end effectors - Drive system for grippers - Mechanical gripper- types of gripper mechanism- gripper force analysis and gripper design - other types of gripper- special purpose grippers.

UNIT – III Robot Mechanics

Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation.

UNIT – IV Machine Vision Fundamentals

Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology - Camera calibration – Stereo Reconstruction.

UNIT – V Robot Programming

Robot programming: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- VAL language commands- motion control, hand control, program control, pick and place applications - palletizing applications using VAL, Robot welding application using VAL program- Rapid Language - basic commands Virtual robotics - VAL-II and AML – applications of robots.

Text Books :

1. Carsten Steger, Markus Ulrich, Christian Wiedemann, Machine Vision Algorithms and Applications, Second edition, Weinheim, WILEY-VCH, 2018.
2. John J. Craig, Introduction to Robotics - Mechanics and Control, 3rd Edition, Pearson Education Inc, 2013.

References :

1. Mikell P Groover, Mitchel Weiss, Roger N Nagel, Nicholas G Odrey, Ashish Dutta, Industrial Robotics Technology, Programming and Applications, Second edition, 2012.
2. S.R. DEB, S.DEB, Robotics Technology and Flexible Automation, 2nd Edition, Tata McGraw Hill Education, 2011.
3. S.K. Saha, Introduction to Robotics, 4thEdition, Tata McGraw Hill Education, 2011.
4. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis, Oxford University Press, Sixth impression, 2010.

Course Outcomes :

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

1. Able to know the basics of robotics.
2. Able to understand the concepts of robot end effectors.
3. Obtain forward, reverse kinematics and dynamics model of the industrial robot arm
4. Develop the vision algorithms.
5. Understand the robot programming and applications of robots.

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

22AIPESCN	AGENT BASED MODELING AND SIMULATION	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basic concepts of Agent based modeling (ABM).
- To understand agent based model design process and to present modeling methodologies.
- To describe the tools for ABM and its architecture.
- To train the students to explore model verification and validation techniques.

UNIT – I Fundamentals of Agent based Modeling

The Challenge: Agents-Why ABMS-Foundations of ABMS-Uses-Overview of ABMS-Design. ABMS Paradigm: Types of models-nondeterminism-cycle of innovation-other angles on nondeterminism-choosing behaviors to models-spectrum of model uses. Agents a close look: attributes-behaviors-simple agents-complex agents-market example-design and development.

UNIT – II Modeling and Simulation

The roots of ABMS: Context-complexity science-diffusion of ABMS. Role of ABMS: Modeling and simulation for business applications-supply chain example-survey of modeling approaches-when to use agents-blended modeling approaches. Discovering agent behaviors: Social agents-behavioral theories-agent diversity-multiagent systems-discovering agent behaviors-market example.

UNIT – III Agents and Modeling

Office ABMS: Progressive development-prototyping ABMS Environment-four model growth path-leveraging change-ABMS Architecture-ABMS Continuum-Examples. Desktop ABMS: Agent spreadsheets-Dedicated ABMS prototyping environment- Example. Participatory ABMS: Strengths and weakness-developing strong minds-market example.

UNIT – IV Large scale ABMS

Large scale ABMS: Features-current Toolkits-Large scale modeling life cycle-designing large scale models-agent patterns and antipatterns-examples. ABMS verification and validation: overview-verification-validation-related aspects of V&V. Visual approach to data collection and cleaning.

UNIT – V ABMS Management

Understanding and presenting ABMS Results: Analyzing ABMS Results-Presenting ABMS results-seven steps. ABMS Project Management: ABMS Business function-fundamentals-project goals-stopping mission creep-champions-domain skills pyramid-ABMS project structures-ABMS business process-Rising to the challenge.

Text Books :

1. Uri Wilensky and William Rand, An Introduction to Agent-Based Modeling: Modeling Natural, Social, and Engineered Complex Systems with NetLogo, MIT Press, Cambridge, England, 2015.
2. Hiroki Sayama, Introduction to the Modeling and Analysis of Complex Systems, Open SUNY Textbooks, 2015.

References :

1. J. Nathan Kutz, Data-Driven Modeling & Scientific Computation: Methods for Complex Systems & Big Data, Oxford University Press, 2013.
2. Jerry Banks, John S Carson, Barry L Nelson, David M Nicol and Shahabudeen P, Discrete -Event System Simulation, Pearson, New Delhi, 2011.
3. Averil M Law, Simulation Modeling and Analysis, Tata-McGraw Hill, New Delhi, 2011.
4. Narsingh Deo, System Simulation with Digital Computer, PHI Learning, New Delhi,2011.

Course Outcomes:

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

1. Understand the agent modeling and apply to a specific domain to make a significant contribution.
2. Leverage the knowledge acquired to build novel agent models.
3. Plan and execute a project that leverages ABMS.
4. Create the business implications of ABMS.
5. Build and explore the ABMS applications that are impacting the field of AI & ML.

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

22AIPESCN	**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	-	-	-	-	-	-

22AIPESCN	**ARTIFICIAL SUPER INTELLIGENCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the problem domain of super intelligent machines.
- To investigate the issues related to the development of super intelligent systems.
- To examine the singularity paradox and machine ethics.
- To build a secure confinement environment allowing humanity to benefit from super intelligence.

UNIT – I AI -Completeness

Introduction-Theory of AI-Completeness-First AI-Hard Problem-Beyond AI-compleness - Space of mind designs and human mental model: Infinitude of minds-size, complexity and properties of minds-space of mind designs-taxonomies-mind cloning.

UNIT – II Inventing Artificial Super intelligence

Motivation-Zero knowledge proof-CAPTCHA-AI-Completeness-Super CAPTCHA - Mental Illness in machines: Wireheading in Machines: Sensory Illusions-potential solutions to wire heading-perverse instantiation.

UNIT – III Forms of Super intelligence

Speed super intelligence-collective super intelligence - quality super intelligence-direct and indirect reach-sources of advantage of digital intelligence. Limits of self-improving artificially intelligent systems: Taxonomy of types of self-improvement-limits of self-improving artificially intelligent systems-analysis-RSI convergence theorem.

UNIT – IV Singularity Paradox

Singularity Paradox (SP) - Methods of SP: Prevention and development-restricted deployment-incorporation into society-self monitoring-indirect solutions-analysis-future research directions. Super intelligence safety engineering: Ethics and intelligent systems-AI safety engineering-grand challenge-artificial general intelligence research is unethical-robot rights.

UNIT – V AI Confinement Problem

AI Confinement problem-hazardous software-critique of the confinement approach-possible escape paths-critique of the AI-boxing critique-countermeasures against escape-AI communication security-safety communicating with super intelligence - Unifying theory of information, computation and intelligence: Efficiency theory-Information and knowledge-intelligence and computation-time and space-compressibility and randomness-oracles and undecidability-intractable and tractable.

Text Books :

1. Roman V. Yampolskiy, Artificial Superintelligence: A Futuristic Approach, CRC Press, Taylor & Francis Group, 2016.
2. Nick Bostrom, Super intelligence: Paths, Dangers, Strategies, Oxford University Press, 2014.

References :

1. Artem Kovera, How to create Machine Super intelligence, Second edition, copyright Artem Kovera, 2018.
2. Amit Ray, Compassionate Artificial Super intelligence AI 5.0 – AI with block chain, BMI, Drone, IoT and biometric technologies, Inner Light Publishers, 2018.
3. Peter J. Scott, Crisis of Control: How Artificial Superintelligences may destroy or save the human race, 2017.

4. Parag Kulkarni, Prachi Joshi, Artificial Intelligence – Building Intelligent Systems, PHI learning private Ltd, 2015.

Course Outcomes:

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

1. Understand the contribution of super intelligent machines in the theory of AI Completeness
2. Develop a super intelligent system without having to reveal the system itself.
3. Understand various forms of super intelligences and their limits.
4. Study the methods of Singularity Paradox.
5. Build intelligent systems for security safety.

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

22AIPESCN	**AI – CHALLENGES AND STRATEGIES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To provide both background and a motivation for the AI theory and applications.
- Introduces the concepts of Machine Learning and Data Science.
- To impart knowledge about recent trends on Block chain Technology.
- Introduces the basics of Natural Language Processing and Robotics.

UNIT - I Introduction

AI History and Applications - The Propositional Calculus - The Predicate Calculus - Using Inference Rules to Produce Predicate Calculus Expressions - Graph Theory - Strategies for State Space Search - Using the State Space to Represent Reasoning with the Predicate Calculus.

UNIT – II Machine Learning

A Framework for Symbol-based Learning - Version Space Search - The ID3 Decision Tree Induction Algorithm - Inductive Bias and Learnability - Competitive Learning - Hebbian Coincidence Learning - Stochastic and Dynamic Models of Learning - Hidden Markov

Models (HMMs) - Dynamic Bayesian Networks and Learning - Stochastic Extensions to Reinforcement Learning.

