SANTHIRAM ENGINEERING COLLEGE, NANDYAL

(AUTONOMOUS)

Approved by A.I.C.T.E., New Delhi, Permanently Affiliated to JNT University, Ananthapuramu;
Accredited by NAAC with Grade-A, Accredited by NBA (ECE & CSE);
An ISO 9001:2015 Certified Institution, 2(f) & 12(B) recognition by UGC Act, 1956
NH-40, Nandyal-518501, Nandyal (Dist), A.P.

ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABI

M.TECH (CSE-AI&ML)

REGULAR TWO YEAR PG DEGREE COURSE

(Applicable for the Admitted Batch 2025-26)

REGULATIONS: R-25

Learn - Grow - Empower

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SANTHIRAM ENGINEERING COLLEGE : NANDYAL

ACADEMIC RULES & REGULATIONS

(Effective for the students admitted into I year from the Academic Year 2025-2026)

Santhiram Engineering College, Nandyal (SREC) offers **Two** Years (**Four** Semesters) full-time Master of Technology (M. Tech) Degree programme, under Choice Based Credit System (CBCS) in different branches of Engineering and Technology with different specializations.

The Santhiram Engineering College, Nandyal (SREC) shall confer M. Tech degree on candidates who are admitted to the programme and fulfill all the requirements for the award of the degree.

1. Award of the M. Tech Degree

A student will be declared eligible for the award of the M. Tech degree if he/she fulfils the following:

1.1 Pursues a course of study for not less than two academic years and not more than four academic years.

1.2 Registers for 75 credits and secures all 75 credits.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within four academic years from the year of their admission, shall forfeit their seat in M. Tech course and their admission stands cancelled.

3. Programme of Study:

The following M. Tech Specializations are offered at present in different branches of Engineering and Technology in non-autonomous affiliated colleges:

S.No.	Discipline	Name of the Specialization	Code
01	Electronics and Communication Engineering	Embedded Systems	55
		VLSI System Design	57
02	Computer Science and Engineering	Computer Science & Engineering	58
		CSE (Artificial Intelligence & Machine Learning)	13

4. Eligibility for Admissions:

4.1 Admission to the M. Tech Program shall be made subject to the eligibility, qualification and specialization prescribed by the A.P. State Government/University from time to time.

4.2 Admissions shall be made either on the basis of either the merit rank or Percentile obtained by the qualified student in the relevant qualifying GATE Examination/ the merit rank obtained by the qualified student in an entrance test conducted by A.P. State Government (APPGECET) for M. Tech programmes an entrance test conducted by University/on the basis of any other exams approved by the University, subject to reservations as laid down by the Govt. from time to time.

5. Programme related terms:

5.1 ***Credit:*** A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit

5.2 ***Academic Year:*** Two consecutive (one odd + one even) semesters constitute one academic year.

5.3 ***Choice Based Credit System (CBCS):*** The CBCS provides choice for students to select from the prescribed courses.

6. Programme Pattern:

6.1 Total duration of the of M. Tech programme is two academic years

6.2 Each academic year of study is divided into two semesters.

6.3 Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per semester.

6.4 The student shall not take more than four academic years to fulfill all the academic requirements for the award of M. Tech degree from the date of commencement of first year first semester, failing which the student shall forfeit the seat in M. Tech programme.

6.5 The medium of instruction of the programme (including examinations and project reports) will be in English only.

6.6 All subjects/courses offered for the M. Tech degree programme are broadly classified as follows:

S. No.	Broad Course Classification	Course Category	Description
1.	Core Courses	Foundational & Professional Core Courses (PC)	Includes subjects related to the parent discipline/department/branch of Engineering
2.	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline which are of importance in the context of special skill development
3.	Mandatory Course	Quantum Technology and Application	To understand importance of latest technologies, research and process of creation of patents through research
		Research methodology & IPR	
4.		Skill Enhancement courses (SE)	Interdisciplinary / job-oriented/domain courses which are relevant to the industry
		Comprehensive Viva	To test the overall domain knowledge
		Short Term Industry Internship	To provide real time exposure
		Dissertation	To provide application of domain knowledge to solve real problems
5.	Audit Courses	Mandatory noncredit courses	Covering subjects of developing desired attitude among the learners.

6.7 The college shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

6.8 A faculty advisor/mentor shall be assigned to each specialization to advise students on the programme, its Course Structure and Curriculum, Choice of Courses, based on his competence, progress, pre-requisites and interest.

6.9 Preferably 25% course work for the theory courses in every semester shall be conducted in the blended mode of learning.

7. Attendance Requirements:

7.1 A student shall be eligible to appear for the external examinations if he/she acquires i) a minimum of 50% attendance in each course and ii) 75% of attendance in aggregate of all the courses.

7.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

7.3 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence

7.4 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class.

7.5 A stipulated fee shall be payable towards condonation of shortage of attendance.

7.6 A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek re-admission into that semester when offered next.

7.7 If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

7.8 If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

8. Evaluation – Distribution and Weightage of Marks:

The performance of a student in each semester shall be evaluated subject - wise (irrespective of credits assigned), for a maximum of 100 marks for theory and 100 marks for practical, based on Internal Evaluation and End Semester Examination.

8.1 There shall be five units in each of the theory subjects. For the theory subjects 60 marks will be for the End Examination and 40 marks will be for Internal Evaluation.

8.2 Two Internal Examinations shall be conducted for 30 marks each, one in the middle of the Semester and the other immediately after the completion of instruction period. The other 10 marks is awarded for continuous assessment in the form of assignments, quizzes, open book examination, presentation, etc. First mid examination shall be conducted for I & II units of the syllabus and second mid

examination for III, IV & V units. Each mid exam shall be conducted for a total duration of 120 minutes with 3 questions (without choice) and each question carries 10 marks. Final Internal marks for a total of 40 marks shall be arrived at by considering the marks secured by the student in both the internal examinations with 80% weightage to the better internal exam and 20% to the other.

8.3 The following pattern shall be followed in the End Examination:

i. Five questions shall be set from each of the five units with either/or type for 12 marks each.
ii. All the questions have to be answered compulsorily.
iii. Each question may consist of one, two or more bits.

8.4 For practical subjects, 60 marks shall be for the End Semester Examinations and 40 marks will be for internal evaluation based on the day-to-day performance.

The internal evaluation based on the day-to-day work-10 marks, record- 10 marks and the remaining 20 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the examiners, with a breakup mark of Procedure-10, Experimentation-25, Results-10, Viva- voce-15.

8.5 There shall be Mandatory **Audit courses** in I & II semesters for zero credits. There is no external examination for audit courses. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 50% or more in the internal examinations. In case, the student fails, a re- examination shall be conducted for failed candidates for 40 marks for every six months/semester satisfying the conditions mentioned in item 1 & 2 of the regulations.

8.6 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

8.7 In case the candidate does not secure the minimum academic requirement in any of the subjects he/she has to reappear for the Semester Examination either supplementary or regular in that subject or repeat the course when next offered or do any other specified subject as may be required.

8.8 The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the Institution norms and shall be produced to the Committees of the University as and when the same are asked for.

9. Credit Transfer Policy

As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the Institution shall allow up to a maximum of 40% of the Professional and Open Electives in a semester through SWAYAM/SWAYAM Plus.

9.1 The Institution shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses through SWAYAM platform.

9.2 The online learning courses available on the SWAYAM platform will be considered for credit transfer. SWAYAM course credits are as specified in the platform

9.3 Student registration for the MOOCs shall be only through the institution, it is mandatory for the student to share necessary information with the institution

9.4 The institution shall select the courses to be permitted for credit transfer through SWAYAM. However, while selecting courses in the online platform institution would essentially avoid the courses offered through the curriculum in the offline mode.

9.5 The institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer in the forthcoming Semester.

9.6 Students may register for an 8-week (2 credits) or 12-week (3 credits) SWAYAM / SWAYAM plus course with the approval of the Head of the Department (HoD).

9.7 Examination fees, if applicable, shall be borne by the student. Pass marks and grading will be as per the Institution academic regulations.

9.8 A student must get minimum 40% marks for assignments and quizzes on the SWAYAM/ SWAYAM plus platform to be eligible for the end-semester examination. The students who are unable to get minimum internal marks in SWAYAM/ SWAYAM plus platform, they have to re-register for the course in subsequent semester through SWAYAM/ SWAYAM plus platform.

9.9 The end-semester exam may be conducted by the National Testing Agency (NTA), the National Programme on Technology Enhanced Learning (NPTEL) or the Institution during the regular end-term exams. Evaluation shall comprise 60% weightage for the end-semester examination and 40% for assignments and quizzes conducted by the SWAYAM/ SWAYAM plus course coordinator. The student has to get 50% marks for internal and external with minimum of 40% marks in the external examination to declare them as pass.

9.10 The institution shall also ensure that the student has to complete the course and produce the course completion certificate as per the academic schedule given for the regular courses in that semester. However, the credits will be transferred to the students who got minimum 50% marks with 40% marks in the external examination

9.11 The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

9.12 The Institution shall ensure no overlap of SWAYAM MOOC exams with that of the Institution examination schedule. In case of delay in SWAYAM results, the Institution will re-issue the marks sheet for such students.

9.13 Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the minimum 50% of marks and grades.

9.14 The respective Departments shall submit the following to the examination section of the Institution:

a) List of students who have passed MOOC courses in the current semester along with the certificates of completion.

b) Undertaking form filled by the students for credit transfer.

9.15 The Institution shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

Note: Students shall also be permitted to register for MOOCs offered through online platforms other than SWAYAM NPTEL. In such cases, credit transfer shall be permitted only

after seeking approval of the Institution/University at least three months prior to the commencement of the semester.

10. Re-registration for Improvement of Internal Evaluation Marks:

A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and has failed in the end examination

10.1 The candidate should have completed the course work and obtained examinations results for **I, II and III** semesters.

10.2 The candidate should have passed all the subjects for which the Internal Evaluation marks secured are more than 50%.

10.3 Out of the subjects the candidate has failed in the examination due to Internal Evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory subject and for a maximum of **three** Theory subjects for Improvement of Internal evaluation marks.

10.4 The candidate has to re-register for the chosen subjects and fulfill the academic requirements.

10.5 For each theory subject, the candidate has to pay the requisite fee along with the requisition through concerned Head of the department.

10.6 In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

11. Evaluation of Project/Dissertation Work:

The Project work shall be initiated at the beginning of the III Semester and the duration of the Project is of two semesters. Evaluation of Project work is for 300 marks with 200 marks for internal evaluation and 100 marks for external evaluation. Progress of the project work is monitored through three reviews:

- Project review – I at the beginning of the III semester for zero marks
- Project review – II at the end of the third semester for 100 marks
- Project review – III before submission of the thesis i.e., end of the IV semesters for 100 marks

External evaluation of final Project work viva voce in IV semester shall be for 100 marks.

