K.S.R.M.
COLLEGE OF ENGINEERING

(UGC - Autonomous)
Accredited by NAAC with A+ Grade & B.Tech. (EEE, ECE, CSE, CE and ME) Programs by NBA
An ISO 9001:2015, 14001: 2015 & 50001: 2018 Certified Institution

ACADEMIC REGULATIONS (R25PG)
COURSE STRUCTURE AND SYLLABI

(Effective for the students admitted into I year
from the academic year 2025 -2026 onwards)

MASTER OF TECHNOLOGY (M.Tech.)
ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

(Regular, Full-time)

K.S.R.M. COLLEGE OF ENGINEERING

VISION:

To evolve as a centre of repute for providing quality academic programs amalgamated with creative learning and research excellence to produce graduates with leadership qualities, ethical and human values to serve the nation.

MISSION:

M1. Provide high quality education with enriched curriculum blended with impactful Teaching-Learning practices.

M2. Promote Research, Entrepreneurship and Innovation through industry collaborations.

M3. Produce highly competent professional leaders for contributing to socio-economic development of the region and the nation.

DEPARTMENT
OF
COMPUTER SCIENCE AND ENGINEERING

VISION:

To evolve as a recognized center of excellence in the area of Computer Science and Engineering and other related inter-disciplinary fields.

MISSION:

M1. To produce competent and industry ready professionals through well balanced curriculum and innovative pedagogy.

M2. To provide conducive environment for research by establishing centre of excellence and industry collaborations.

M3. To instill leadership qualities, ethical values among students through various co-curricular and extracurricular activities.

M.Tech ARTIFICIAL INTELLEGENCE AND DATA SCIENCE

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1. Equip graduates with advanced knowledge in AI, machine learning, and data science to solve complex problems and drive innovation.

PEO2. Enable postgraduates to contribute effectively in industries, academia, research, and startups using modern AI tools and methodologies.

PEO3. Promote innovation, entrepreneurship, and lifelong learning in emerging areas like deep learning, NLP, computer vision, and big data.

PEO4. Develop ethical responsibility, communication, and leadership skills for collaborative work and sustainable AI solutions.

PROGRAM OUTCOMES (POs)

After completion of the Program, graduates will be able to

PO1. Apply advanced AI and data science concepts to solve complex problems using modern tools and techniques.

PO2. Conduct research to address challenges in AI domains like NLP, computer vision, and predictive analytics.

PO3. Design scalable, efficient, and ethical AI systems that meet performance and societal requirements.

PO4. Use programming languages, software frameworks, and project management tools to develop and deploy AI solutions.

PO5. Communicate technical insights effectively and uphold ethical standards in data and AI practices.

PO6. Engage in lifelong learning and assess the global and societal impact of AI technologies.

K.S.R.M. COLLEGE OF ENGINEERING

(AUTONOMOUS)

Academic Regulations of M.Tech. (Full Time/Regular) Programme

(Effective for the students admitted into I year from the Academic Year 2025-26 and onwards)

K.S.R.M. College of Engineering (KSRMCE) 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 affiliating university Jawaharlal Nehru Technological University Anantapur 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 and are as follows:

Discipline	**Name of the Specialization**	**Code**
Civil Engineering	Geo Technical Engineering	12
Electrical and Electronics Engineering	Power Systems	52
Mechanical Engineering	Renewable Energy	99
Computer Science and Engineering	Artificial Intelligence and Data Science	98
Electronics & Communication Engineering	Embedded Systems & VLSI	84

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/specialization.
2.	Elective Courses	Professional Elective Courses (PE)	Includes elective courses related to the parent discipline / department / branch of Engineering
		Open Elective Courses (OE)	Elective courses which include inter-disciplinary courses or courses in an area outside the parent discipline which are of importance in the context of special skill development
3.	Mandatory Courses	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

S. No.	Broad Course Classification	Course Category	Description
		Short Term Industry Internship	To provide real time exposure
		Dissertation	To provide application of domain knowledge to solve real problems
5.	Audit Courses	Mandatory non-credit courses	Covering courses 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 Semester-End 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 semester-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 course - wise (irrespective of credits assigned), for a maximum of 100 marks for theory and 100 marks for practical, based on Internal Evaluation and Semester-End Examination.

8.1 There shall be five units in each of the theory courses. For the theory courses 60 marks will be for the Semester-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 sub-questions.