UNIT – III Data Science

Big Data and Data Science Hype – Datafication - Data Scientist - Current Landscape of Perspectives - Statistical Inference - Populations and Samples - Statistical Modeling - Probability Distributions - Modeling - Exploratory Data Analysis - Philosophy- Data Science Process - Algorithms: Linear Regression - k-NN - k-means - Spam Filters - Naive Bayes - Wrangling - Logistic Regression: Classifiers - M6D Logistic Regression.

UNIT – IV Block Chain

Currency – Contracts - Justice Applications Beyond Currency, Economics, and Markets - Efficiency and Coordination Applications Beyond Currency, Economics, and Markets - Advanced Concepts – Limitations.

UNIT – V Natural Language Processing & Robotics

Introduction to NLP - Text Analysis - Language Models - Vectorizing Text and Transformations and n-grams - Clustering and Classifying Text - Similarity Queries and Summarization.

History of Robotics – Types of Robots – Robot Mechanics – Robot Electronic Design – Robotic Sensors – Vision Systems.

Text Books :

1. Rachel Schutt and Cathy O'Neil, Doing Data Science, Straight Talk From The Frontline, O'Reilly Media, 2013.
2. George F Luger, Artificial Intelligence - Structures and Strategies for Complex Problem Solving, Pearson Education, Inc., 2009.

References :

1. Bhargav Srinivasa-Desikan, Natural Language Processing and Computational Linguistics, Packt Publishing, 2018.
2. Z. Falomir, K. Gibert, E. Plaza, Artificial Intelligence Research and Development: Current Challenges, New Trends and Applications, IOS Press, 2018.
3. Melanie Swan, Blockchain: Blueprint for a New Economy, O'Reilly Media, Inc., 2015.
4. Harry H. Poole, Fundamentals of Robotics Engineering, Springer Science & Business Media, 2012.

Course Outcomes:

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

1. Understand the core concepts and applications of Artificial Intelligence.
2. Handle real world problem in Machine Learning Techniques.
3. Implement the technology of Block Chain.
4. Apply the techniques in Natural Language Processing.
5. Acquire sufficient knowledge on Robotics.

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

22AIPESCN	**DEDUCTIVE AND INDUCTIVE REASONING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To study the basic concepts in reasoning.
- To acquire knowledge in deductive reasoning.
- To evaluate inductive generalizations.
- To learn the fallacies of inductive reasoning.

UNIT – I Introduction

Logic - Inferences and Arguments - Classification: Concepts and Referents, Rules of Classification, Levels of Organization - Definitions: Functions of a Definition, Rules for Definitions, Constructing Definitions - Propositions - Statements versus Propositions - Argument Analysis - Fallacies - Induction, Deduction, and Argument Strength in Human Reasoning.

UNIT – II Deductive Reasoning

Reasoning: Modus Ponens, Modus Tollens, law of syllogism - Square of Opposition - Existential Import - Venn Diagrams - Immediate Inference: Conversion, Obversion, Contraposition - Propositional Logic - Proof : Rules of inference, Constructing a Proof - Equivalence: Rules of Equivalence, Predicate Logic: Singular and Quantified Statements, Categorical Statements, Quantifier Scope and Statement Forms.

UNIT – III Reasoning with Syllogisms

Categorical Propositions - Categorical Syllogisms - Disjunctive Syllogisms - Hypothetical Syllogisms - Distilling Deductive Arguments: Identifying the Form of a Syllogism, Nonstandard Quantifiers - Extended Arguments: Categorical and Hypothetical Syllogisms in Extended Arguments, Compound Components, Distilling an Extended Argument.

UNIT – IV Inductive Reasoning

Development of Inductive Reasoning - Inductive Generalizations - Evaluating Inductive Generalizations - Argument by Analogy - Statistical Reasoning: Logic and Statistics, Using

Statistics in Argument, Statistical Evidence of Causality - Casual Arguments - Adequacy of Hypotheses, Truth of Hypotheses - Probability: Probability Measures, Probability Calculus.

UNIT – V Fallacies of Inductive Reasoning

Fallacies of Generalization – Fallacies of Non-observation – False Analogy –Interpreting Asymmetries of Projection in Children's Inductive Reasoning - Use of Single or Multiple Categories in Category based Induction – Abductive Inference from Philosophical Analysis to Neural Mechanisms.

Text Books :

1. Carveth Read, Logic Deductive and Inductive, Createspace, 2016.
2. David Kelley, The Art of Reasoning: An Introduction to Logic and Critical Thinking, 4th Edition, W. W. Norton & Company, 2014.

References :

1. Ruth M.J. Byrne, Jonathan St.B.T. Evans, Stephen E. Newstead, Human Reasoning: The Psychology of Deduction, Psychology Press, 2019.
2. Dr. Treat Preston, How To Figure Things Out: Inductive Reasoning versus Deductive Reasoning, Ceatespace, 2014.
3. William Minto, Logic: Inductive and Deductive, Pantianos Classics, 2010.
4. Walter Schaeken, Gino De Vooght, Andre Vandierendonck, Gery d'Ydewalle, Deductive Reasoning and Strategies, Lawrence Erlbaum Associates, 2000.

Course Outcomes :

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

1. Gain basic knowledge in deduction and induction.
2. Apply deductive reasoning techniques in real world problems.
3. Use different types of syllogisms for reasoning.
4. Develop reasoning skills using statistics and probability.
5. Use single or multiple categories in inductive reasoning.

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	-	-	-	-	-	-	-	-

OPEN ELECTIVES

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

Course Objectives:

- To understand the fundamentals of Internet of Things.
- To gain knowledge on IoT Architecture and Data Analytics for IoT.
- To build a small low cost embedded system using Raspberry Pi and Arduino.
- To apply the concept of Internet of Things in the real world scenario.

UNIT - I Introduction

Introduction to IoT– Characteristics –Various Things in IoT – IoT Protocols – IoT Functional Blocks – IoT Communication Models – IoT Communication APIs – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT and M2M.

UNIT – II Design Methodology

Need for IoT Systems Management – Simple Network Management Protocol and its Limitations – Network Operator Requirements – NETCONF – YANG – IoT Systems Management with NETCONF-YANG – IoT Design Methodology – IoT System for Weather Monitoring – Logical Design of IoT System using Python – Python Packages for IoT.

UNIT – III Data Analytics for IoT

Apache Hadoop – MapReduce Programming Model – Hadoop MapReduce Job Execution – MapReduce Job Execution Workflow – Hadoop Cluster Setup – Hadoop YARN for Batch Data Analysis – Setting up Oozie – Oozie Workflows for IoT Data Analysis – Apache Spark – Setting up a Storm Cluster – Apache Storm for Real-time Data Analysis.

UNIT –IV Raspberry Pi & Arduino

Physical device – Linux on Raspberry Pi – Raspberry Pi Interfaces – Programming: Controlling LED with Raspberry Pi – Interfacing an LED and Switch with Raspberry Pi – Interfacing a Light Sensor (LDR) with Raspberry P – Other IoT Devices – Intel Galileo Gen2 with Arduino – Interfaces – Arduino IDE – Programming – APIs and Hacks.

UNIT – V Tools and Applications

Chef – Puppet – IoT Code Generator – Various Real time applications of IoT: Home Automation– Smart Parking – Air Pollution Monitoring – Forest Fire Detection – Smart Irrigation – Connecting IoT to cloud – Cloud Storage for IoT –IoT Printer.

Text Books :

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things – A hands-on approach, Universities Press, 2015.
2. Manoel Carlos Ramon, Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers, Apress, 2014.

References :

1. Qusay F. Hassan, Internet of Things A to Z: Technologies and Applications, John Wiley & Sons, 2018.
2. Peter Waher, Learning Internet of Things, Packt Publishing, 2015.
3. Marco Schwartz, Internet of Things with the Arduino Yun, Packt Publishing, 2014.
4. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2014.

Course Outcomes:

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

1. Expertise with IoT Architecture.
2. Do Data Analytics for IoT in Industrial Environment.
3. Design IoT devices using Rasperry Pi and Arduino.
4. Develop web services to access/control IoT devices.
5. Analyze applications of IoT in real time scenario.

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

22AIOESCN	**ARTIFICIAL INTELLIGENCE AND KNOWLEDGE ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To expose students to the basic concepts and problem solving process in AI.
- To evaluate uninformed and informed search techniques.
- To represent knowledge and to make decisions.
- To develop AI applications.

UNIT – I Introduction to AI

Introduction - History of AI - AI Techniques - Problem Solving with AI - AI models - Data Acquisition and Learning Aspects in AI - Problem Solving Process - Formulating Problems - Problem Types and Characteristics - Problem Analysis and Representation - Performance Measuring - Problem Space and Search - Toy problems – Real world problems - Problem Reduction Methods.