A Project Review Committee (PRC) shall be constituted with the Head of the Department as Chairperson, Project Supervisor and one faculty member of the department offering the M. Tech programme.

11.1 A candidate is permitted to register for the Project Work in III Semester after satisfying the attendance requirement in all the subjects, both theory and laboratory (in I & II semesters).

11.2 A candidate is permitted to submit Project dissertation with the approval of PRC. The candidate has to pass all the theory, practical and other courses before submission of the Thesis.

11.3 Project work shall be carried out under the supervision of teacher in the parent department concerned.

11.4 A candidate shall be permitted to work on the project in an industry/research organization on the recommendation of the Head of the Department. In such cases, one of the teachers from the department concerned would be the internal guide and an expert from the industry/ research organization concerned shall act as co-supervisor/

external guide. It is mandatory for the candidate to make full disclosure of all data/results on which they wish to base their dissertation. They cannot claim confidentiality simply because it would come into conflict with the Industry‟s or R&D laboratory‟s own interests. A certificate from the external supervisor is to be included in the dissertation.

11.5 Continuous assessment of Project Work - I and Project Work – II in III & IV semesters respectively will be monitored by the PRC.

11.6 The candidate shall submit status report by giving seminars in three different phases (two in III semester and one in IV semester) during the project work period. These seminar reports must be approved by the PRC before submission of the Project Thesis.

11.7 After registration, a candidate must present in Project Review - I, in consultation with his Project Supervisor, the title, objective and plan of action of his Project work to the PRC for approval within four weeks from the commencement of III Semester. Only after obtaining the approval of the PRC can the student initiate the project work.

11.8 The Project Review - II in III semester carries internal marks of 100. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate the work for the other 50 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain and progress of the Project Work.

11.9 A candidate has to secure a minimum of 50% of marks to be declared successful in Project Review - II. Only after successful completion of Project Review – II, candidate shall be permitted for Project Work Review – III in IV Semester. The unsuccessful students in Project Review - II shall reappear after three months.

11.10 The Project Review - III in IV semester carries 100 internal marks. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate it for the other 50 marks. The PRC will examine the overall progress of the Project Work and decide whether or not eligible for final submission. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Review - III. If student fails to obtain the required minimum marks, he/she has to reappear for Project Review - III after a month.

11.11 For the approval of PRC the candidate shall submit the draft copy of dissertation to the Head of the Department and make an oral presentation before the PRC.

11.12 After approval from the PRC, the student is permitted to submit a report. The dissertation report will be accepted only when the plagiarism is within 30% checked through Turnitin software (repository mode). The plagiarism report shall be submitted along with the dissertation report.

11.13 Research paper related to the Project Work shall be published in an SCI/ESCI/Scopus/UGC Care listed journal, or in conference proceedings with ISBN number organized by professional societies such as IEEE, IEI, etc.

11.14 After successful plagiarism check and publication of research paper, three copies of the dissertation certified by the supervisor and HOD shall be submitted to the College.

11.15 The dissertation shall be adjudicated by an external examiner selected by the Institution. For this, the Principal of the College shall submit a panel of three examiners as submitted by the supervisor concerned and department head for each student. However, the dissertation will be adjudicated by one examiner nominated by the Head of the Institution.

11.16 If the report of the examiner is not satisfactory, the candidate shall revise and resubmit the dissertation, in the time frame as decided by the PRC. If report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidate has to reregister for the project and complete the project within the stipulated time after the approval from the Institution.

11.17 If the report of the examiner is satisfactory, the Head of the Department shall coordinate and make arrangements for the conduct of Project Viva voce exam.

11.18 The Project Viva voce examinations shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who has adjudicated the dissertation. For Dissertation Evaluation (Viva voce) in IV Sem. there are external marks of 100 and it is evaluated by external examiner. The candidate has to secure a minimum of 50% marks in Viva voce exam.

11.19 If he fails to fulfill the requirements as specified, he will reappear for the Project Viva voce examination only after three months. In the reappeared examination also, if he fails to fulfill the requirements, he will not be eligible for the award of the degree.

12. Industry Internships:

Industry internship either onsite or virtual with a minimum of 06-08 weeks" duration, done at the end of 1st year second semester. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the PG program. The student shall register for the internship as per course structure after commencement of academic year.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, Mentor/Supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. Internship will be evaluated for 100 marks with 50 marks for the report evaluated by the mentor and 50 marks for oral presentation. A student should secure minimum 50% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the Institution.

13. Comprehensive Viva

A Comprehensive Viva shall be conducted after the II Semester examinations for 100 marks by a committee consisting of the Head of the Department, one senior faculty member of the same specialization, and an external subject expert appointed by the Head of the Institution. The student must secure a minimum of 50% marks to be declared as passed

14. Credits for Co-curricular Activities

The college shall be introducing Co-Curricular activities in IV semester with One credit. The student must be participating in Co-Curricular / extra-curricular activities such as publishing a paper or participating in a National / International workshops / symposium / seminar / training organized by any private institution / Govt. organization / Training centers in virtual/offline mode. The student has to participate in Co-Curricular activities during their program duration and submit the certificate at the end of the IV semester. If he/she fails to submit will not be eligible for the award of degree. In such cases, the student shall repeat and submit the Co-Curricular activity.

Following are the guidelines for awarding Credits for Co-curricular Activities

Name of the Activity	**Maximum Credits / Activity**
Participation in National Level Seminar/ Conference / Workshop /Training programs (related to the specialization of the student)	0.5
Participation in International Level Seminar / Conference / workshop/Training programs held outside India (related to the specialization of the student)	1
Academic Award/Research Award from State Level/National Agencies	0.5
Academic Award/Research Award from International Agencies	1
Research / Review Publication in National Journals (Indexed in Scopus / Web of Science)	0.5
Research / Review Publication in International Journals with Editorial board outside India (Indexed in Scopus / Web of Science)	1

Note:

i) Credit shall be awarded only for the first author. Certificate of attendance and participation in a Conference/Seminar is to be submitted for awarding credit. A minimum participation of five days is required to earn the necessary credits. Alternatively, the student may attend five different one day programs to meet this requirement.

ii) Certificate of attendance and participation in workshops and training programs (Internal or External) is to be submitted for awarding credit. The total duration should be at least one week.

iii) Participation in any activity shall be permitted only once for acquiring required credits under cocurricular activities

15. Grading:

As a measure of the student‟s performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade points Assigned
≥ 90	S (Superior)	10
≥ 80 < 90	A (Excellent)	9
≥ 70 < 80	B (Very Good)	8
≥ 60 < 70	C (Good)	7
≥ 50 < 60	D (Pass)	6
< 50	F (Fail)	0
Absent	Ab (Absent)	0

i) A student obtaining Grade „F‟ or Grade „Ab‟ in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

ii) For noncredit audit courses, “Satisfactory” or “Unsatisfactory” shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA = \Sigma (C_i \times G_i) / \Sigma C_i$$

where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

i) The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program, i.e.,

$$CGPA = \Sigma (C_i \times S_i) / \Sigma C_i$$

where "S_i" is the SGPA of the i^{th} semester and C_i is the total number of credits up to that semester.

ii) Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iii) While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D and F.

16. Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree, he shall be placed in one of the following three classes:

Class Awarded	CGPA to be secured
First Class with Distinction	≥7.5%
First Class	< 7,5≥ 6.5
Pass Class	< 6.5

17. Exit Policy:

The student shall be permitted to exit with a PG Diploma based on his/her request to the university through the respective institution at the end of first year subject to passing all the courses in first year.

The University shall resolve any issues that may arise in the implementation of this policy from time to time and shall review the policy in the light of periodic changes brought by UGC, AICTE and State government.

18. Withholding of Results:

If the candidate has any case of in-discipline pending against him/her, the result of the candidate shall be withheld, and he/she will not be allowed/promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

19. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been

detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

20. General:

20.1 The academic regulations should be read as a whole for purpose of any interpretation.

20.2 Disciplinary action for Malpractice/improper conduct in examinations is appended.

20.3 There shall be no places transfer within the constituent colleges and affiliated colleges of Jawaharlal Nehru Technological University Anantapur.

20.4 Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

20.5 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

20.6 The University may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the University.

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RULES FOR

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The Hall Ticket of the candidate is to be cancelled and handed over to the examination of the autonomous college.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all examinations, if his involvement is established. Otherwise, the candidate is debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject only.
6.	Refuses to obey the orders of the Chief Superintendent /Assistant - Superintendent /any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty inor outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the Controller of Examinations / Assistant Controller of Examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. If the candidate physically assaults the invigilator/ Controller of Examinations / Assistant Controller of Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person (s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject only or in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations, depending on the recommendation of the committee.

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
3. A show cause notice shall be issued to the college.
4. Impose a suitable fine on the college.
5. Shifting the examination centre from the college to another college for a specific period of not less than one year.

Note:-

Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfil allthe norms required for the award of Degree.

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SANTHIRAM ENGINEERING COLLEGE

(AUTONOMOUS)

DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

M.Tech
I-Semester Course Structure

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

M.Tech. I Sem. - Course Structure

S.No	Subject Code	Course Category	Name of the Subject	Hours/Week				Marks		
				Lecture	Tutorial	Practical	Credits	Internal	External	Total
1	25D13101	PC	ADVANCED ALGORITHMS	3	0	0	3	40	60	100
2	25D13102	PC	MATHEMATICS FOR AI AND ML	3	0	0	3	40	60	100
3	25D13103A	PE	EVOLUTIONARY COMPUTING (PE-I)	3	0	0	3	40	60	100
4	25D13103B	PE	DEEP LEARNING TRANSFORMERS (PE-I)	3	0	0	3	40	60	100
5	25D13103C	PE	KNOWLEDGE GRAPHS & REASONING (PE-I)	3	0	0	3	40	60	100
6	25D13103D	PE	REINFORCEMENT LEARNING (PE-I)	3	0	0	3	40	60	100
7	25D13104A	PE	MEDICAL IMAGING WITH AI (PE-II)	3	0	0	3	40	60	100
8	25D13104B	PE	DRONE TECHNOLOGIES (PE-II)	3	0	0	3	40	60	100
9	25D13104C	PE	AUTONOMOUS VEHICLES (PE-II)	3	0	0	3	40	60	100
10	25D13104D	PE	MACHINE LEARNING & DEEP LEARNING APPLICATIONS (PE-II)	3	0	0	3	40	60	100
11	25D58105	PC	ADVANCED DATA STRUCTURES & ALGORITHMS LAB	0	0	4	2	40	60	100
12	25D13105	PC	AI AND ML LAB	0	0	4	2	40	60	100
13	25D57107	MC(C)	RESEARCH METHODOLOGY AND IPR	2	0	0	2	40	60	100
14	25D13106	SC	MLOPS & AI MODEL DEVELOPMENT	0	1	2	2	40	60	100
15	25D57109A	MC(NC)	ENGLISH FOR RESEARCH PAPER WRITING (AC-I)	2	0	0	0	40	0	40
16	25D57109C	MC(NC)	DISASTER MANAGEMENT (AC-I)	2	0	0	0	40	0	40
17	25D57109D	MC(NC)	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (AC-I)	2	0	0	0	40	0	40

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

M.Tech
I -Semester Syllabus

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D13101) ADVANCED ALGORITHMS

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To provide rigorous training in analyzing the time, space, and complexity bounds of advanced algorithms.
2. To study divide & conquer, dynamic programming, greedy, backtracking, and branch & bound techniques with proofs of correctness.
3. To explore network flows, approximation, randomized, and parameterized algorithms in depth
4. To understand the theoretical foundations of NP-Completeness and explore emerging topics like quantum and parallel algorithms.
5. To apply algorithm design paradigms to AI, ML, data science, and optimization problems

UNIT-I ADVANCED COMPLEXITY ANALYSIS

Review of asymptotic notations (Big-O, Ω, Θ, little-o), Amortized analysis: aggregate, accounting, potential methods, Solving recurrences: recursion tree, Master's theorem, Akra–Bazzi method, Average-case analysis (probabilistic methods), Complexity classes: P, NP, co-NP, PSPACE, Polynomial hierarchy and beyond, Lower bounds on algorithmic complexity, Case studies: complexity in large-scale ML training.