8.4 For practical courses, 60 marks shall be for the Semester-End 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 semester-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 course if he secures a minimum of 40% of marks in the Semester-End Examination and a minimum aggregate of 50% of the total marks in the Semester-End Examination and Internal Evaluation taken together.

8.7 In case the candidate does not secure the minimum academic requirement in any of the courses he/she has to reappear for the Semester-End Examination either supplementary or regular in that course or repeat the course when next offered or do any other specified course 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 University 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, students are allowed to do up to a maximum of 40% of the Professional and Open Electives in a semester through SWAYAM/SWAYAM Plus.

9.1 The college offers 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 college, it is mandatory for the student to share necessary information with the college

9.4 The institution will list out 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 will 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 JNTUA 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 semester-end 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 semester-end exam may be conducted by the National Testing Agency (NTA), the National Programme on Technology Enhanced Learning (NPTEL) or the College during the regular end-term exams. Evaluation shall comprise 60% weightage for the semester-end 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 also ensures that the student completes the course and produces 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 will 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 college will ensure no overlap of SWAYAM MOOC exams with that of the semester-end examination schedule. In case of delay in SWAYAM results, the college 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 institution maintains the following in the examination section and submits as and when demanded by the university:

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 college will 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 are 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 Principal with the recommendations of the concerned HoD and Dean, Academics 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 course 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 courses for which the Internal Evaluation marks secured are more than 50%.

10.3 Out of the courses 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 course and for a maximum of **three** Theory courses for Improvement of Internal evaluation marks.

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

10.5 For re-registration, the candidates have to apply to the Principal through the respective HoD by paying the requisite fees and get approval from the Principal before the start of the semester in which re-registration is required

10.6 In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the Semester-End Examinations marks secured in the previous attempt(s) for the reregistered courses 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 requirements in all the courses, 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. Student shall initiate the project work, only after obtaining the approval of the PRC.

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 College. For this, a panel of three examiners shall be submitted by the supervisor concerned and department head for each student. However, the dissertation will be adjudicated by one examiner nominated by the Principal.

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 taking the approval from the Principal.

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 College.

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 Principal. The student must secure a minimum of 50% marks to be declared as passed

14 Credits for Co-curricular Activities

A Student should earn 01 credits under the head of co-curricular activities, viz., attending Conference, Scientific Presentations and Other Scholarly Activities.

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 course 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 course shall be considered failed and will be required to reappear for that course 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} course 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.,

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

   where "S_i" is the SGPA of the i^{th} semester and C_j 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 courses 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 Academic Council 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 courses as and when courses 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 College 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 College.

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RULES FOR

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

S.No.	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 course 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 course of the examination).	Expulsion from the examination hall and cancellation of the performance in that course only.
1.(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 course 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 course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
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 University 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 courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all University examinations if his

S.No.	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
		involvement is established. Otherwise, the candidate is 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. 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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses 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.
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 course 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 in or 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 officer-in-charge, 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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester / year. If the candidate physically assaults the invigilator / officer-in-charge of the 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.

S.No.	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
	of the examination.	
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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses 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	Possessany lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses 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 colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses 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 course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses 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 course only or in that course and all other courses the candidate has appeared including practical examinations and project work of that semester / year

S.No.	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
		examinations, depending on the recommendation of the committee.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

1. Malpractices identified by squad or special invigilators
2. Punishments to the candidates as per the above guidelines.
3. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
4. A show cause notice shall be issued to the college.
5. Impose a suitable fine on the college.
6. Shifting the examination center 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 course/courses due to Malpractice, he has to register for End Examinations in that course/courses consequently and has to fulfil all the norms required for the award of Degree.

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COURSE STRUCTURE

M.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

I-SEMESTER

S. No.	Course Code	Course Title	Category	Hours per week			Credits
				L	T	P	
1.	2598101	Artificial Intelligence and Intelligent Systems	PC	3	0	0	3
2.	2598102	Statistical Foundations for Data Science	PC	3	0	0	3
3.	**Program Elective-I**		PE	3	0	0	3
	2598103	Mining of Massive Datasets					
	2598104	Generative AI					
	2598105	Applied Machine Learning					
4.	**Program Elective-II**		PE	3	0	0	3
	2598106	Medical Imaging with AI					
	2598107	Smart Sensor Networks and IoT					
	2598108	Computing for Data Analytics					
5.	2598151	Artificial Intelligence and Intelligent Systems Lab	PC	0	0	4	2
6.	2598152	Statistical Foundations for Data Science using R Lab	PC	0	0	4	2
7.	2598153	Full Stack Development using MERN	SE	0	1	2	2
8.	2599171	Research Methodology & Intellectual Property Rights	MC	2	0	0	2
9.	**Audit Course–I**		AC	2	0	0	2
	2599181	English for Research Paper Writing					
	2512181	Disaster Management					
	2598181	Essence of Indian Traditional Knowledge					
			TOTAL	**16**	**1**	**10**	**22**