UNIT – II Heuristic Search Techniques

General Search Algorithm - Uninformed Search Methods: Breadth First Search, Uniform Cost Search, Depth First Search, Depth Limited Search, Iterative Deepening - Informed Search: Generate and Test, Best First Search, A* Search, Memory Bounded Heuristic Search - Local Search Algorithms and Optimization Problems - Hill Climbing and Stimulated Annealing - Intelligent Agents: Agents and Environment, Agent Function, Representation, Types.

UNIT – III Knowledge Representation

Knowledge Management - Types of Knowledge - Approaches and issues of Knowledge Representation - Knowledge representation using Predicate logic: Basic Predicate Representations, Conversion of WFF to Clause Form, Resolution, Issues with Resolution - Knowledge representation using other logic -Structured representation of knowledge, Semantic Networks, Frames.

UNIT – IV Uncertain Knowledge and Reasoning

Uncertainty and Methods - Bayesian Probability and Belief Network - Probabilistic Reasoning - Probabilistic Reasoning over time - Forward and Backward Reasoning - Perceptron - Making Simple Decisions - Making Complex Decisions - Other Techniques: Non_monotonic Reasoning, Fuzzy Logic, Ontological Engineering, Dempster_Shafer Theory.

UNIT – V Advanced Topics

Game Playing: Minimax search procedure, Adding alpha-beta cutoffs - Expert System: Architecture- Knowledge acquisition, Rule based Expert System, Frame based and Fuzzy based expert system - Robotics: Hardware, Robotic Perception, Planning, Application domains - Future Trends in Knowledge Engineering: Tactical and Strategic Considerations, Anticipation Technologies, Beyond the Information Age.

Text Books :

1. Parag Kulkarni, Prachi Joshi, Artificial Intelligence – Building Intelligent Systems, PHI learning private Ltd, 2015.
2. Vinod Chandra S.S., Anand Hareendran S, Artificial Intelligence and Machine Learning, 2014.

References :

1. Thomas B. Cross, Knowledge Engineering: The Uses of Artificial Intelligence in Business, 2017.
2. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering: Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, 2016.
3. H. Elaine Rich, Kevin Knight, Shivashankar B Nair, Artificial Intelligence, Mc Graw Hill, 2009.
4. S.L. Kendal, M. Creen, An Introduction to Knowledge Engineering, Springer, 2007.

Course Outcomes:

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

1. Identify problem types and appropriate AI methods to solve a problem.
2. Analyze various search strategies.
3. Manage and represent knowledge.
4. Handle uncertain knowledge.
5. Apply AI techniques in the development of problem-solving and learning systems.

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

22AIOESCN	**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 machine learning algorithms.
- To introduce the methods of combining the classifiers.
- To understand the methods of solving real life problems using the machine learning techniques.

UNIT – I Bayesian Decision Theory and Normal Densities

Machine perception - feature extraction - classification, clustering and regression - design cycle - types of learning. Bayesian decision theory - classifiers, discriminant functions, and decision surfaces - univariate and multivariate normal densities - Bayesian belief networks.

UNIT – II Component Analysis and Markov Model

Principal component analysis - Linear discriminant analysis. Markov model - Introduction to hidden Markov model.

UNIT – III Classification Algorithms

Perceptron and backpropagation neural network - radial basis function neural network - probabilistic neural network - k-nearest-neighbor rule. Support vector machine: Training - multicategory generalizations. Decision trees: classification and regression tree - random forest.

UNIT – IV Clustering and Regression Algorithms

k-means clustering - fuzzy k-means clustering - Gaussian mixture models - autoassociative neural network. Regression analysis - support vector regression.

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. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Third Edition, 2014.
2. R. O. Duda, E. Hart, and D.G. Stork, Pattern classification, Second edition, John Wiley & Sons, Singapore, 2003.

References :

1. Tom M. Mitchell, Machine Learning, 1st Edition, McGraw Hill Education, 2017.
2. M. Mohri, A. Rostamizadeh, and A. Talwalkar, Foundations of Machine Learning, MIT Press, 2012.
3. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
4. C. M. Bishop, Pattern Recogniti on and Machine Learning, Springer, 2006.

Course Outcomes :

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

1. Understand the basic concepts of machine learning.
2. Understand the classification, clustering and regression algorithms.
3. Implement the classification, clustering and regression algorithms.
4. Combine the evidence from two or more models/methods for designing a system.
5. Design and implement a method for solving real life problem 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	1	1	-	1	1	-	-	-	-	-	-	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-
CO5	2	2	1	1	1	-	-	-	-	-	-	-

22AIOESCN	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives :

- To familiarize the students with the basic concepts of Natural Language Processing and Information Retrieval.
- To study the concepts related to the processing of words.
- To study the various level of analysis involved in Natural Language Processing.
- To gain knowledge on natural language generation and machine translation.

UNIT – I Introduction

Origin of Natural Language processing – Language and Knowledge– Processing Indian Languages – NLP applications–Introduction to language modelling – Various grammar-based Language Models – Statistical language model – Introduction to Information Retrieval-Information Retrieval Models.

UNIT – II Words

Regular expressions – Finite state Automata – Survey of English Morphology - Finite State Morphological parsing-Speech Sounds and Phonetic Transcription-Phoneme and Phonological Rules-Dealing with Spelling Errors-Spelling Error Patterns-Probabilistic Models-Ngram models of syntax – Counting words – Unsmoothed N-grams – Smoothing – Speech Recognition architecture – Hidden Markov models.

UNIT – III Syntax

English Word classes– Tagsets– Part of Speech Tagging – Transformation based tagging – Context free rules and trees – The noun phrase – Verb phrase – Finite state and context free grammars – Top down parsing – Bottom up parsing – Feature structures – Unification of Feature Structures-Feature Structure in the Grammer-Implementing Unification –Constraints – Probabilistic context free grammars – Probabilistic Lexicalized context free grammars .

UNIT – IV Semantic

Computational Desiderata of for Representations- Meaning Structure of Language-First order predicate calculus- Syntax Driven Semantic analysis – Attachments – Idioms and Compositionality – Relations among Lexemes and their Senses-WordNet-Internal Structure of Words.

UNIT – V Pragmatics

Introduction to Discourse Processing- Cohesion- Reference Resolution – Discourse Coherence and Structure- Introduction to Natural Language Generation – Architecture of NLG Systems-Generation tasks and Representations- Introduction to Machine Translation-Machine Translation Approaches.

Text Books :

1. Samuel Burns, Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 1st Edition, 2019.
2. Yoav Goldberg, Graeme Hirst, Neural Network Methods for Natural Language Processing, Morgan and Claypool Life Sciences, 2017.

References :

1. Daniel Jurafsky and James H Martin, Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Pearson Education, 6thEdition, 2011.
2. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, 2nd edition, Chapman & Hall/Crc: Machine Learning & Pattern Recognition, CRC press, Feb 2010.
3. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
4. Ehud Reiter, Robert Dale, Building Natural Language Generation Systems, Cambridge University Press, 2006.

Course Outcomes :

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

1. Understand the basic concept of Natural Language Processing,NLP applications and Language modeling.
2. Understand the processing of words and algorithms used to process the words.
3. Understand the parts of speech and phrase structure grammars for English.
4. Understand the semantic analysis and internal structure of words.
5. Understand various methods of machine translation.

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

22AIOESCN	**EXPERT SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the basic concepts of Expert systems.
- To gain knowledge in both theory and applications.
- To integrate theory with real-world situations.
- To appreciate the role played by expert systems in today's world.

UNIT – I Introduction

Expert Systems: Features of Expert systems-ES Building. Real Experts-Keep human in loop. Organization of ES: Organizing knowledge-Representing knowledge-Expert systems vs conventional programs: Characteristics of ES-Activities of ES-Types of problems that ES solve.

UNIT – II Expert System Tools

Knowledge Representation in Expert Systems: Using rules-using semantic nets-using frames. Nature of expert system tools: Programming languages-knowledge engineering languages-system building aids-support facilities. ES building process.Stages in the development of ES Tools.

UNIT – III Building an Expert System

Expert system for a problem: ES development-possible, justified, appropriate. Building ES: Tasks-Stages.Choosing tools-Acquiring knowledge from Experts-knowledge acquisition process-interviewing the expert.

UNIT – IV Difficulties with ES Development

Difficulties in developing an ES: Lack of resources-Limitations-Long time. Common Pitfalls in planning an ES: Choosing problem-Resources for building an ES-choosing the ES tool. Dealing with Domain Expert: Choosing domain expert-interacting with expert. ES Development Process: Implementation-Testing and Evaluation.

UNIT – V Expert systems in Marketplace

ES at Universities-Research organizations-knowledge engineering companies. High performance Expert Systems used in Research-Business-Computer Systems-Expert systems to Intelligent systems.

Text Books :

1. Patterson, Introduction to Artificial Intelligence and Expert Systems, Pearson Education India, 2015.
2. Spyros Tzafestas, Expert Systems in Engineering Applications, Springer, 2011.