UNIT-II ADVANCED DIVIDE AND CONQUER & GEOMETRY ALGORITHMS

Strassen's algorithm & fast matrix multiplication improvements, Closest pair of points problem, Convex hull algorithms (Graham's scan, Divide & Conquer), Voronoi diagrams & Delaunay triangulations, Range searching and segment trees, Parallel divide-and-conquer algorithms, Applications in image processing & computational biology, Case study: fast convolution for deep learning.

UNIT-III GREEDY, DYNAMIC PROGRAMMING & NETWORK OPTIMIZATION

Matroid theory & greedy-choice property, Graph algorithms: MST (Prim's, Kruskal's), shortest paths (Dijkstra, Bellman-Ford), Maximum flow algorithms (Ford-Fulkerson, Edmonds-Karp, Push Relabel), Matching algorithms in bipartite graphs (Hungarian algorithm), Dynamic programming in sequence alignment & edit distance, Optimal binary search trees & matrix chain multiplication, Applications of DP in reinforcement learning. Case study: optimization problems in natural language processing.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

UNIT-IV ADVANCED SEARCH – BACKTRACKING, BRANCH & BOUND, CSPS

Backtracking: general method and complexity analysis, N-Queens, subset sum, graph coloring revisited, Branch & Bound: TSP, knapsack with bounding techniques, Constraint satisfaction problems (CSP) and heuristics, SAT solving and backtracking-based SAT solvers, Exact exponential algorithms (clique, independent set), Integer programming & cutting-plane methods, Applications in scheduling, robotics, and AI planning.

UNIT-V NP-COMPLETENESS, APPROXIMATION & RANDOMIZED ALGORITHMS

Cook-Levin theorem & NP-Complete proofs, Reductions between NP-complete problems, Parameterized complexity & fixed-parameter tractability (FPT), Approximation algorithms: vertex cover, set cover, Polynomial-time approximation schemes (PTAS, FPTAS), Primal-dual method for approximations, Randomized algorithms: Monte Carlo, Las Vegas, Emerging topics: quantum algorithms and complexity.

TEXT BOOKS:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein – Introduction to Algorithms, MIT Press.
2. E. Horowitz, S. Sahni, S. Rajasekaran – Fundamentals of Computer Algorithms, Galgotia.
3. J. Kleinberg, E. Tardos – Algorithm Design, Pearson.

REFERENCE BOOKS:

1. V. Vazirani ??? Approximation Algorithms, Springer.
2. S. Dasgupta, C.H. Papadimitriou, U.V. Vazirani ??? Algorithms, McGraw Hill.
3. M. Sipser ??? Introduction to the Theory of Computation, Cengage.
4. S. Arora, B. Barak ??? Computational Complexity: A Modern Approach, Cambridge University Press.
5. T. Roughgarden ??? Algorithms Illuminated series (for deeper insights into algorithmic paradigms).
6. Selected research papers from STOC, FOCS, and SODA conferences (for emerging topics like quantum algorithms, streaming algorithms, and AI-related optimizations).

COURSE OUTCOMES:

1. Analyze and evaluate the asymptotic complexity of advanced algorithms.
2. Apply divide-and-conquer, greedy, and dynamic programming methods to design efficient algorithms.
3. Formulate and solve optimization problems in graphs, networks, and sequence alignment using DP and network flow techniques.
4. Develop solutions for constraint satisfaction and NP-Hard problems using backtracking and branch & bound.
5. Classify problems into P, NP, NP-Complete, NP-Hard, and explore approximation and randomized algorithms for intractable problems.

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6. Demonstrate ability to connect algorithmic paradigms to AI/ML, bioinformatics, and data driven applications.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									
CO6									

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D13102) MATHEMATICS FOR AI AND ML

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To strengthen the knowledge of linear algebra, probability, and statistics as a foundation for AI and ML.
2. To study optimization methods (convex, constrained, gradient-based) for ML model training.
3. To apply numerical methods to efficiently solve AI-related mathematical problems.
4. To understand vector calculus tools used in deep learning and advanced ML models.
5. To bridge mathematical theory with practical applications in machine learning, data science, and AI.

UNIT-I LINEAR ALGEBRA FOR ML

Vector spaces, subspaces, basis, dimension, Linear transformations and matrices, Eigenvalues, eigenvectors, diagonalization, Singular Value Decomposition (SVD), Orthogonality and projections, Matrix decompositions: LU, QR, Cholesky, Positive definite matrices and applications in ML, Case study: PCA (Principal Component Analysis).

UNIT-II PROBABILITY & STATISTICS FOR AI

Probability axioms, conditional probability, Bayes' theorem, Random variables and expectations, Common distributions: Bernoulli, Binomial, Gaussian, Exponential, Poisson, Joint, marginal, conditional distributions, Law of large numbers, Central Limit Theorem, Estimation: MLE, MAP, Bayesian inference, Hypothesis testing and confidence intervals, Applications in generative models & Bayesian networks.

UNIT-III OPTIMIZATION FOR ML

Convex sets and convex functions, Gradient Descent and Stochastic Gradient Descent (SGD), Newton's method and Quasi-Newton methods, Constrained optimization (Lagrange multipliers, KKT conditions), Duality in convex optimization, Optimization in neural networks (backpropagation), Regularization methods (L1, L2, dropout interpretation), Case study: Optimization in deep learning frameworks.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

UNIT-IV NUMERICAL METHODS FOR AI

Root-finding methods (Bisection, Newton-Raphson), Fixed-point iteration and convergence analysis, Polynomial interpolation (Lagrange, Newton interpolation), Numerical differentiation, Numerical integration (Trapezoidal, Simpson's rule), Systems of linear equations: Gaussian elimination, iterative methods, Numerical stability and error analysis, Applications in training ML models (approximation techniques).

UNIT-V VECTOR CALCULUS IN ML

Functions of multiple variables, partial derivatives, Gradient, directional derivatives, Jacobian and Hessian matrices, Taylor expansion for multivariate functions, Divergence and curl (applications in optimization), Gradient flow dynamics in ML, Backpropagation using vector calculus, Case study: Application to deep learning (CNNs, RNNs).

TEXT BOOKS:

1. Sheldon Axler – Linear Algebra Done Right, Springer.
2. Christopher Bishop – Pattern Recognition and Machine Learning, Springer.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman – The Elements of Statistical Learning, Springer.

REFERENCE BOOKS:

1. 1. Gilbert Strang – Linear Algebra and Its Applications, Cengage
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville – Deep Learning, MIT Press
3. Stephen Boyd, Lieven Vandenberghe – Convex Optimization, Cambridge University Press
4. Dimitri Bertsekas – Nonlinear Programming, Athena Scientific
5. Marc Peter Deisenroth, A. Faisal, C. Ong – Mathematics for Machine Learning, Cambridge.
6. Morris H. DeGroot, Mark J. Schervish – Probability and Statistics, Pearson.

COURSE OUTCOMES:

1. Apply concepts of linear algebra (vector spaces, eigenvalues, SVD) to machine learning.
2. Use probability and statistics for data modeling, inference, and Bayesian reasoning in AI.
3. Formulate and solve optimization problems in ML training using gradient descent and convex optimization.
4. Apply vector calculus (gradients, Jacobians, Hessians) in deep learning model design.
5. Implement numerical methods for root finding, interpolation, and integration in AI problem-solving.
6. Integrate mathematical foundations to evaluate, analyze, and improve ML algorithms.

Mapping COs with POs & PSOs:

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									
CO6									

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D13103A) EVOLUTIONARY COMPUTING (PE-I)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. 1. To introduce the theory and biological inspiration behind evolutionary algorithms.
2. To understand genetic algorithms, genetic programming, and swarm intelligence techniques in depth.
3. To apply evolutionary computing for single-objective and multi-objective optimization problems.
4. To explore hybrid approaches combining evolutionary and machine learning algorithms.
5. To develop evolutionary computing solutions for AI/ML applications such as feature selection, hyperparameter tuning, and neural architecture search.

UNIT-I INTRODUCTION TO EVOLUTIONARY COMPUTING

Biological inspiration: Darwin's theory, natural selection, survival of the fittest, General evolutionary algorithm framework, Representation schemes: binary, real-valued, permutation encoding, Fitness evaluation functions, Selection methods: roulette wheel, tournament, rank-based, Schema theorem and building block hypothesis, Exploration vs exploitation in evolutionary algorithms, Applications in search, optimization, and learning.

UNIT-II GENETIC ALGORITHMS (GA)

Canonical GA: initialization, selection, crossover, mutation, Advanced operators: adaptive mutation, elitism, steady-state GA, Parameter tuning and convergence analysis, Hybrid GA with local search (memetic algorithms), Applications in combinatorial optimization (scheduling, routing), Feature selection in machine learning using GA, Case study: GA for function optimization, Case study: GA for ML hyperparameter tuning.

UNIT-III GENETIC PROGRAMMING (GP)

Basics of GP and evolutionary computation models, Tree-based representation of programs, Genetic operators in GP: crossover, mutation, reproduction, Fitness measures in GP (error-based, complexity-based), Symbolic regression and classification using GP, Automatic program generation and symbolic AI, Applications in neural architecture search and reinforcement learning, Case study: GP for automated ML pipeline design.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

UNIT-IV SWARM INTELLIGENCE TECHNIQUES

Particle Swarm Optimization (PSO): velocity update, global/local best, Ant Colony Optimization (ACO): pheromone model, path construction, Artificial Bee Colony (ABC) optimization, Firefly Algorithm and Cuckoo Search, Comparative study of SI techniques with GA/GP, Applications in clustering and routing problems, Neural network training using SI algorithms, Case study: PSO/ACO for AI optimization problems.