2598101	M.Tech. I-SEMESTER ARTIFICIAL INTELLIGENCE AND INTELLIGENT SYSTEMS (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)	L	T	P	C
		3	0	0	3

Pre-Requisites: UG level course in Mathematics, Data Structures

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1. Solve basic AI based problems.
CO2. Define the concept of Artificial Intelligence.
CO3. To apply logical and probabilistic reasoning techniques to design intelligent planning systems.
CO4. Apply AI techniques to real-world problems to develop intelligent systems.
CO5. Select appropriately from a range of techniques when implementing intelligent systems.

SYLLABUS:

UNIT-I: INTRODUCTION (08 periods)

Overview of AI problems, AI problems as NP, NP-Complete and NP Hard problems. Strong and weak, neat and scruffy, symbolic and sub-symbolic, knowledge-based and data-driven AI.

UNIT-II: SEARCH STRATEGIES (09 periods)

Problem spaces (states, goals and operators), problem solving by search, Heuristics and informed search, Min-max Search, Alpha-beta pruning. Constraint satisfaction (backtracking and local search methods).

UNIT-III: KNOWLEDGE REPRESENTATION AND REASONING (09 periods)

Propositional and predicate logic, Resolution and theorem proving, Temporal and spatial reasoning. Probabilistic reasoning, Bayes theorem. Totally- ordered and partially-ordered Planning. Goal stack planning, Nonlinear planning, Hierarchical planning.

UNIT-IV: LEARNING AND NATURAL LANGUAGE PROCESSING (09 periods)

Learning from example, learning by advice, Explanation based learning, learning in problem solving, Classification, Inductive learning, Naive Bayesian Classifier, decision trees.
Language models, n-grams, Vector space models, Bag of words, Text classification. Information retrieval.

UNIT-V: AGENTS, INTELLIGENT SYSTEMS AND KEY APPLICATION AREAS (10 periods)

Definition of agents, Agent architectures (e.g., reactive, layered, cognitive), multi-agent systems-Collaborating agents, Competitive agents, Swarm systems and biologically inspired models. Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.
Expert system, decision support systems, Speech and vision, Natural language processing, Information Retrieval, Semantic Web.

Total Periods: 45

Textbooks:

T1. Artificial Intelligence: A Modern Approach, S. Russell and P. Norvig, Prentice Hall, 4Th Edition, 2020.

Reference Books:

R1. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill, 5Th Edition. 2025.

R2. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education, 1St Edition, 1990.

Web Resources:

1. http://peterindia.net/AILinks.html
2. http://nptel.ac.in/courses/106106139
3. https://nptel.ac.in/courses/106/105/106105152/

2598102	M.Tech. I-SEMESTER STATISTICAL FOUNDATIONS FOR DATA SCIENCE (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)	L	T	P	C
		3	0	0	3

Prerequisites: Mathematics courses of first year of study.

Course Outcomes: After completion of the course, student will be able to

CO1. Apply the number theory concepts to cryptography domain

CO2. Apply the concepts of probability and distributions to some case studies

CO3. Analyze data using normal distributions and apply sampling techniques based on the Central Limit Theorem.

CO4. Perform statistical inference through estimation methods and hypothesis testing for various population parameters.

CO5. Model and analyze random systems using stochastic processes and Markov chains.

SYLLABUS:

UNIT-I: GREATEST COMMON DIVISORS AND PRIME FACTORIZATION (08 Periods)

Greatest common divisors, The Euclidean algorithm, The fundamental theorem of arithmetic, Factorization of integers and the Fermat numbers Congruences: Introduction to congruences, Linear congruences, The Chinese remainder theorem, Systems of linear congruences

UNIT-II: SIMPLE LINEAR REGRESSION AND CORRELATION (10 Periods)

Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model, Properties of the Least Squares Estimators, Inferences Concerning the Regression Coefficients, Prediction, Simple Linear Regression Case Study Random Variables and Probability Distributions: Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Statistical Independence. Discrete Probability Distributions: Binomial Distribution, Poisson distribution.