References :

1. Donald. A. Waterman, A Guide To Expert Systems, 3rd Edition, Pearson Education, 2009.
2. J. Giarratano and G. Riley, Expert Systems -- Principles and Programming, 4thEdition, PWS Publishing Company, 2004.
3. Peter Jackson, Introduction to Expert Systems, Addison Wesley Longman, 1999.
4. Nikolopoulos, Expert Systems, Marcel Dekker Inc. 1997.

Course Outcomes:

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

1. Understand the features and characteristics of Expert systems.
2. Be acquainted with various tools and the development process of Expert systems.
3. Be familiar in building an Expert system.

4. Demonstrate awareness in the Expert system development.
5. Exhibit knowledge in the role of Expert system in various applications.

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

22AIOESCN	**COMPUTER VISION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the basic concepts of computer vision and segmentation.
- To gain knowledge in foundation of image formation and image analysis.
- To understand the Basic concepts of Recognition.
- To learn the various concepts of Computer Vision in other application areas.

UNIT – I Introduction

Image formation - Geometric primitives and transformations - Geometric primitives - 2D transformations - 3D transformations - 3D rotations - 3D to 2D projections - Lens distortions – Photometric image formation - Lighting - Reflectance and shading – Optics - The digital camera - Sampling and aliasing – Color – Compression.

UNIT – II Feature Detection and Matching

Points and patches - Feature detectors - Feature descriptors - Feature matching - Feature tracking - Application: Performance driven animation - Edges - Edge detection - Edge linking - Application: Edge editing and enhancement – Lines - Successive approximation - Hough transforms - Vanishing points -Application: Rectangle detection.

UNIT – III Segmentation

Active contours - Snakes - Dynamic snakes and CONDENSATION – Scissors - Level Sets - Application: Contour tracking and rotoscoping – Split and merge - Watershed - Region splitting - Region merging - Graph-based segmentation - Probabilistic aggregation – Mean shift and mode finding - K-means and mixtures of Gaussians - Mean shift – Normalized cuts - Graph cuts and energy-based methods - Application: Medical image segmentation.

UNIT – IV Structure from Motion

Triangulation - Two-frame structure from motion – Factorization - Bundle adjustment - Constrained structure and motion. Dense motion estimation - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT – V Image Stitching and Recognition

Motion models - Global alignment – Compositing - Recognition - Object detection - Face detection - Pedestrian detection - Face recognition – Eigenfaces - Active appearance and 3D shape models - Instance recognition - Geometric alignment - Large databases - Category recognition - Bag of words - Part-based models - Recognition with segmentation - Context and scene understanding - Learning and large image collections - Recognition databases and test sets.

Text Books :

1. Forsyth, A., D. and Ponce, J., Computer Vision: A Modern Approach, Pearson Education, 2nd Edition, 2012.
2. Szeliski, R., Computer Vision: Algorithms and Applications, Springer-Verlag London Limited, 1st Edition, 2011.

References :

1. Gonzalez C. R., and Woods E. R., Digital Image Processing, Addison-Wesley, 4th Edition, 2018.
2. Hartley, R. and Zisserman, A., Multiple View Geometry in Computer Vision, Cambridge University Press, 2nd Edition, 2003.
3. Fukunaga, K., Introduction to Statistical Pattern Recognition, Academic Press, Morgan Kaufmann, 2nd Edition, 1990.
4. Trucco and Verri, Introductory Techniques for 3D Computer Vision, Prentice Hall, 1998.

Course Outcomes:

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

1. Understand the fundamental problems of computer vision.
2. Implement various techniques and algorithms used in computer vision.
3. Acquire knowledge and understanding of Feature detection and matching.
4. Demonstrate awareness of the current key research issues in computer vision.
5. Exhibit knowledge in Image stitching and Recognition.

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

22AIOESCN	ROBOTICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To enlighten the students about the fundamentals of robotic systems.
- To impart basic knowledge of Robots and its roles in Automation.
- Ability to understand the features and operation of automation products.
- Ability to understand ethical and professional responsibilities.

UNIT - I Introduction

Classification of Robots-Industrial Robots- Autonomous Mobile -Humanoid Robots - Educational Robots-The Generic -Differential Drive-Proximity -Ground -Embedded -The Algorithmic Formalism-Sensors: Classification of Sensors-Distance Sensors-Cameras and onther sensors-Range, Resolution, Precision, Accuracy- Nonlinearity.

UNIT – II Reactive Behavior

Braitenberg Vehicles-Reacting to the Detection of an Object-Reacting and Turning-Line Following-Braitenberg's Presentation of the Vehicles-Finite State Machines: State Machines-Reactive Behavior with State-Search and Approach-Implementation of Finite State Machines.

UNIT – III Robotic Motion and Odometry

Distance, Velocity and Time- Acceleration as Change in Velocity-From Segments to Continuous Motion-Navigation by Odometry-Linear Odometry-Odometry with Turns-Errors in Odometry-Wheel Encoders-Inertial Navigation Systems-Degrees of Freedom and Numbers of Actuators-The Relative Number of Actuators and DOF.

UNIT – IV Control

Control Models-On-Off Control-Proportional (P) Controller-Proportional-Integral (PI) Controller-Proportional-Integral-Derivative (PID) Controller- Local Navigation: Obstacle Avoidance- Wall Following- Wall Following with Direction- The Pledge Algorithm-Following a Line with a Code- Ants Searching for a Food Source- A Probabilistic Model of the Ants' Behavior- A Finite State Machine for the Path Finding Algorithm.

UNIT – V Localization

Determining Position from Objects whose Position is Known - Global Positioning System-Probabilistic Localization- Uncertainty in Motion- Fuzzy Logic Control:Fuzzify-Apply Rules-Defuzzify-Image Processing:Obtaining Images-Image Enhancement-Edge Detection-corner detection-Recognizing Blobs.

Text Books :

1. Mordechai Ben-Ari, Francesco Mondada, Elements of Robotics, Springer, 2018.
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.

References :

1. S.R. Deb, Sankha Deb, Robotics Technology and Flexible Automation, 2nd edition, Tata McGraw Hill Education, 2010.
2. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated approach, Phi Learning., 2009.
3. Carl D. Crane and Joseph Duffy, Kinematic Analysis of Robot manipulators, Cambridge University press, 2008.
4. Bharat Bhushan., Springer Handbook of Nanotechnology, Springer, 2004.

Course Outcomes:

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

1. Know the basics of robot.
2. Understand the reactive behavior of robotics.
3. Get an idea about robot motion and sensors.
4. Develop path finding algorithms to control the motion of robot.
5. Apply fuzzy logic in robotic systems.

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	-	-	-	-	-	-	-

22AIOESCN	**MINING MASSIVE DATASETS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To describe the design of good MapReduce algorithms and parallel algorithm.
- To explore the notions of similarity in finding similar items of sets.
- To understand the fundamental problem of maintaining of Data Stream.
- To establish the problem of finding frequent Itemsets differs from the similarity search.

UNIT – I Data Mining and MapReduce

Introduction to Data Mining – Statistical Limits on Data Mining - MapReduce : Distributed File Systems - Details of MapReduce Execution - Algorithms Using MapReduce - Extensions to MapReduce - Communication Cost Model - Complexity Theory for MapReduce - Applications of Near-Neighbor Search - Distance Measures - LSH Families for Other Distance Measures

UNIT –II Finding Similar Items and Mining Data Streams

Applications of Near-Neighbor Search - Shingling of Documents - Similarity-Preserving Summaries of Sets - Locality-Sensitive Hashing for Documents - Distance Measures - The Theory of Locality-Sensitive Functions - LSH Families for Other Distance Measures - Applications of Locality-Sensitive Hashing - Methods for High Degrees of Similarity - The 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.

UNIT – III Link Analysis and Frequent Itemsets

PageRank - Efficient Computation of PageRank - Topic-Sensitive PageRank - Link Spam - Hubs and Authorities - The Market-Basket Model - Market Baskets and the A-Priori Algorithm - Handling Larger Datasets in Main Memory - Limited-Pass Algorithms - Counting Frequent Items in a Stream.

UNIT – IV Clustering and Advertising on the Web

Introduction to Clustering Techniques - Clustering in Non-Euclidean Spaces - Clustering for Streams and Parallelism –. Issues in On-Line Advertising - On-Line Algorithms - The Matching Problem - The Adwords Problem - Adwords Implementation.

UNIT – V Recommendation Systems and Mining Social-Network Graphs

A Model for Recommendation Systems - Content-Based Recommendations - Collaborative Filtering - Dimensionality Reduction - The Netflix Challenge - Social Networks as Graphs - Clustering of Social-Network Graphs - Direct Discovery of Communities - Partitioning of Graphs - Finding Overlapping Communities – Simrank - Counting Triangles - Neighborhood Properties of Graphs.

Text Books :

1. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, Mining of Massive Data sets, Cambridge University Press, 2014.
2. Nina Zumel, John Mount, Practical Data Science with R, Manning Publications, 2014.