UNIT-V MULTI-OBJECTIVE & ADVANCED APPLICATIONS

Multi-objective optimization: Pareto optimality and dominance, Evolutionary algorithms for multi objective optimization (NSGA-II, SPEA2), Differential Evolution (DE) and Evolution Strategies (ES), Hybrid evolutionary algorithms with ML/DL, Ensemble methods using evolutionary optimization, Neural architecture search using evolutionary algorithms, Applications in robotics, computer vision, and data mining, Case study: Multi-objective optimization for deep learning hyperparameter tuning.

TEXT BOOKS:

1. 1. David E. Goldberg – Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson.
2. Melanie Mitchell – An Introduction to Genetic Algorithms, MIT Press.
3. A.E. Eiben, J.E. Smith – Introduction to Evolutionary Computing, Springer.

REFERENCE BOOKS:

1. Kalyanmoy Deb – Multi-Objective Optimization Using Evolutionary Algorithms, Wiley.
2. James Kennedy, Russell Eberhart, Y. Shi – Swarm Intelligence, Morgan Kaufmann.
3. Riccardo Poli, William B. Langdon, Nicholas McPhee – A Field Guide to Genetic Programming.
4. Simon D. – Evolutionary Optimization Algorithms, Wiley.
5. Yaochu Jin – Knowledge Incorporation in Evolutionary Computation, Springer.

COURSE OUTCOMES:

1. Explain the working principles and biological basis of evolutionary algorithms.
2. Apply genetic algorithms and genetic programming to solve optimization and search problems.
3. Implement swarm intelligence algorithms for AI/ML applications.
4. Analyze and solve multi-objective optimization problems using Pareto-based evolutionary techniques.
5. Develop evolutionary computing solutions for AI/ML tasks such as feature selection, model optimization, and neural architecture design.
6. Compare and evaluate different evolutionary and swarm-based techniques for computational intelligence tasks.

Mapping COs with POs & PSOs:

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									
CO6									

SANTHIRAM ENGINEERING COLLEGE

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D13103B) DEEP LEARNING TRANSFORMERS (PE-I)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Introduce the fundamentals of attention mechanisms and transformer architectures.
2. Understand the principles of encoder–decoder models in sequence learning.
3. Explore state-of-the-art models such as BERT, GPT, and Vision Transformers
4. Study transfer learning and fine-tuning techniques for transformers.
5. Apply transformers to Natural Language Processing (NLP), Computer Vision (CV), and multimodal AI tasks.

UNIT-I INTRODUCTION & ATTENTION MECHANISMS

Sequence modeling challenges in RNNs and LSTMs, Additive vs. multiplicative attention, Self attention and multi-head attention, Positional encoding and its significance, Applications of attention in NLP and computer vision, Comparative study: RNN/LSTM vs. Transformers, Practical use cases of attention mechanisms, Limitations and scalability issues in attention-based models.

UNIT-II TRANSFORMER ARCHITECTURE

Encoder–decoder structure and working, Scaled dot-product attention, Multi-head attention mechanism, Feed-forward layers and residual connections, Layer normalization and dropout in transformers, Training transformers: optimization and parallelization, Handling long sequences (efficient transformer variants), Challenges in training large-scale transformer models.

UNIT-III BERT AND GPT MODELS

BERT: bidirectional encoding and masked language modelling, Pre-training and fine-tuning strategies for BERT, GPT family: autoregressive modeling and generative capabilities, Applications: text classification, summarization, translation, and dialogue systems, Comparative study: BERT vs. GPT architectures, Case studies in real-world NLP tasks, Transfer learning with large pre-trained models, Deployment issues and challenges with large models.

UNIT-IV VISION TRANSFORMERS & MULTIMODAL MODELS

Vision Transformer (ViT) architecture and patch embeddings, Image classification using ViT, Multimodal transformers: CLIP, ALIGN, Flamingo, Applications in image captioning, cross-modal retrieval, and video understanding, Transformers in healthcare imaging and robotics, Case studies in autonomous driving and surveillance, Comparison with CNN-based approaches, Future scope of transformers in multimodal AI.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

UNIT-V FINE-TUNING & ADVANCED TOPICS

Transfer learning strategies in transformers, Domain adaptation and low-resource fine-tuning, Prompt engineering techniques, Parameter-efficient fine-tuning (LoRA, adapters), Challenges: computational cost, model bias, interpretability, and ethical concerns, Emerging trends: Large Language Models (LLMs) and foundation models, Transformers in scientific discovery and industrial applications, Future research directions in transformer-based AI.

TEXT BOOKS:

1. Vaswani et al. – Attention is All You Need, NeurIPS 2017 (Original Transformer Paper).
2. Lewis Tunstall, Leandro von Werra, Thomas Wolf – Natural Language Processing with Transformers, O'Reilly.
3. Hugging Face Team – Transformers Library Documentation.

REFERENCE BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville – Deep Learning, MIT Press.
2. Denis Rothman – Transformers for Natural Language Processing, Packt Publishing
3. Jay Alammar – The Illustrated Transformer (Online Resource).
4. Dosovitskiy et al. – An Image is Worth 16x16 Words: Transformers for Image Recognition at Scale (ViT), ICLR 2021.
5. Devlin et al. – BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding.
6. Radford et al. – GPT Series Papers (GPT-2, GPT-3), OpenAI.
7. Radford et al. – Learning Transferable Visual Models from Natural Language Supervision (CLIP), ICML 2021.

COURSE OUTCOMES:

1. Explain the working of attention mechanisms and their significance in deep learning.
2. Analyze transformer architectures and their components.
3. Implement BERT, GPT, and Vision Transformers for real-world AI problems.
4. Apply fine-tuning and transfer learning strategies for domain-specific applications.
5. Evaluate transformer-based models in NLP, CV, and multimodal tasks, considering efficiency, scalability, and interpretability.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

CO4									
CO5									

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

M.Tech. I Sem.

L	T	P	C
3	0	0	3

(25D13103C) KNOWLEDGE GRAPHS & REASONING (PE-I)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Introduce the fundamentals of knowledge representation using graphs.
2. Understand RDF, ontologies, and graph databases for semantic data modeling.
3. Study reasoning techniques and inference mechanisms.
4. Learn to query and manipulate knowledge graphs using SPARQL and Cypher.
5. Apply knowledge graphs in AI applications like NLP, recommendation systems, and question answering.

UNIT-I INTRODUCTION TO KNOWLEDGE GRAPHS

Basics of knowledge representation and semantic web concepts, Graph structures: nodes, edges, labels, properties, Difference between relational databases and graph databases, Labeled property graphs vs RDF graphs, Applications of knowledge graphs in AI and data integration, Case study: Google Knowledge Graph, Knowledge graph lifecycle: construction and storage, Tools and platforms: Neo4j, GraphDB (overview).

UNIT-II RDF AND SEMANTIC DATA MODELING

RDF basics: triples, subjects, predicates, objects, RDF Schema (RDFS): defining vocabularies, Web Ontology Language (OWL) – introduction, Ontology design principles,Linked Data principles, Schema alignment and integration, Example datasets: DBpedia, Wikidata, Tools for RDF modeling: Protégé, RDFLib.

UNIT-III ONTOLOGIES AND REASONING

Ontology concepts and examples, Building ontologies using Protégé, Types of reasoning: deductive, inductive, abductive (overview), Description logics – basics, Reasoning tasks: classification, consistency checking, Reasoning engines: Pellet, HermiT (introductory use), Rule-based reasoning: SWRL, Case study: ontology-driven applications in healthcare.

UNIT-IV QUERYING KNOWLEDGE GRAPHS

SPARQL basics: triple patterns and graph matching, SPARQL queries with filters and optional patterns, SPARQL updates, Querying linked datasets (e.g., DBpedia), Introduction to Cypher query language (Neo4j), Path queries and shortest path problems, Query optimization basics, Hands-on exercise: small KG query using SPARQL and Neo4j.

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

UNIT-V APPLICATIONS OF KNOWLEDGE GRAPHS

Knowledge graphs in search engines, Knowledge graphs in recommendation systems, Question answering with knowledge graphs, Integration with NLP: entity linking, Relation extraction for knowledge graph construction, Explainable AI using knowledge graphs, Industrial case studies: e commerce, social networks, Research challenges and open problems in KG.

TEXT BOOKS:

1. Dean Allemang & James Hendler – Semantic Web for the Working Ontologist, Morgan Kaufmann.
2. Ian Robinson, Jim Webber, Emil Eifrem – Graph Databases, O'Reilly.
3. Tom Heath & Christian Bizer – Linked Data: Evolving the Web into a Global Data Space, Morgan & Claypool.

REFERENCE BOOKS:

1. Franz Baader et al. – The Description Logic Handbook: Theory, Implementation and Applications.
2. Pascal Hitzler et al. – Foundations of Semantic Web Technologies.
3. Neo4j Documentation (online).
4. Protégé tutorials (Stanford).
5. RDFLib Python library documentation.

COURSE OUTCOMES:

1. Explain graph-based knowledge representation and semantic modeling.
2. Use RDF and ontologies for structured knowledge representation.
3. Apply reasoning techniques using engines and description logics.
4. Query knowledge graphs using SPARQL and graph databases.
5. Implement real-world AI applications using knowledge graphs.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									

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L	T	P	C
3	0	0	3

(25D13103D) REINFORCEMENT LEARNING (PE-I)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Understand the fundamentals of Reinforcement Learning (RL) and its elements.
2. Analyze and solve multi-armed bandit problems using exploration vs. exploitation strategies.
3. Master Markov Decision Processes (MDPs) and dynamic programming techniques for RL.
4. Apply Monte Carlo and Temporal Difference methods for prediction and control in RL.
5. Utilize eligibility traces and function approximation methods for advanced RL algorithms.

UNIT-I INTRODUCTION

:

Introduction to Reinforcement Learning (RL) – Difference between RL and Supervised Learning, RL and Unsupervised Learning. Elements of RL, Markov property, Markov chains, Markov reward process (MRP).

UNIT-II EVALUATIVE FEEDBACK - MULTI-ARM BANDIT PROBLEM

:

An n-Armed Bandit Problem, Exploration vs Exploitation principles, Action value methods, Incremental Implementation, tracking a non- stationary problem, optimistic initial values, upper-confidence-bound action selection, Gradient Bandits. Introduction to and proof of Bellman equations for MRPs

UNIT-III INTRODUCTION TO MARKOV DECISION PROCESS (MDP)

state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.

Dynamic Programming (DP): Overview of dynamic programming for MDP, principle of optimality, Policy Evaluation, Policy Improvement, policy iteration, value iteration, asynchronous DP , Generalized Policy Iteration.

UNIT-IV MONTE CARLO METHODS FOR PREDICTION AND CONTROL

:

Overview of Monte Carlo methods for model free RL, Monte Carlo Prediction, Monte Carlo estimation of action values, Monto Carlo Control, On policy and off policy learning, Importance sampling. Temporal Difference Methods: TD Prediction, Optimality of TD(0), TD Control methods - SARSA, Q-Learning and their variants.

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UNIT-V ELIGIBILITY TRACES

:

n-Step TD Prediction, Forward and Backward view of TD(??), Equivalence of forward and backward view, Sarsa(??),, Watkins???s Q(??), Off policy eligibility traces using importance of sampling. Function Approximation Methods: Value prediction with function approximation, gradient descent methods, Linear methods, control with function approximation.

TEXT BOOKS:

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction", 2nd Edition, The MIT Press.
2. CsabaSzepesvari – Algorithms for Reinforcement Learning – Morgan & Claypool, 2010.

REFERENCE BOOKS:

1. Reinforcement Learning By Richard S. (University Of Alberta) Sutton,Andrew G. (Co-Director Autonomous Learning Laboratory) Barto

COURSE OUTCOMES:

1. Explain and apply core RL concepts and elements.
2. Solve multi-armed bandit problems using action value methods.
3. Implement and evaluate MDPs and dynamic programming techniques.
4. Apply Monte Carlo and TD methods to RL problems.
5. Use eligibility traces and function approximation for complex RL scenarios.
6. Design and implement RL algorithms for practical and complex decision making problems.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									
CO6									

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3	0	0	3

(25D13104A) MEDICAL IMAGING WITH AI (PE-II)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Introduce the fundamentals of medical imaging modalities such as MRI, CT, Ultrasound, X ray, and PET.
2. Understand preprocessing, enhancement, and feature extraction techniques in medical imaging.
3. Apply segmentation and detection algorithms, including AI-based approaches.
4. Implement deep learning models for classification, detection, and analysis of medical images.
5. Explore ethical, legal, and regulatory issues in AI-driven healthcare applications.

UNIT-I INTRODUCTION TO MEDICAL IMAGING

Overview of imaging modalities: MRI, CT, X-ray, Ultrasound, PET, Basic principles of image acquisition and reconstruction, Characteristics of medical images: resolution, contrast, artifacts, and noise, Clinical importance of imaging in diagnosis and treatment, File formats in medical imaging (DICOM, NIfTI), Limitations and challenges in medical image analysis, Role of AI in clinical decision support and imaging workflows.

UNIT-II PREPROCESSING AND FEATURE EXTRACTION

Image enhancement: filtering, denoising, histogram equalization, Noise reduction techniques: Gaussian, median, and non-local means filtering, Normalization and standardization of medical image datasets, Feature extraction: shape, texture, intensity, and edge-based features, Dimensionality reduction: PCA, LDA, t-SNE (overview), Data augmentation strategies for medical imaging datasets, Introduction to medical imaging datasets: BraTS, CheXpert, LIDC-IDRI, ISLES, Hands-on: preprocessing pipeline for MRI/CT images.

UNIT-III SEGMENTATION AND DETECTION

Traditional segmentation methods: thresholding, region growing, clustering, Watershed algorithm and morphological segmentation, AI-based segmentation: U-Net, Mask R-CNN, DeepLab, Tumor and lesion detection techniques in MRI/CT images, Object detection in medical images using Faster R-CNN, YOLO, Evaluation metrics: Dice coefficient, Jaccard index, sensitivity/specificity, Case study: brain tumor segmentation (BraTS challenge), Hands-on: segmentation workflow for lung X rays or MRI scans.

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UNIT-IV DEEP LEARNING IN MEDICAL IMAGING

CNN architectures for classification: VGG, ResNet, DenseNet, Transfer learning and fine-tuning on medical datasets, Multi-modal deep learning: combining imaging with clinical data, Generative models (GANs, VAEs) for synthetic medical image generation, Applications: cancer detection, organ segmentation, COVID-19 diagnosis, Explainability in deep learning models for medical imaging, Deployment of AI models in clinical settings, Case study: deep learning for chest X-ray anomaly detection

UNIT-V ETHICS, REGULATIONS & ADVANCED TOPICS

Ethical issues in AI for healthcare: bias, transparency, and fairness, Data privacy and patient confidentiality challenges, Regulatory frameworks: HIPAA, GDPR, and FDA guidelines, Explainable AI and interpretability in medical decision-making, Federated learning for privacy preserving medical AI, Emerging trends: digital twins, precision medicine, personalized AI diagnosis, Role of AI in treatment planning and prognosis prediction, Research challenges and future directions in AI for healthcare imaging.

TEXT BOOKS:

1. S. Kevin Zhou, Hayit Greenspan, Dinggang Shen – Deep Learning for Medical Image Analysis, Academic Press.
2. Ayman El-Baz, Jasjit S. Suri – Big Data in Multimodal Medical Imaging, CRC Press.
3. Klaus D. Toennies – Guide to Medical Image Analysis, Springer.

REFERENCE BOOKS:

1. Geert Litjens et al. – A Survey on Deep Learning in Medical Image Analysis, Medical Image Analysis, 2017.
2. Ronneberger et al. – U-Net: Convolutional Networks for Biomedical Image Segmentation.
3. Esteva et al. – A Guide to Deep Learning in Healthcare, Nature Medicine.
4. Kaggle datasets and grand challenges: BraTS, ISLES, CheXpert.
5. Online resources: Medical Imaging with Deep Learning (MIDL) conference papers

COURSE OUTCOMES:

1. Explain medical imaging modalities and their fundamental characteristics.
2. Apply preprocessing and feature extraction techniques to medical images.
3. Implement deep learning architectures for classification, segmentation, and anomaly detection.
4. Evaluate AI methods for medical imaging tasks such as cancer detection, brain analysis, and organ segmentation.
5. Analyze ethical, privacy, and regulatory challenges in deploying AI for healthcare.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									

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CO2									
CO3									
CO4									
CO5									

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(25D13104B) DRONE TECHNOLOGIES (PE-II)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Introduce the fundamentals of drone design, aerodynamics, and system integration.
2. Explore navigation techniques, positioning systems, and autonomous flight mechanisms.
3. Understand the role of sensors, communication protocols, and payloads in drones.
4. Apply AI and machine learning techniques for drone control, perception, and decision making.
5. Study swarm drone concepts and their applications in defense, agriculture, logistics, and disaster management.
6. Analyze regulatory, ethical, and safety considerations in drone deployment.

UNIT-I FUNDAMENTALS OF DRONE DESIGN

Introduction to UAVs and types of drones (fixed-wing, rotary-wing, hybrid), Drone aerodynamics and flight principles, Structural design and material selection, Propulsion systems: motors, propellers, batteries, fuel cells, Flight dynamics and stability considerations, Drone system architecture: hardware and software components, Case studies: consumer drones vs. industrial drones

UNIT-II NAVIGATION, GUIDANCE, AND CONTROL

Basics of UAV navigation and guidance systems, GPS, GNSS, and alternative localization methods, Inertial Navigation Systems (INS) and sensor fusion, Path planning algorithms (Dijkstra, A*, RRT), Control strategies: PID, LQR, MPC for UAVs, Autonomous flight modes and autopilot systems (PX4, Ardupilot), Obstacle avoidance and collision detection methods

UNIT-III SENSORS, PAYLOADS, AND COMMUNICATION

Onboard sensors: IMU, gyroscope, accelerometer, magnetometer, Vision-based sensors: RGB, thermal, LiDAR, depth cameras, Environmental sensing (gas, weather, multispectral sensors), Payload integration: cameras, delivery mechanisms, agricultural sprayers, Communication systems: RF, Wi-Fi, 4G/5G, LoRaWAN, Drone-to-drone and drone-to-ground communication protocols, Power management and endurance enhancement techniques

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UNIT-IV AI AND AUTONOMOUS DRONE CONTROL

Role of AI in UAV autonomy and perception, Computer vision for drones (object detection, SLAM, mapping), Deep learning for aerial image classification and tracking, Reinforcement Learning (RL) for UAV path optimization, Swarm intelligence and AI-based coordination, Edge computing and onboard AI processing, Applications: surveillance, precision agriculture, disaster response, delivery services

UNIT-V SWARM DRONES, REGULATIONS, AND FUTURE TRENDS

Swarm drone architectures and coordination mechanisms, Multi-agent systems and communication in swarms, Applications of swarm drones (defense, search & rescue, smart cities), Cybersecurity threats and countermeasures in UAV networks, Regulatory frameworks: FAA, DGCA, EASA guidelines, Ethical and legal challenges in drone deployment, Future trends: drone taxis, autonomous cargo, military UAVs, AI-powered UAV swarms

TEXT BOOKS:

1. Randal W. Beard & Timothy W. McLain – Small Unmanned Aircraft: Theory and Practice, Princeton University Press.
2. Kimon P. Valavanis & George J. Vachtsevanos – Handbook of Unmanned Aerial Vehicles, Springer.
3. B.L. Stevens & F.L. Lewis – Aircraft Control and Simulation, Wiley.

REFERENCE BOOKS:

1. Paul G. Fahlstrom & Thomas J. Gleason – Introduction to UAV Systems, Wiley.
2. Michael S. Lewis – Autonomous Flying Robots: Unmanned Aerial Vehicles and Micro Aerial Vehicles, Springer.
3. Hussein A. Abbass et al. – Foundations of Trusted Autonomy, Springer (for AI and swarm aspects).
4. Research papers from IEEE Transactions on Robotics, Journal of Field Robotics, and Unmanned Systems.
5. Online resources: PX4 and Ardupilot documentation, Dronecode Consortium, FAA & DGCA guidelines.

COURSE OUTCOMES:

1. Explain drone design principles, aerodynamics, and system architecture.
2. Apply navigation, guidance, and control techniques for UAVs.
3. Evaluate and integrate sensors, payloads, and communication systems in drones.
4. Implement AI and machine learning algorithms for drone autonomy and decision making.
5. Analyze swarm drone coordination strategies and real-world applications.
6. Assess regulatory, safety, and ethical issues in drone technologies.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**

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CO1									
CO2									
CO3									
CO4									
CO5									
CO6									

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(25D13104C) AUTONOMOUS VEHICLES (PE-II)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Introduce the fundamentals of autonomous driving systems and their architecture.
2. Study perception methods using sensors and computer vision for environment understanding.
3. Explore localization, mapping, and state estimation techniques.
4. Apply path planning and control algorithms for autonomous navigation.
5. Integrate deep reinforcement learning for decision-making and vehicle control.
6. Analyze safety, ethical, and regulatory issues in autonomous vehicle deployment.