References :

1. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, Practical Data Science Cookbook, Packt Publishing Ltd., 2014.
2. W. N. Venables, D. M. Smith and the R Core Team, An Introduction to R, 2013.
3. Mark Gardener, Beginning R - The Statistical Programming Language, John Wiley & Sons, Inc., 2012.
4. Nathan Yau, Visualize This: The FlowingData Guide to Design, Visualization, and Statistics, Wiley, 2011.

Course Outcomes:

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

1. Understand the data-mining concepts and design of good Map Reduce algorithms.
2. Describe a Similarity of data sets and Stream Data Model.
3. Recognize the PageRank and other approaches for detecting link spam.
4. Describe the concepts of Clustering in Non-Euclidean Spaces.
5. Determine an appropriate Clustering of Social-Network Graphs.

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

22AIOESCN	**DEEP GENERATIVE MODELS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the machine learning basics.
- To gain knowledge in deep learning architecture.
- To learn and understand the challenges in deep models and convolutional networks.
- To appreciate the role played by deep generative models.

UNIT - I Introduction

Machine learning basics: Learning algorithms-overfitting and underfitting-estimators, bias and variance-bayesian statistics-supervised learning algorithms-unsupervised learning algorithms-stochastic gradiant descent.

UNIT – II Deep Learning

Gradient based learning-hidden units-architecture design-back propagation algorithms. Parameter norm penalties-norm penalties-under constrained problems-dataset augmentation-noise robustness-semi supervised and multitask learning-early stopping-parameter tying and sharing-sparse representations-bagging and ensemble methods-dropout-adversarial training

UNIT – III Optimization for training deep models and convolutional networks

Learning vs optimization-challenges-basic algorithms-parameter initialization strategies-adaptive learning-second order methods-optimization strategies. Convolutiional networks: Convolution operation-motivation-pooling-convolution and pooling as an infinitely strong

prior-variants of convolution function-structured outputs-data types-efficient convolution algorithms.

UNIT – IV Recurrent & recursive nets and Autoencoders

Recurrent neural networks-Bidirectional RNNs-Encoder decoder architecture-Deep RN-Recursive NN-long term dependencies.Autoencoders: Undercomplete, regularized autoencoders-representational power, layer size and depth-stochastic encoders and decoders-denoising autoencoders-learning manifolds-contractive autoencoders-predictive sparse decomposition.

UNIT – V Deep Generative Models

Boltzmann machines-Restricted Boltzmann machines-deep belief networks-deep Boltzmann machines-Boltzmann machines for real valued data-convolutional Boltzmann machines-Boltzmann machines for structured or sequential outputs-back propagation through random operations-directed generative nets-drawing samples from autoencoders-generative stochastic networks-evaluating generative models.

Text Books :

1. David Foster, Generative Deep Learning, O'Reilly, 2019.
2. Goodfellow, Y. Bengio, A. Courville, Deep Learning, MIT Press, 2016.

References :

1. Sudharsan Ravichandiran, Hands-on Deep Learning Algorithms with Python, Packt Publishing, 2019.
2. Rajalingappa Shanmugamani, Deep Learning for Computer Vision, Packt Publishing, 2017.
3. K. P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
4. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Course Outcomes:

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

1. Understand the basics of machine learning.
2. Be acquainted with deep learning basics.
3. Be familiar with various techniques in Optimization for training deep models and convolutional networks.
4. Demonstrate knowledge in Recurrent & recursive nets and Autoencoders.
5. Exhibit knowledge in deep generative models.

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	-	-	-	-	-	-	-	-

22AIOESCN	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", 3rd Edition, Packt Publishing Ltd., 2020.
5. Paul DuBios, "MySQL", 4th 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 (HTML5).
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview (Javascript).
3. 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", 4th 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

22AIOESCN	**BIG DATA ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To train students to use Bigdata analytics, applications and Map reducing Algorithms.
- To learn tips and tricks for Big Data use cases and solutions.
- To build and maintain reliable, scalable, distributed systems with Apache Hadoop.
- To get knowledge about Hive Architecture and Installation.

UNIT I – Introduction to Big Data

Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

UNIT II – Introduction to Hadoop

Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

UNIT – III Hadoop Architecture

Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

UNIT – IV Hadoop Ecosystem and Yarn

Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features Name Node, High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

UNIT – V Hive and HiveQL, HBase

Hive Architecture and Installation, Comparison with Traditional Database, HiveQL – Querying Data - Sorting And Aggregating, Map Reduce Scripts, Joins & Subqueries, HBase

concepts Advanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

Text Books :

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Professional Hadoop Solutions, Wiley, 2015.
2. Chris Eaton, Dirk deroos et al. Understanding Big data, McGraw Hill, 2012.

References :

1. Tom Plunkett, Brian Macdonald et al, Oracle Big Data Handbook, Oracle Press, 2014.
2. Vignesh Prajapati, Big Data Analytics with R and Haoop, Packet Publishing 2013.
3. Jy Liebowitz, Big Data and Business analytics, CRC press, 2013.
4. Tom White, HADOOP: The definitive Guide, O Reilly 2012.

Course Outcomes :

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

1. Gain knowledge in map reduce algorithm.
2. Acquire knowledge and understanding of Hadoop Data Serialization.
3. Exhibit the knowledge in Hadoop architecture and storage.
4. Understand the Hadoop ecosystem and yarn.
5. Acquire Knowledge in Hive,Pig and Zookeeper.

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	-	-	-	-	-	-	-	-

22AIOESCN	**INTELLECTUAL PROPERTY RIGHTS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To understand the concepts IPR
- To understand Trademarks, Trade Secretes and GI of goods.
- To understand Copyrights, Patents and Industrial Designs.
- To learn about how to manage IP rights and legal aspects.
- To understand the concepts of Cyber laws in IPR.

UNIT - I

Introduction to Intellectual Property: IPR - Definition - Types of IPR: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, IP as a factor in R&D; Few Case Studies WTO - Definition - Functions - Forms of IPR Protection.

UNIT–II

Trade Marks: Purpose and function of trademarks, Acquisition of trade mark rights, transfer of rights, Selecting and evaluating trademark, registration of trademarks, claims.

Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriation of trade secrets, trade secret litigation. Geographical Indication of Goods: Basic aspects and need for the registration.

UNIT–III

Copyrights: Fundamentals of copyright law, originality of material, right of reproduction, right to perform the work publicly, copyright ownership issues, notice of copyright.

Patents: Foundation of patent law, patent searching process, Basic Criteria of Patentability
Industrial Designs: Kind of protection provided in Industrial design.

UNIT–IV

Managing IP Rights: Acquiring IP Rights: letters of instruction, joint collaboration agreement.
Protecting IP Rights: nondisclosure agreement, cease and desist letter, settlement memorandum.
Transferring IP Rights: Assignment contract, license agreement, deed of assignment .

UNIT-V

Introduction to Cyber law: Information Technology Act, cybercrime and e-commerce, data security, confidentiality, privacy, international aspects of computer and online crime.

References :

1. Bare Act, The Indian Patent Act 1970 and the Patent Rules, Universal Law Publishing Co. Pvt. Ltd., 2007.
2. Mittal D.P., Indian Patents Law. Taxmann Allied Services (p) Ltd., 1999.
3. Deborah E Bouchoux, Intellectual Property: Right: The Law of Trademarks, Copyrights, Patents and Trade Secrets, 2012.
4. Gerald R. Ferrera, Cyber law: Text and Cases, South-Western Cengage Learning, 2012.
5. N.K Acharya, Intellectual property rights, Scandinavian Languages Edition, 2021.
6. Kompal Bansal, Fundamentals of Intellectual Property for Engineers, BS Publications 2013.
7. P. Radhakrishna, Intellectual Property Rights: Text and Cases, Excel Books, 2008.

Course Outcomes :

At the end of this course, students will demonstrate the ability to

1. Learner should be able to demonstrate understanding of basic concepts of IPR.
2. Able to differentiate between Trademarks, Trade secrets and GI of goods.
3. Able to understand Copyrights, Patents and Industrial Designs.

4. Able to manage and protect IP.
5. Will gain Knowledge on Cyber law.

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

22AIOESCN	**NCC (Army Wing)**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objective

This course is designed especially for NCC Cadets. This course will help develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, learning military subjects including weapon training.

Unit – I NCC Organization and National Integration

NCC Organization – History of NCC- NCC Organization - NCC Training- Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honours and Awards – Incentives for NCC cadets by central and state govt. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Factors affecting national integration.

Unit – II Personality Development and Leadership

Introduction - Factors influencing / shaping Personality - Self-Awareness – Know yourself/ Insight - Communication Skills - Leadership Traits – Types – Attitude - Time Management - Effects of Leadership - Stress Management Skills - Interview Skills - Conflict Motives - Resolution - Importance of Group / Team Work - Influencing Skills - Body Language - Sociability: Social Skills.

Unit – III Social Awareness and Community Development

Aims of Social service-Various Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSY-JGSY-NSAP-PMGSY-

Terrorism and counter terrorism- Corruption – female foeticide -dowry –child abuse-RTI Act- RTE Act- Protection of children from sexual offences act- civic sense and responsibility.

Unit – IV Specialized Subject (Army Wing)

Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra- Career in the Defence forces- Service tests and interviews-Fieldcraft and Battlecraft-Basics of Map reading.

Unit – V Basic Physical Training and Weapon Training

Basic physical Training – various exercises for fitness (with Demonstration) - Food – Hygiene and Cleanliness. Drill- Words of commands- position and commands- sizing and forming- saluting- marching (WITH DEMONSTRATION).

Main Parts of a Rifle- Characteristics of .22 rifle- Characteristics of 7.62mm SLR- Characteristics of 5.56mm INSAS rifle - stripping and assembling – position and holding- safety precautions – range procedure- firing simulation.

Text Book :

1. "National Cadet Corps- A Concise handbook of NCC Cadets", Ramesh Publishing House, New Delhi, 2014.

References:

1. "Cadets Handbook – Common Subjects SD/SW", published by DG NCC, New Delhi.
2. "Cadets Handbook- Specialized Subjects SD/SW", published by DG NCC, New Delhi.
3. "NCC OTA Precise", published by DG NCC, New Delhi.

COURSE OUTCOMES:

On completion of the course, the students will be able to

1. Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion
2. Acquaint and provide knowledge on personality development, self awareness, communication skills with leadership traits to work as a team and sociability values
3. Understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils
4. Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles.
5. Demonstrate health exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders and basic knowledge of weapons and their use and handling.

HONOURS SUBJECTS

22AIHESCN	COMPUTATIONAL NEUROSCIENCE	L	T	P	C
		3	1	0	4

Course Objectives:

- To Learn about Single Neuron and Signaling Components in a neuron.
- To get the knowledge of Neuroanatomy and Neurobiology.
- To understand the basic of Neural Network Models and Reinforcement Learning Models.
- To get knowledge about Dendritic Processing, Axonal Propagation and Synaptic Transmission.

UNIT - I Introduction

History of neuroscience.- History of computational neuroscience -Linear algebra - Eigenvalues and eigenvectors for symmetric matrices - Quadratic forms, solving a system of linear equations (3 cases) - Dynamical systems - Types of fixed pts, bifurcation map in terms of trace and determinant - Phase plane analysis - null clines - Hopf bifurcation and limit cycles.

UNIT – II Organization of Nervous System and Neuroanatomy

Neuron – axons – Dendrites - The four components of Neural Signaling - Neurotransmission: Neurotrasmitter, Receptor, Ion channel, Channel gating - Electrophysiology - Nernst potential - Resting potential - Goldman-Hodgkin-Katz voltage equation - Outline of the Hodgkin-Huxley model - Modeling ion channel kinetics - Activation and inactivation gates - Complete formulation of Hodgkin-Huxley model - Relation between output firing and constant input current.

UNIT – III Biophysical Models of Single Neuron

Derivation of the cable equation - Defining axial - Radial resistance and membrane capacitance - Defining quantities in terms of per unit length - Steady state Solution for Infinite cable and semi-infinite cable - Solution for Finite cable: sealed end, killed end and arbitrary boundary conditions - Time-dependent solution for impulse input. Propagationdelay, pseudo-velocity - Relation between cable diameter and conduction velocity - Branchedcables and Rall's condition - Modeling synaptic transmission.

UNIT – IV Simplified Neuron Models and Learning Mechanisms

Fitzhugh-Nagumo neuron model - Phase-plane analysis, showing excitability - Bistability and oscillations - Integrate and fire neuron - Resonate and fire neuron - Izhikevich models - Classical conditioning and instrumental condition - Sensitization, habituation and priming - Cellular correlates of learning - Hebbian learning, Long-term Potentiation (LTP) and Long-term Depression (LTD) – Perceptron – MLP - Backpropagation algorithm - Case studies: Past tense learning, NetTalk, biological plausibility of backpropagation algorithm.

UNIT – V Unsupervised Learning, Hopfield Network and Hebbian Learning

Discrete model formulation - Lyapunov or Energy function - The concept of memory capacity - Continuous models of associative memory - bi-directional associative memory - Case study: memory storage in hippocampus - Competitive learning and Self-organizing map - Case studies: somatosensory map adaptation, auditory cortex of bats, orientation maps in mammalian visual cortex - Introduction to Hebbian learning - Hebbian learning and PCA - Variations of Hebbian learning - Linsker's model of the visual system - Reinforcement Learning - Spiking neuron networks.

Text Books :

1. Paul Miller, Terrence J. Sejnowski, Tomaso A. Poggio, An introductory Course in Computational Neuroscience, 1st Edition, MIT Press, 2018.
2. Jianfeng Feng, Computational neuroscience: a comprehensive approach, Chapman & Hall/CRC, 2010.

References :

1. Peter Dayan & LF Abbot, Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems, MIT Press, 2005.
2. Patricia Churcland & Terence Sejnowski, Computational Brain, MIT Press, 2017.
3. Randall C. O'Reilly, Yuko Munakata, Computational explorations in cognitive neuroscience: understanding the mind by Simulating the Brain, MIT Press, 2005.
4. Christof Koch, Biophysics of computation: information processing in single neurons, Oxford University Press, 2005.

Course Outcomes:

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

1. Know about computational neuroscience Basics.
2. Understand nervous system and Neuroanatomy.
3. Study about Modeling synaptic transmission.
4. Develop Simple neuron models.
5. Understand the principles of Hopfield network and Hebbian Learning.

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

22AIHESCN	ROBOT LEARNING AND SENSORIMOTOR CONTROL	L	T	P	C
		3	1	0	4

Course Objectives:

- To establish understanding of sensorimotor systems like humanoid robots/autonomous vehicles.
- To introduce various aspects involved in motor planning, control, estimation and prediction with an emphasis on computational perspective.
- To understand the approaches of planning under uncertainty, sensorimotor transformations.
- To make the students understand topics in human motor control, experimental paradigms and the use of computational methods in understanding biological sensorimotor mechanisms.

UNIT - I Introduction

Robotics-Components and structure of robots: Symbolic representation-degrees of freedom and workspace-classification of robots-common kinematic arrangements-robotic systems-accuracy and repeatability-wrists and end effectors.

UNIT - II Rigid Motions and Homogeneous Transformations

Representing positions-representing rotations-in plane-in 3D-rotational transformations-composition of rotations-current coordinate frame-fixed frame-parameterizations of rotations-Euler Angles-Roll, pitch, yaw angles-axis/angle representation-homogeneous transformations.

UNIT – III Computer Vision

Geometry of image formation-camera coordinate frame-perspective projection-image plane and the sensor array-camera caliberation-extrinsic camera parameters-intrinsic camera parameters-determining the camera parameters-segmentation and thresholding-connected components-position and orientation.

UNIT – IV Planning and Optimization

Path planning and collision avoidance: The configuration space-path planning using configuration space potential fields-planning using workspace potential fields-using random motions to escape local minima-probabilistic roadmap methods. Trajectory planning: Trajectories for point to point motion-tranjectories for paths specified via points.

UNIT – V Cue Integration and Sensorimotor Adaptation

Independent Joint Control: Actuator dynamics-set point tracking-Feedforward control and computed torque-drive train dynamics. Force Control: Constrained dynamics-static force/torque relationships - constraint surfaces-natural and artificial constraints-network models and impedance-force control strategies.

Text Books :

1. Elements of Robotics, Mordechai Ben-Ari, Francesco Mondada, Springer, 2018.
2. Principles of robot motion: Theory, algorithms and implementations, Howie Choset, Kevin Lynch, seth Hutchinson, George Kantor, Wolfram Burgard, Lydia Kavraki and Sebastian Thrun, MIT Press, 2005.

References :

1. Human and robot hands: Sensorimotor synergies to bridge the gap between neuroscience and robotics, Bilanchi, Matteo, Moscatelli, Alessandro (Eds.) Springer series in Touch and Haptic systems, Springer, 2016.
2. Industrial Robotics: Technology programming and Applications, Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, McGraw Hill, 2012.
3. Kinematic Analysis of Robot manipulators, Carl D. Crane and Joseph Duffy Cambridge University press, 2008.
4. Robot dynamics and control, Mark W. Spong, Seth Hutchinson, M. Vidyasagar, Second edition, John Wiley & Sons, 2004.

Course Outcomes:

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

1. Understand the important concepts in robotics as applied to industrial robot manipulators.
2. Establish various coordinate systems related to robot kinematics.
3. Realize computer vision, the most powerful sensing modality that a robot used to interact with the environment.
4. Describe the path planning problem and to handle its computational complexity.
5. Apply the control techniques and methodologies to the control problem for robot manipulators.

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	-	-	-	-	-	-	-

22AIHESCN	**HUMAN COMPUTER INTERACTION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

The students should be made to

- Learn the history of evolution of Human Computer Interaction.
- Study and design HCI experiments.
- Become familiar with various interaction models of HCI.
- Be skilled at searching and visualizing information.