UNIT-I FUNDAMENTALS OF AUTONOMOUS VEHICLES

Introduction to autonomous driving: Levels of autonomy (SAE L0–L5), System architecture: perception, planning, control, and actuation layers, Vehicle dynamics and motion models (bicycle, kinematic, dynamic models), Drive-by-wire systems and electronic control units (ECUs), Autonomous driving platforms (Apollo, Autoware, CARLA simulator), Real-world applications: self-driving taxis, delivery vehicles, smart mobility, Challenges in autonomous driving (weather, infrastructure, safety)

UNIT-II PERCEPTION SYSTEMS

Sensors for AVs: LiDAR, radar, ultrasonic, cameras, Sensor calibration, synchronization, and fusion techniques, Environment perception: object detection and tracking, Semantic segmentation for road and lane detection, SLAM (Simultaneous Localization and Mapping) basics, Computer vision applications: traffic sign recognition, pedestrian detection, Datasets for AV perception (KITTI, Waymo, nuScenes)

UNIT-III LOCALIZATION AND MAPPING

Global Navigation Satellite Systems (GNSS) and limitations, Inertial Measurement Units (IMUs) and odometry, Kalman filters and Extended Kalman Filter (EKF) for state estimation, Particle filters and Monte Carlo Localization (MCL), Visual SLAM and LiDAR-based SLAM methods, High definition (HD) maps and map-based localization, Sensor fusion for robust localization under challenging conditions

UNIT-IV PATH PLANNING AND CONTROL

Motion planning problem formulation in AVs, Graph-based planning: Dijkstra, A*, RRT, PRM, Optimal control methods for trajectory generation, Local vs. global planning approaches, Control algorithms: PID, LQR, MPC for vehicle control, Obstacle avoidance strategies in dynamic environments, Simulation platforms for testing planning and control (CARLA, SUMO, Gazebo)

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UNIT-V DEEP REINFORCEMENT LEARNING, SAFETY & ETHICS

Introduction to Reinforcement Learning (RL) in autonomous driving, Deep RL architectures for control (DQN, DDPG, PPO, SAC), Imitation learning and behavior cloning for driving policy learning, Safe RL for collision-free navigation, Ethical challenges: decision-making in safety critical scenarios, Legal and regulatory issues in autonomous vehicle deployment, Future trends: V2X communication, cooperative AVs, AI-powered traffic systems

TEXT BOOKS:

1. Rajesh Rajamani – Vehicle Dynamics and Control, Springer.
2. Shaoshan Liu, Liyun Li, Jie Tang – Deep Learning for Autonomous Vehicle Control, Springer.
3. Umit Ozguner, Tankut Acarman, Keith Redmill – Autonomous Ground Vehicles, Artech House.

REFERENCE BOOKS:

1. Steven Waslander et al. – Autonomous Driving: Technical, Legal and Social Aspects, Springer.
2. Sebastian Thrun et al. – Probabilistic Robotics, MIT Press.
3. Recent papers from IEEE Transactions on Intelligent Transportation Systems and IEEE Robotics and Automation Letters.
4. Datasets & open platforms: KITTI, Waymo, nuScenes, Apollo, Autoware, CARLA simulator.

COURSE OUTCOMES:

1. Explain the system architecture and components of autonomous vehicles.
2. Apply perception techniques using LiDAR, radar, and vision-based systems.
3. Implement localization and mapping algorithms for autonomous navigation.
4. Develop path planning and motion control strategies.
5. Apply deep reinforcement learning techniques for autonomous driving tasks.
6. Analyze safety, ethical, and regulatory issues in autonomous vehicle systems.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									
CO6									

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L	T	P	C
3	0	0	3

(25D13104D) MACHINE LEARNING & DEEP LEARNING APPLICATIONS (PE-II)

Course Category	**Professional Elective (PE)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To learn basic machine learning and probabilistic decision concepts.
2. To study various classification and estimation techniques in machine learning.
3. To understand ensemble techniques, dimensionality reduction, and clustering methods in machine learning.
4. Understand clustering methods and neural network models for pattern analysis.
5. Understand deep learning architectures and their applications in complex data analysis.

UNIT-I UNIT-I

Introduction to ML, Performance Measures, Bias-Variance Trade off, Linear Regression. Bayes Decision Theory, Normal Density and Discriminant Function, Bayes Decision Theory – Binary Features, Bayesian Belief Network.

UNIT-II UNIT-II

Parametric and Non- Parametric Density Estimation – ML and Bayesian Estimation, Parzen Window and KNN, Perceptron Criteria, Discriminative models, Support Vector Machines (SVM), Logistic Regression, Decision trees, Hidden Markov Model (HMM).

UNIT-III UNIT-III

Ensemble methods: Ensemble strategies, boosting and bagging, Random Forest Dimensionality Problem, Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), Concept of mixture model, Gaussian mixture model, Expectation Maximization Algorithm, K- means clustering.

UNIT-IV UNIT-IV

Clustering - Fuzzy K-means clustering, Hierarchical Agglomerative Clustering, Mean-shift clustering. Neural network: Perceptron, multilayer network, backpropagation, RBF Neural Network, Applications

UNIT-V UNIT-V

Introduction to Deep Learning, Convolutional Neural Networks (CNN), Vanishing and Exploding Gradients in Deep Neural Networks, LeNet - 5, AlexNet, VGGNet, GoogleNet, and ResNet. Generative Adversarial Networks (GAN), Auto Encoders and Relation to PCA, Recurrent Neural Networks, U-Net, Applications and Case studies.

TEXT BOOKS:

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1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 4th Edition, 2020.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
3. Trevor Hastie, Robert Tibshirani, and Jerome Friedman, The Elements of Statistical

REFERENCE BOOKS:

1. Learning: Data Mining, Inference, and Prediction, Springer, 2nd Edition, 2009.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.

COURSE OUTCOMES:

1. Able to apply machine learning and Bayesian methods for prediction and analysis.
2. Able to apply parametric, non-parametric, and discriminative models for pattern recognition.
3. Able to implement ensemble, dimensionality reduction, and clustering algorithms for data analysis.
4. Apply clustering and neural network techniques for data classification and prediction.
5. Utilize deep neural network models for image, sequence, and generative tasks.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									

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L	T	P	C
0	0	4	2

(25D58105) ADVANCED DATA STRUCTURES & ALGORITHMS LAB

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Provide hands-on experience with advanced data structures and algorithms.
2. Implement graph algorithms, trees, heaps, and hashing techniques.
3. Explore AI-based data structures and their applications.
4. Develop problem-solving and optimization skills for AI and ML applications.
5. Enhance programming proficiency in implementing efficient algorithms.

1. Implementation of Min Heap and Max Heap – insertion, deletion, heapify.

2. Priority Queue using Heaps – scheduling applications.

3. B-Trees and B+ Trees – insertion and search operations.

4. Hash Tables – linear probing, quadratic probing, chaining.

5. Disjoint Set (Union-Find) – applications in network connectivity.

6. Graph Traversals – BFS, DFS, applications in AI search.

7. Shortest Path Algorithms – Dijkstra, Bellman-Ford, A*.

8. Minimum Spanning Trees – Kruskal’s and Prim’s algorithms.

9. Tries (Prefix Trees) – autocomplete and spell-check applications.

10. KD-Trees for Nearest Neighbor Search – AI and ML use cases.

11. R-Trees for Spatial Data Indexing – GIS and computer vision applications.

12. AI-based Experiment – Implement Graph Neural Network (GNN) basics or Reinforcement Learning search using advanced data structures.

TEXT BOOKS:

1. Thomas H. Cormen et al. – Introduction to Algorithms, MIT Press.
2. Sartaj Sahni – Data Structures, Algorithms and Applications in C++, Universities Press.

3. Narasimha Karumanchi – Data Structures and Algorithms Made Easy.

REFERENCE BOOKS:

1. Steven Skiena – The Algorithm Design Manual, Springer.
2. Goodrich & Tamassia – Algorithm Design and Applications.
3. Research papers on AI-based data structures (Trie, KD-Tree, GNN).
4. Online resources: GeeksforGeeks, LeetCode, Kaggle (for AI applications).

COURSE OUTCOMES:

1. Implement and analyze advanced data structures (heaps, B-trees, hashing).
2. Apply graph algorithms to solve real-world AI-related problems.
3. Design and implement AI-based data structures (Trie, KD-Tree, R-Tree).
4. Evaluate performance and complexity of implemented algorithms.
5. Use modern tools and libraries to implement and visualize algorithms.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									

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L	T	P	C
0	0	4	2

(25D13105) AI AND ML LAB

Course Category	**Professional Core course (PC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. Provide hands-on experience with machine learning and deep learning techniques.
2. Implement supervised and unsupervised learning algorithms on real-world datasets.
3. Explore deep learning frameworks (TensorFlow, PyTorch) for AI applications.
4. Apply AI/ML methods to natural language processing (NLP) and computer vision (CV) tasks.
5. Develop problem-solving and model evaluation skills using modern AI tools.

1. Linear Regression & Polynomial Regression – predicting continuous values.

2. Logistic Regression & SVM – binary/multi-class classification.

3. Decision Trees and Random Forests – classification on real-world datasets.

4. K-Means and Hierarchical Clustering – unsupervised learning applications.

5. Principal Component Analysis (PCA) – dimensionality reduction & visualization.

6. Artificial Neural Networks (ANNs) – basic feedforward and backpropagation.

7. Convolutional Neural Networks (CNNs) – image classification (MNIST/CIFAR-10).

8. Transfer Learning with Pretrained Models – ResNet, VGG, or MobileNet.

9. Recurrent Neural Networks (RNNs) & LSTMs – text sequence modeling.

10. NLP Experiment – text classification / sentiment analysis using embeddings (Word2Vec, BERT).

11. Computer Vision Experiment – object detection using YOLO/Faster R-CNN.

12. Capstone AI Experiment – integrate ML/DL for a real-world dataset (healthcare, finance, or social media analytics).

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COURSE OUTCOMES:

1. Implement classical ML algorithms for regression, classification, and clustering.
2. Apply neural networks and deep learning models using TensorFlow/PyTorch.
3. Solve NLP tasks using text processing and deep learning approaches.
4. Apply computer vision models for image classification and detection tasks.
5. Evaluate AI/ML models with appropriate metrics and optimize performance.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									

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M.Tech. I Sem. L T P C

(25D13205) AGENTIC AI LAB

Course Category	
Course Enrichment Relevance	

COURSE OBJECTIVES:

1. Linear Regression & Polynomial Regression – predicting continuous values.

2. Logistic Regression & SVM – binary/multi-class classification.

3. Decision Trees and Random Forests – classification on real-world datasets.

4. K-Means and Hierarchical Clustering – unsupervised learning applications.

5. Principal Component Analysis (PCA) – dimensionality reduction & visualization.

6. Artificial Neural Networks (ANNs) – basic feedforward and backpropagation.

7. Convolutional Neural Networks (CNNs) – image classification (MNIST/CIFAR-10).

8. Transfer Learning with Pretrained Models – ResNet, VGG, or MobileNet.

9. Recurrent Neural Networks (RNNs) & LSTMs – text sequence modeling.

10. NLP Experiment – text classification / sentiment analysis using embeddings (Word2Vec, BERT).

11. Computer Vision Experiment – object detection using YOLO/Faster R-CNN.

12. Capstone AI Experiment – integrate ML/DL for a real-world dataset (healthcare, finance, or social media analytics).

COURSE OUTCOMES:

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**

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M.Tech. I Sem. L T P C

(25D13206) XAI AND RESPONSIBLE AI LAB (PYTHON FOR BIG DATA)

Course Category	
Course Enrichment Relevance	

COURSE OBJECTIVES:

1. Linear Regression & Polynomial Regression – predicting continuous values.

2. Logistic Regression & SVM – binary/multi-class classification.

3. Decision Trees and Random Forests – classification on real-world datasets.

4. K-Means and Hierarchical Clustering – unsupervised learning applications.

5. Principal Component Analysis (PCA) – dimensionality reduction & visualization.

6. Artificial Neural Networks (ANNs) – basic feedforward and backpropagation.

7. Convolutional Neural Networks (CNNs) – image classification (MNIST/CIFAR-10).

8. Transfer Learning with Pretrained Models – ResNet, VGG, or MobileNet.

9. Recurrent Neural Networks (RNNs) & LSTMs – text sequence modeling.

10. NLP Experiment – text classification / sentiment analysis using embeddings (Word2Vec, BERT).

11. Computer Vision Experiment – object detection using YOLO/Faster R-CNN.

12. Capstone AI Experiment – integrate ML/DL for a real-world dataset (healthcare, finance, or social media analytics).

COURSE OUTCOMES:

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

M.Tech. I Sem.