UNIT – I Historical Context and Interaction Elements

Introduction - Memex – Sketchpad – Mouse - Xerox star - Birth of HCI -Growth of HCI and GUIs – Human factor : Sensors – Responders - The brain –Language - Human performance - Interaction Elements : Hard controls and soft controls – Control-display relationships - Natural versus learned relationships - Mental models and metaphor – Modes -Mobile context - Interaction errors.

UNIT – II Designing HCI Experiments

Ethics – Experiment design – Variables – independent, dependent, control, random, confounding - Task and procedure – Participants – Hypothesis testing : Analysis of variance – Chi-square test - Parametric tests - Non-parametric tests.

UNIT – III Interaction Models and Design Issues

Interaction models : Descriptive models - Predictive models - Design issues - Quality of Service : Introduction, Models of response, Time impacts, Expectations and attitudes, User productivity, Variability in response time, Frustrating experiences - Balancing function and fashion, Error messages, Design -Information search and Visualization : Searching in textual documents and Database querying, Multimedia document searches, Advanced filtering and search interfaces, Information visualization.

UNIT – IV Mobile Interfaces

Mobile ecosystem - Application frameworks - Types of mobile applications- Mobile information architecture - Mobile design – Elements - Mobile web Apps - Mobile 2.0 – Mobile web development-WebKit.

UNIT – V Web Interfaces

In-Page Editing - Drag and Drop - Direct selection - Contextual tools – Overlays - Inlays - Virtual pages - Process flow – Use transitions – Patterns.

Text Books :

1. Kent L. Norman and Jurek Kirakowski, The Wiley Handbook of Human Computer Interaction Volume 1, John Wiley and Sons Ltd, 2018.
2. I. Scott Mackenzie, Human-Computer Interaction – An Empirical Research Perspective, Elsevier, 2013.

References:

1. Alan Dix, Janet Finlay, Gregory D. Abowd and Russell Beale, Human Computer Interaction, Pearson Education, Third Edition, 2004.
2. Meena, K and Sivakumar, R, Human-Computer Interaction, PHI Learning, First Edition, 2014.
3. Gerard Jounghyun Kim, Human-Computer Interaction - Fundamentals and Practice, Auerbach Publications, First Edition, 2015.
4. Ben Shneiderman and Catherine Plaisant, Designing the User Interface: Strategies for Effective Human-Computer Interaction, Addison-Wesley, 2010

Course Outcomes:

Upon completion of the course, the students should be able to

1. Realize the evolution and importance of HCI.
2. Design effective experiments for HCI.
3. Learn and employ different models of interaction and understand design issues of HCI.
4. Develop mobile interfaces.
5. Implement web interfaces.

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

22AIHESCN	**ENTERPRISE DEEP LEARNING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To get knowledge about Machine learning, Deep learning and AI.
- To Understand the knowledge of Neural network, Convolution networks and RNN.
- To know the various Deep Generative models.
- To learn about the concept of Recommendation engines in business and various Deep learning business application.

UNIT - I Introduction

Introduction to Machine learning, Deep learning and AI – Historical trends in Deep learning – Significance of Deep learning – Learning algorithms – Supervised, Unsupervised and semi-supervised learning algorithms – Stochastic Gradient descent – building a machine learning algorithm – challenges motivating Deep learning – Deep learning drives AI.

UNIT – II Deep Learning and Neural Networks

Perceptrons –Single-layer and Multi-layer Perceptron – Cross-entropy loss functions for Neural net – Matrix representation of Neural nets – Convolutional networks – variants of the basic convolution function – efficient convolution algorithms – Recurrent Neural networks – Bidirectional RNNs – Deep recurrent networks – recursive neural networks – The Long short-term memory and other gated RNNs.

UNIT – III Deep Generative Models

Boltzmann machines – Deep belief networks – Convolutional Boltzmann machines – Boltzmann machines for structured or sequential outputs – Back-propagation through random operations – Directed generative nets – Generative stochastic networks – other generation schemes – evaluating generative models.

UNIT – IV Deep Learning: Business Application

Games and Art– Anomaly detection and fraud – security and prevention – Forecasting – Medicine and Biomedical – applications of Deep learning in business – Business use case example.

UNIT – V Recommendation Engines

Introduction – Recommendation system techniques – content-based recommendation – collaborative recommendation – Hybrid approaches – Applications of recommendation engines in business – Applications of NLP in business – employing AI in business – embedding AI into business processes.

Text Books :

1. Rajendra Akerkar, Artificial Intelligence for Business, Springer briefs in business, 2019.
2. Ian Good fellow, Yoshua Bengio and Aaron Courville, Deep Learning: Adaptive Computation and Machine Learning, The MIT Press, Cambridge, London, England, 2016.

References :

1. Eugene Charniak, Introduction to Deep Learning, The MIT Press, 2019.
2. Armando Vieira and Bernardete Ribeiro, Introduction to Deep Learning Business applications for Developers, Apress publication, 2018.
3. Sandro Skansi, Introduction to Deep Learning: From Logical Calculus to Artificial Intelligence, 1st Edition, Springer, 2018.
4. Josh Patterson and Adam Gibson, Deep Learning: A Practioners Approach, 2017.

Course Outcomes:

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

1. Gain knowledge in Machine learning, Deep learning and AI.
2. Acquire knowledge and understanding neural network, Convolution network and RNN.
3. Exhibit the knowledge in Deep Generative models.
4. Analyze the various Deep learning business applications.
5. Knowledge in Recommendation engines and employing AI in business.

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

22AIHESCN	STOCHASTIC PROCESS AND QUEUEING THEORY	L	T	P	C
		3	0	0	3

Course Objectives :

- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of queueing models and apply in engineering.
- To understand the significance of advanced queueing models.
- To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.

UNIT – I Random Processes

Classification – Stationary process – Markov process – Poisson process – Random telegraph process.

UNIT – II Correlation and Spectral Densities

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT – III Linear Systems with Random Inputs

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and Cross correlation functions of input and output.

UNIT – IV Queueing Models

Markovian queues – Birth and death processes – Single and multiple server queueing models –Little‘s formula – Queues with finite waiting rooms – Queues with impatient customers : Balkingand reneging.

UNIT – V Advanced Queueing Models

Finite source models – M/G/1 queue – Pollaczek Khinchin formula – M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.

Text Books :

1. Moorthy,M.B.K., Subramani,K and Santha.A.,Probability and Random Processes, Sci tech Publications(India) Pvt. Ltd 7th Edition , 2015.
2. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., Fundamentals of Queueing Theory, Wiley Student 4thEdition, 2014.

References :

1. U. Narayan Bhat, An Introduction to Queueing Theory: Modeling and Analysis in Applications, Birkhauser, 2015.
2. Robert G. Gallager, Stochastic Processes: Theory for Applications, Cambridge University, 2013.
3. Medhi, J., Stochastic Models in Queuing Theory,Academic press, second Edition, 2003.
4. Trivedi, K.S., Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2ndEdition, John Wiley and Sons, 2002.

Course Outcomes :

1. Upon successful completion of the course, students should be able to:
2. Apply the concept of random processes in engineering disciplines.
3. Understand the tool to represent signals i.e. noise.
4. Acquire the right methodology to quantify the randomness associated with the image processing and neural networks.
5. Acquire skills in analyzing queueing models.

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

22AIHESCN	**CNN FOR VISUAL RECOGNITION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To gain basic knowledge of deep learning principles.
- To understand CNNs, their fundamental processes and their applications.
- To recognize, identify and understand visual information from single image or video sequence.
- To explore CNN for visual recognition.

UNIT – I Machine Learning for Computer Vision

A brief history of computer vision- Challenges in Computer Vision - Machine Learning for Vision-Machine Learning Basics - Learning Algorithms - Capacity, Overfitting and Underfitting- Hyper parameters and Validation - Estimators, Bias and Variance - Maximum Likelihood Estimation - Bayesian Statistics - Supervised Learning Algorithms - Unsupervised Learning Algorithms - Stochastic Gradient Descent - Building a Machine Learning Algorithm - Challenges Motivating Deep Learning.

UNIT – II Deep Learning and Convolutional Networks

Deep Feedforward Networks -Example: Learning XOR - - Gradient-Based Learning - Hidden Units Architecture Design Back-Propagation and Other Differentiation Algorithms Convolutional Networks -The Convolution Operation -Motivation - Pooling -Convolution and Pooling as an Infinitely Strong Prior -Variants of the Basic Convolution Function -

Structured Outputs-Data Types-Efficient Convolution Algorithms -Random or Unsupervised Features -The Neuroscientific Basis for Convolutional Networks.

UNIT – III Convolutional Neural Networks Architectures

Popular CNN Model Architectures -Introduction to ImageNet-LeNet-AlexNet architecture-VGGNet architecture-GoogLeNet architecture-Architecture insights-Inception module-ResNet architecture- Convolutional Networks for Detection and Segmentation.