L	T	P	C
2	0	0	2

(25D57107) RESEARCH METHODOLOGY AND IPR

Course Category	**Mandatory Course (credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To understand the research design process and data collection methods.
2. To develop skills in data analysis and reporting
3. To familiarize students with intellectual property rights (IPR) and patents.
4. To apply research skills in real-world contexts.

UNIT-I UNIT-I

Overview of research process and design - Types of Research - Approaches to Research (Qualitative vs Quantitative) - Observation studies, Experiments and Surveys - Use of Secondary and exploratory data to answer the research question - Importance of Reasoning in Research and Research ethics - Documentation Styles (APA/IEEE etc.) - Plagiarism and its consequences

Learning Outcomes ● Recall key concepts of the research process, including different types and approaches to research, and the importance of ethics.

● Differentiate between qualitative and quantitative research approaches and the various uses of secondary data.

● Identify the core principles of research design and ethics, including plagiarism and documentation styles.

● Explain the significance of reasoning and ethical conduct in all stages of the research process.

● Apply knowledge of different documentation styles, such as APA and IEEE, to properly cite sources and avoid plagiarism.

UNIT-II UNIT-II

Importance of Data Collection - Types of Data - Data Collection Methods - Data Sources - primary, secondary and Big Data sources - Data Quality & Ethics - Tools and Technology for Data Collection

Learning Outcomes

● Identify different types of data and the various methods for collecting both primary and secondary data.

● Explain the importance of data quality and ethical considerations in data collection.

● Differentiate between primary, secondary, and Big Data sources.

● Describe the various tools and technologies used for effective data collection. Analyze the ethical implications of data collection and ensure data quality in a research study.

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UNIT-III UNIT-III

Overview of Multivariate analysis - Experimental research, cause-effect relationship, and development of hypotheses- Measurement systems analysis, error propagation, and validity of experiments - Guidelines for writing abstracts, introductions, methodologies, results, and discussions - Writing Research Papers & proposals

Learning Outcomes

● Apply knowledge of multivariate analysis and experimental research to develop hypotheses and analyze data.

● Explain the process of measurement systems analysis and error propagation in experimental design.

● Formulate clear and concise abstracts, introductions, and methodologies for research papers.

● Write effective results and discussion sections based on data analysis. Develop comprehensive research papers and proposals based on proper data analysis and reporting guidelines.

UNIT-IV UNIT-IV

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

Learning Outcomes ● Recall the fundamental concepts of Intellectual Property (IP) and its evolution.

● Describe the roles of organizations like **WIPO** and **WTO** in the establishment of IPR.

● Differentiate between various types of IPR, including trade secrets and trademarks.

● Explain the common rules and features of IPR agreements and the role of UNESCO.

● Analyze the relationship between IPR and biodiversity, and its broader impact.

UNIT-V UNIT-V

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification - Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents

Learning Outcomes

● Explain the objectives, benefits, and key features of a patent, including the concept of an inventive step.

● Differentiate between the various types of patent applications and the e-filing process.

● Describe the process of patent examination, grant, and revocation.

● Identify the roles of patent agents and the process for their registration. Analyze the concepts of equitable assignments, licenses, and licensing of related patents.

TEXT BOOKS:

1. 1.Stuart Melville and Wayne Goddard, Research Methodology: An introduction for Science & Engineering students, Juta and Company Ltd, 2004
2. 2.Catherine J. Holland, Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets, Entrepreneur Press, 2007.

3. 1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education 11e (2012).
4. Ranjit Kumar , Research Methodology: A Step-by-Step Guide for Beginners. . David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
5. Deborah E. Bouchoux , Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 6th Edition, Cengage 2024.
6. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, The Craft of Research, 5th Edition, University of Chicago Press, 2024

REFERENCE BOOKS:

1. Coursera / edX – Research Methodology and Data Analysis courses
2. Springer Link & ScienceDirect – Latest journals on research design and statistics
3. Google Scholar – Free access to research papers
4. NCBI Bookshelf – Open-access research methodology resources
5. Khan Academy (Statistics & Probability) – For fundamentals of hypothesis testing, regression, and ANOVA.

COURSE OUTCOMES:

1. Recall key concepts and terminology related to research design, data collection, and intellectual property rights.
2. Explain the importance of research design and data analysis in research studies, and describe the concept of intellectual property rights.
3. Design a research study, including data collection and analysis methods, and apply intellectual property rights principles to protect research findings.
4. Analyze research studies to identify strengths and limitations, and evaluate the effectiveness of data collection and analysis methods.
5. Assess the impact of intellectual property rights on research and innovation, and evaluate the effectiveness of research designs and methods.
6. Develop a comprehensive research plan, including a detailed research design, data collection and analysis methods, and a plan for protecting intellectual property.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									
CO6									

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M.Tech. I Sem.

L	T	P	C
0	1	2	2

(25D13106) MLOPS & AI MODEL DEVELOPMENT

Course Category	**Skill Oriented Course (SC)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To provide hands-on exposure to building and deploying AI/ML models.
2. To introduce MLOps practices for scalable and reproducible AI systems.
3. To integrate data pipelines, CI/CD, and monitoring for ML workflows.
4. To develop industry-ready skills for AI application deployment.

Unit I:

Fundamentals of MLOps & Workflow Automation Introduction to MLOps: Need & Benefits, ML Lifecycle: Data → Model → Deployment → Monitoring, Experiment tracking (MLflow, Weights & Biases), Data versioning (DVC, Delta Lake), Workflow orchestration basics (Airflow, Kubeflow), Reproducibility & automation challenges, Case study: End-to-end ML workflow, Hands-on: Setting up ML pipeline with MLflow

Unit II:

Data Engineering for AI Pipelines: Data ingestion & preprocessing pipelines, Handling structured & unstructured data, Batch vs. real time data processing, Streaming data in ML (Kafka, Spark Streaming), Feature engineering & feature stores, Data quality monitoring, Scalable storage systems for ML, Hands-on: Building a data pipeline with Kafka/Spark

Unit III:

Model Development & Deployment: Model training best practices, Hyperparameter tuning & AutoML, Model compression & optimization, Containerization with Docker, Deployment strategies: REST APIs, microservices, Model serving frameworks (TensorFlow Serving, TorchServe, FastAPI), CI/CD for ML models (GitHub Actions, Jenkins), Hands-on: Deploying a model as REST API using Docker + FastAPI

Unit IV:

Monitoring, Maintenance & Responsible AI Model monitoring: drift detection, performance tracking, Logging & error handling, Continuous monitoring frameworks (Prometheus, Grafana, EvidentlyAI), Retraining pipelines for adaptive learning, A/B testing & shadow deployment in ML, Bias, fairness, and explainability in AI models,

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Ethical AI practices in deployment, Hands-on: Monitoring drift in deployed model

Unit V:

Industrial Applications & Case Studies

MLOps in healthcare (diagnosis, patient monitoring), MLOps in finance (fraud detection, risk analytics), AI in manufacturing (predictive maintenance, anomaly detection), Cloud platforms for MLOps (AWS Sagemaker, Azure ML, GCP AI Platform), Blockchain integration for AI model security, Scaling MLOps in large enterprises, Case study: End-to-end MLOp

TEXT BOOKS:

1. Mark Treveil, Alok Shukla ??? Introducing MLOps: How to Scale Machine Learning in the Enterprise. O???Reilly.
2. Emmanuel Raj ??? Engineering MLOps: Rapidly build, test, and manage production-ready machine learning life cycles. Packt.

REFERENCE BOOKS:

1. Hannes Hapke, Catherine Nelson – Machine Learning in Production: Developing and Operating AI Models. O'Reilly.
2. Munn, Deep – Practical MLOps. Manning.

COURSE OUTCOMES:

1. Explain MLOps concepts and lifecycle for ML/AI model development.
2. Apply pipeline automation for training, validation, deployment, and monitoring.
3. Use containerization and orchestration for scalable AI services.
4. Evaluate ML models in production with monitoring and drift detection.
5. Analyze challenges in governance, reproducibility, and ethical deployment of AI systems.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									

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L	T	P	C
2	0	0	0

(25D57109A) ENGLISH FOR RESEARCH PAPER WRITING (AC-I)

Course Category	**Mandatory Course (Non-credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To equip students with the fundamentals of academic English for research paper writing.
2. To develop students' advanced reading skills for analyzing and evaluating research articles.
3. To refine students' grammar and language skills for clarity and precision in research writing.
4. To master the skills of revising, editing, and proofreading research papers.
5. To familiarize students with the role of technology and AI in research writing, including digital literacy and ethical considerations.

UNIT-I UNIT-I

:

Academic English - MAP (Message-Audience-Purpose) - Language Proficiency for Writing - Key Language Aspects - Clarity and Precision - Objectivity - Formal Tone - Integrating References - Word order - Sentences and Paragraphs - Link Words for Cohesion - Avoiding Redundancy / Repetition - Breaking up long sentences - Structuring Paragraphs - Paraphrasing Skills – Framing Title and Sub headings

UNIT-II UNIT-II

Reading Academic Texts - Critical Reading Strategies - Skimming and Scanning - Primary Research Article vs. Review Article - Reading an Abstract - Analyzing Research Articles - Identifying Arguments - Classifying Methodologies - Evaluating Findings - Making Notes

UNIT-III UNIT-III

Advanced Punctuation Usage - Grammar for Clarity - Complex Sentence Structures - Active- Passive Voice - Subject-Verb Agreement - Proper Use of Modifiers - Avoiding Ambiguous Pronoun References - Verb Tense Consistency - Conditional Sentences

UNIT-IV UNIT-IV

Effective Revisions - Restructuring Paragraph - Editing vs Proofreading, Editing for Clarity and Coherence - Rectifying Sentence Structure Issues - Proofreading for Grammatical Precision – Spellings - Tips for Correspondence with Editors - Critical and Creative Phases of Writing

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UNIT-V UNIT-V

Digital Literacy and Critical Evaluation of Online Content - Technology and Role of AI in Research Writing – Assistance in Generating Citations and References - Plagiarism and Ethical Considerations – Tools and Awareness – Fair Practices

TEXT BOOKS:

1. Bailey. S. Academic Writing: A Handbook for International Students. London and New York: Routledge,2015.
2. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

REFERENCE BOOKS:

1. Craswell, G. Writing for Academic Success, Sage Publications, 2004.
2. Peter Elbow, Writing With Power, E-book, Oxford University Press, 2007
3. Oshima, A. & Hogue, A. Writing Academic English, Addison-Wesley, New York, 2005
4. Swales, J. & C. Feak, Academic Writing for Graduate Students: Essential Skills and Tasks. Michigan University Press, 2012.
5. Goldbort R.Writing for Science, Yale University Press (available on Google Books), 2006
6. Day R.How to Write and Publish a Scientific Paper, Cambridge University Press, 2006

COURSE OUTCOMES:

1. Recall the key language aspects and structural elements of academic writing in research papers.
2. Explain the importance of clarity, precision, and objectivity in research writing.
3. Apply critical reading strategies and advanced grammar skills to analyze and write research papers.
4. Analyze research articles and identify the strengths and limitations of different methodologies.
5. Evaluate research papers to check for plagiarism, structure, clarity, and language accuracy.
6. Develop a well-structured research paper that effectively communicates complex ideas.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									

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CO6									

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

M.Tech. I Sem.

L	T	P	C
2	0	0	0

(25D57109C) DISASTER MANAGEMENT (AC-I)

Course Category	**Mandatory Course (Non-credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To enable the students to understand the fundamental concepts of disasters, hazards, their factors, and significance with special reference to India.
2. To prepare them to classify and analyze different types of natural and man-made disasters, their causes, magnitude, and impacts.
3. To foster them develop understanding of disaster preparedness, monitoring systems, and the role of government, community, and media.
4. To equip them in learning risk assessment techniques, disaster risk reduction strategies, and the importance of global and national cooperation.
5. To foster their ability to think critically and respond to disasters and design effective mitigation measures (structural and non-structural) with a focus on emerging trends and Indian disaster management programs.

UNIT-I UNIT-I

Disaster - Definition, Factors and Significance - Difference Between Hazard and Disaster - Natural and Man-made Disasters - Difference, Nature, Types and Magnitude - Disaster Prone Areas in India - Study of Seismic Zones - Areas Prone to Floods and Droughts, Landslides and Avalanches - Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami - Post-Disaster Diseases and Epidemics.

UNIT-II UNIT-II

Economic Damage - Loss of Human and Animal Life - Destruction of Ecosystem - Natural Disasters - Earthquakes, Volcanism, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster - Nuclear Reactor Meltdown - Industrial Accidents - Oil Slick sand Spills - Outbreaks of Disease and Epidemics War and Conflicts

UNIT-III UNIT-III

Preparedness - Monitoring of Phenomena - Triggering a Disasteror Hazard - Evaluation of RiskApplication of Remote Sensing - Data from Meteorological and Other Agencies - Media ReportsGovernmental and Community Preparedness

UNIT-IV UNIT-IV

Disaster Risk -Concept and Elements, Disaster Risk Reduction - Global and National Disaster Risk Situation -Techniques of Risk Assessment – Global Co-Operation in Risk Assessment and Warning - People’s participation in Risk Assessment – Strategies for Survival

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UNIT-V UNIT-V

Meaning, Concept and Strategies of Disaster Mitigation - EmergingTrends in Mitigation - Structural Mitigation and Non- Structural Mitigation - Programs of Disaster Mitigation in India.

TEXT BOOKS:

1. Gupta, H. K. Disaster Management. Universities Press, 2003
2. Singh, R. B. Natural Hazards and Disaster Management. Rawat Publications, 2006.

REFERENCE BOOKS:

1. Coppola, D. P. (2020). Introduction to International Disaster Management (4th ed.). Elsevier.
2. Shaw, R., & Izumi, T. (2022). Science and Technology in Disaster Risk Reduction in Asia. Springer.
3. Wisner, B., Gaillard, J. C., & Kelman, I. (2021). Handbook of Hazards and Disaster Risk Reduction and Management (2nd ed.). Routledge.
4. Saini, V. K. (2021). Disaster Management in India: Policy, Issues and Perspectives. Sage India.
5. Kelman, I. Disaster by Choice: How Our Actions Turn Natural Hazards into Catastrophes, Oxford University Press, 2022
6. Sahni, P. & Dhameja, A. Disaster Mitigation: Experiences and Reflections. Prentice Hall of India, 2004.

COURSE OUTCOMES:

1. Define and distinguish between hazards and disasters, and explain their types, nature, and impacts.
2. Identify and map disaster-prone areas in India and understand the epidemiological consequences of disasters.
3. Assess the economic, social, and ecological repercussions of major natural and man-made disasters.
4. Demonstrate knowledge of disaster preparedness tools such as remote sensing, meteorological data, risk evaluation, and community awareness.
5. Apply risk assessment methods and propose disaster risk reduction strategies at local, national, and global levels.
6. Formulate and evaluate structural and non-structural disaster mitigation strategies, with emphasis on Indian programs and emerging trends.

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									

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CO4									
CO5									
CO6									

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DEPARTMENT OF CSE - COMPUTER SCIENCE ENGINEERING (AI&ML)

M.Tech. I Sem.

L	T	P	C
2	0	0	0

(25D57109D) ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (AC-I)

Course Category	**Mandatory Course (Non-credit)**
Course Enrichment Relevance	**Employability**

COURSE OBJECTIVES:

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system.
2. To make them understand the need for protecting traditional knowledge and its significance in the global economy.
3. To make them understand the legal frame work and policies related to traditional knowledge protection.
4. To enable them to understand the relationship between traditional knowledge and intellectual property rights.
5. To make them explore the applications of traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology

UNIT-I UNIT-I

Introduction to traditional knowledge - Definition, Nature and characteristics, scope and importance - Kinds of traditional knowledge - Physical and social contexts in which traditional knowledge develop - Historical impact of social change on traditional knowledge systems - Indigenous Knowledge (IK) – Characteristics - traditional knowledge vis-à-vis indigenous knowledge -Traditional knowledge Vs western knowledge, traditional knowledge vis-à-vis formal knowledge.

Learning Outcomes: At the end of the unit the student will able to:

> Understand the concept of traditional knowledge.
> Contrast and compare characteristics, importance& kinds of traditional knowledge.
> Analyze physical and social contexts of traditional knowledge.
> Evaluate social change on traditional knowledge.

UNIT-II UNIT-II

Protection of traditional knowledge- Need for protecting traditional knowledge - Significance of TK Protection - Value of TK in global economy - Role of Government to harness TK.

Learning Outcomes: At the end of the unit the student will able to:

> Know the need of protecting traditional knowledge.
>Apply significance of TK protection.
>Analyze the value of TK in global economy.
> Evaluate role of government

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UNIT-III UNIT-III

Legal frame work and TK - A)The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 - Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act) – B)The Biological Diversity Act 2002 and Rules 2004 - the protection of traditional knowledge bill, 2016 - Geographical Indicators Act 2003.

Learning Outcomes: At the end of the unit the student will able to:

>Understand legal frame work of TK.

> Contrast and compare the ST and other traditional forest dwellers

> Analyze plant variant protections

> Understand the rights of farmers forest dwellers

UNIT-IV UNIT-IV

Traditional knowledge and Intellectual property - Systems of traditional knowledge protection - Legal concepts for the protection of traditional knowledge - Certain non-IPR mechanisms of traditional knowledge protection - Patents and traditional knowledge - Strategies to increase protection of traditional knowledge -Global legal FORA for increasing protection of Indian Traditional Knowledge.

Learning Outcomes: At the end of the unit the student will able to:

> Understand TK and IPR

> Apply systems of TK protection.

> Analyze legal concepts for the protection of TK.

>Evaluate strategies to increase the protection of TK.

UNIT-V UNIT-V

Traditional knowledge in different sectors - Traditional knowledge and Engineering - Traditional medicine system - TK and Biotechnology - TK in Agriculture - Traditional societies depend on it for their food and healthcare needs - Importance of conservation and sustainable development of environment - Management of biodiversity, Food security of the country and protection of TK

Learning Outcomes: At the end of the unit the student will be able to:

> Know TK in different sectors.

> Apply TK in Engineering.

>Analyze TK in various sectors.

> Evaluate food security and protection of TK in the country.

TEXT BOOKS:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning Pvt.Ltd. Delhi, 2022.
2. Basanta Kumar Mohanta and Vipin Kumar Singh,Traditional Knowledge System and Technology in India, PratibhaPrakashan 2012.

REFERENCE BOOKS:

1. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.

2. Kak, S.C. “On Astronomy in Ancient India”, Indian Journal of History of Science, 22(3), 1987
3. Subbarayappa, B.V. and Sarma, K.V. Indian Astronomy: A Source Book, Nehru Centre, Mumbai, 1985.
4. Bag, A.K. History of Technology in India, Vol. I, Indian National Science Academy, New Delhi, 1997.
5. Acarya, P.K. Indian Architecture, Munshiram Manoharlal Publishers, New Delhi, 1996.
6. Banerjea, P. Public Administration in Ancient India, Macmillan, London, 1961.
7. Kapoor Kapil, Singh Avadhesh,Indian Knowledge Systems Vol – I & II, Indian Institute of Advanced Study, Shimla, H.P., 2022

COURSE OUTCOMES:

1. Define and explain the concept of traditional knowledge, its nature, characteristics, and scope
2. Understand the need for protecting traditional knowledge and its significance in the global economy
3. Explain the legal framework and policies related to traditional knowledge protection
4. Apply traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology
5. Analyze the importance of traditional knowledge in various contexts, including its historical impact and social change
6. Analyze the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms

Mapping COs with POs & PSOs:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1									
CO2									
CO3									
CO4									
CO5									
CO6									

SANTHIRAM ENGINEERING COLLEGE, NANDYAL (AUTONOMOUS)

R-25

M.TECH (CSE-AI & ML)

VISION

- To become a nucleus for pursuing technical education and pool industrial research and developmental activities with social-conscious and global standards.

MISSION

M1: To provide Advanced Educational Programs and prepare students to achieve success and take leading roles in their chosen fields of specialization by arising a self-sustained University.

M2: To establish postgraduate programs in the current and Advanced Technologies.

M3: To establish an R&D Consultancy through developing Industry Institute Interaction, building up exceptional infrastructure.

M4: To propel every individual, realize and act for the technical development of the society.

MOTTO

- Education for Peace and Progress

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