UNIT – IV Recurrent Neural networks and Reinforcement Learning

Recurrent Neural Networks-Recurrent Neurons-Training RNNs-Deep RNNs-LSTM Cell-GRU Cell-Reinforcement Learning- Deep Reinforcement Learning

UNIT – IV Autoencoders,Generative Models with Adversarial Learning

Generative Models- Taxonomy of Generative models - PixelRNN - PixelCNN- variational auto encoders (VAE) - generative adversarial network(GAN)- Visualizing and Understanding - Feature visualization and inversion -Adversarial examples -DeepDream and style transfer.

Text Books :

1. Ragav Venkatesan, Baoxin Li, Convolutional Neural Networks in Visual Computing: A Concise Guide", CRC Press, 2018.
2. Ian Goodfellow and YoshuaBengio and Aaron Courville, Deep Learning, MIT press, http://www.deeplearningbook.org, 2016.

References :

1. Pradeep Pujari, Md. Rezaul Karim, Mohit Sewak, Practical Convolutional Neural Networks, Packt Publishing, February 2018.
2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer, September 2018.
3. Salman Khan; Hossein Rahmani; Syed Afaq Ali Shah; Mohammed Bennamoun; Gerard Medioni; Sven Dickinson, A Guide to Convolutional Neural Networks for Computer Vision, Morgan & Claypool, 2018.
4. Xavier Alameda, Elisa Ricci, Multimodal Behaviour Analysis in the wild: Advances and challenges, 1st Edition, Academic Press, 2018

Course Outcomes :

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

1. Understand the challenges in computer vision.
2. Gain knowledge of how deep learning algorithms could be used in computer vision.
3. Understand the advantages and trade-offs of various CNN and RNN architectures.
4. Apply CNN for object detection and segmentation.
5. Apply generative adversarial networks (GANs)for Visual Recognition.

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

22AIHESCN	**MACHINE LEARNING FOR PREDICTIVE DATA ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To introduce most important machine learning approaches used in predictive data analytics.
- To learn four approaches to machine learning: information-based learning, similarity-based learning, probability-based learning, and error-based learning.
- To learn the techniques for evaluating prediction models.
- To learn statistics and data visualization for Machine Learning.

UNIT – I Introduction

Machine Learning for Predictive Data Analytics - Is Predictive Data Analytics - Is Machine Learning - Machine Learning Work- Can Go Wrong with Machine Learning - The Predictive Data Analytics Project Lifecycle - Predictive Data Analytics Tools - Data to Insights to Decisions-Converting Business Problems into Analytics Solutions - Assessing Feasibility-Designing the Analytics Base Table- Designing & Implementing Features.

UNIT – II Data Exploration

The Data Quality Report-Getting to Know the Data-The Normal Distribution-Identifying Data Quality Issues - Missing Values - Irregular - Handling Data Quality Issues - Handling Missing Values- Handling Outliers - Advanced Data Exploration - Visualizing Relationships Between Features-Measuring Covariance & Correlation - Data Preparation – Normalization - Binning- Sampling – Information - Based Learning - Big Idea – Fundamentals - Decision Trees-Shannon's Entropy Model-Information Gain - Standard Approach: The ID3 Algorithm - Example: Predicting Vegetation Distribution-Alternative Feature Selection & Impurity Metrics.

UNIT – III Handling Continuous Descriptive Features

Predicting Continuous Targets - Tree Pruning - Model Ensembles - Similarity-based Learning- Feature Space-Measuring Similarity Using Distance Metrics - The Nearest Neighbor Algorithm- Data Normalization - Predicting Continuous Targets - Probability-

based Learning- Bayes' Theorem-Bayesian Prediction - Handling Continuous Features: Probability Density Functions- Handling Continuous Features: Binning - Bayesian Networks- Simple Linear Regression- Measuring Error-Error Surfaces- Multivariable Linear Regression with Gradient Descent- Multivariable Linear Regression- Choosing Learning Rates & Initial Weights- Interpreting Multivariable Linear Regression Models-Setting the Learning Rate Using Weight.

UNIT – IV Designing Evaluation Experiments

Performance Measures: Categorical Targets- Performance Measures: Prediction Scores-Performance Measures: Multinomial Targets-Performance Measures: Continuous Targets-Evaluating Models after Deployment-Case Study: Customer Churn-Business Understanding-Data Understanding - Data Preparation - Modeling-Evaluation-Deployment -The Art of Machine Learning for Predictive Data Analytics- Different Perspectives on Prediction Models- Choosing a Machine Learning Approach- Matching Machine Learning Approaches to Projects-Matching Machine Learning Approaches to Data.

UNIT – V Statistics & Data Visualization for Machine Learning

Descriptive Statistics for Continuous Features-Central Tendency- Variation-Descriptive Statistics for Categorical Features- Populations & Samples-Data Visualization-Bar Plots-Histograms-Box Plots-Introduction to Probability for Machine Learning-Probability Basics-Probability Distributions & Summing Out-Some Useful Probability Rules-Differentiation Techniques for Machine Learning-Derivatives of Continuous Functions-The Chain Rule-Partial Derivatives.

Text Books :

1. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy,Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies ,1stEdition,The MIT Press, Kindle Edition, 2014.
2. Statistical and Machine-Learning Data Mining: Techniques for Better Predictive Modeling and Analysis of Big Data, Bruce Ratner,Second Edition, CRC Press, 2012.

References :

1. Tom M. Mitchell, Machine Learning, 1st Edition, McGraw Hill Education, 2017.
2. Thomas W. Miller,Modeling Techniques in Predictive Analytics with Python and R: A Guide to Data Science, FT Press Analytics, Pearson Education, 2015.
3. Witten, I. H., E. Frank, and M. A. Hall,Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann, 2011.
4. Hastie, T., R. T. Jerome, and H. Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction, Springer, 2009.

Course Outcomes :

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

1. Understand the machine learning approaches for predictive data analytics.
2. Understand the various machine approaches.
3. Apply machine learning techniques and evaluate predictive modeling.

4. Choose and implement appropriate performance measures for predictive models.
5. Document and transfer the results, and effectively communicate the findings using visualization techniques.

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	-	-	-	-	-	-	-

ONE CREDIT COURSES

22AIOCSCN	MAP REDUCE PROGRAMMING WITH HADOOP LAB	L	T	P	C
		0	0	2	1

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 executeHadoopMapReducev2 computations on standalone Hadoopv2 on a local machine and distributed cluster environment.
- To understand how to runHadoopMapReducev2 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

22AIOCSCN	**DATA VISUALISATION LAB**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

Course Objectives :

- To learn the interface in Tableau / MS-Excel for creating visualisations.
- To understand the methods for drawing charts and graphs.
- To learn the use of maps and tables in creating visualisation.
- To prepare dashboard design for data analytics applications.

LIST OF EXERCISES

(The exercises are to be done in Tableau / MS-Excel)

1. Study of interface, screen and visual cues in Tableau / MS-Excel
2. Connecting with various data sources
3. Working with measures and dimensions
4. Working with Colours
5. Working with Expressions, Functions, Date, Time
6. Drawing Charts and Graphs
7. Creating Maps
8. Working with Table Calculations
9. Sorting Data
10. Applying Filters
11. Dashboard design

Course Outcomes :

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

1. Discover the various elements in the interface to load and analyze data.
2. Design filters for data visualization.
3. Develop dashboard design for typical data analytics applications.

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

22AIOCSCN	MOBILE APPLICATION DEVELOPMENT LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives :

- To understand the components and structure of mobile application development frameworksfor 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 mobileapplications.
- 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.

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

22AIOCSCN	SECURITY LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives :

- To learn different cipher techniques
- To implement the algorithms DES, RSA,MD5,SHA-1
- To use network security tools and vulnerability assessment tools

LIST OF EXERCISES

1. Perform encryption, decryption using the following substitution techniques
   (i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
   i) Rail fence ii) row & Column Transformation
3. Apply DES algorithm for practical applications.
4. Apply AES algorithm for practical applications.
5. Implement RSA Algorithm using HTML and JavaScript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME - Digital Signature Standard.
9. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
10. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool
11. Defeating Malware
    i) Building Trojans ii) Rootkit Hunter

Course Outcomes :

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

1. Develop code for classical Encryption Techniques to solve the problems.
2. Build cryptosystems by applying symmetric and public key encryption algorithms.
3. Construct code for authentication algorithms.
4. Develop a signature scheme using Digital signature standard.
5. Demonstrate the network security system using open source tools

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

22AIOCSCN	PROFESSIONAL COMMUNICATION	L	T	P	C
		0	1	0	1

COURSE OBJECTIVES

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

Recommended Software 1. Globearena 2. Win English

References :

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
2. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

Course Outcomes :

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

1. Make effective presentations.
2. Participate confidently in Group Discussions.
3. Attend job interviews and be successful in them.
4. Develop adequate Soft Skills required for the workplace .

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