UNIT-III: CONTINUOUS PROBABILITY DISTRIBUTIONS (08 Periods)

Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial, Fundamental Sampling Distributions: Random Sampling, Sampling Distributions, Sampling, Distribution of Means and the Central Limit Theorem, Sampling Distribution of S2, t–Distribution, FDistribution.

UNIT-IV: ESTIMATION & TESTS OF HYPOTHESES (09 Periods)

Introduction, Statistical Inference, Classical Methods of Estimation. Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Tolerance Limits, Estimating the Variance, Estimating a Proportion for single mean, Difference between Two Means, between Two Proportions for Two Samples and Maximum Likelihood Estimation.

UNIT-V: STOCHASTIC PROCESSES AND MARKOV CHAINS (08 Periods)

Introduction to Stochastic processes- Markov process. Transition Probability, Transition Probability Matrix, First order and Higher order Markov process, n step transition probabilities, Markov chain, Steady state condition, Markov analysis.

Total Periods: 43

Textbooks:

T1. Kenneth H. Rosen, Elementary number theory & its applications, 7th Edition, Addison Wesley, ISBN 978 0-321-50031-1.2019.

T2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics

for Engineers & Scientists, 9th Edition 2021. Pearson Publishers.
T3. S. D. Sharma, Operations Research, Kedarnath and Ramnath Publishers, Meerut, Delhi 4th Edition 2009

Reference Books:

R1. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications 12th Edition 2020.
R2. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons Ltd, 1st Edition 2004.
R3. Sheldon M Ross, Probability and statistics for Engineers and scientists, Academic Press 6th Edition 2017.

Web Resources:

1. https://nptel.ac.in/courses/106/105/106105152/
2. http://nptel.ac.in/courses/106106139
3. http://peterindia.net/AILinks.html

2598103	M.Tech. I-SEMESTER MINING MASSIVE DATASETS (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)	L	T	P	C
		3	0	0	3

PRE-REQUISITES:
Data mining, algorithms, basic Probability Theory and Discrete Maths.

COURSE OUTCOMES:
After completion of the Course, student will be able to
CO1. Handle massive data using MapReduce.
CO2. Develop and implement algorithms for massive data sets and methodologies in the context of data mining.
CO3. Demonstrate the algorithms for extracting models and information from large Datasets.
CO4. Develop recommendation systems.
CO5. Demonstrate experience in matching various algorithms for particular classes of problems.

SYLLABUS:

UNIT-I: DATA MINING MAPREDUCE AND THE NEW SOFTWARE STACK **(09 Periods)**

Introduction-Definition of Data Mining-Statistical Limits on Data Mining, Distributed File Systems, MapReduce, Algorithms Using MapReduce

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UNIT-II: SIMILARITY SEARCH AND STREAMING DATA (09 Periods)

Finding Similar Items-Applications of Near-Neighbor Search, Shingling of Documents, Similarity-Preserving Summaries of Sets, Distance Measures.
Mining Data Streams-The Stream Data Model, Sampling Data in a Stream, Filtering Streams

UNIT-III: LINK ANALYSIS, FREQUENT ITEM SETS AND CLUSTERING (09 Periods)

PageRank, Efficient Computation of PageRank, Link Spam
Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.
The CURE Algorithm, Clustering in Non-Euclidean Spaces, Clustering for Streams and Parallelism

UNIT-IV: ADVERTISING ON THE WEB AND RECOMMENDATION SYSTEMS **(10 Periods)**

Issues in On-Line Advertising, On-Line Algorithms, The Matching Problem, The AdWords Problem, AdWords Implementation.
A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Dimensionality Reduction, The Netflix Challenge.

UNIT-V: **(08 Periods)**

Mining Social-Network Graphs-Social Networks as Graphs, Clustering of Social-Network Graphs, Partitioning of Graphs, Sim rank, Counting Triangles.

Total Periods: 45

Textbooks:

T1. Jure Leskovec, Anand Rajaraman, Jeff Ullman, Mining of Massive Datasets, 3rd. Edition.

Reference Books:

R1. Jiawei Han & Micheline Kamber, Data Mining — Concepts and Techniques, 3rd Edition Elsevier.

R2. Margaret H Dunham, Data Mining Introductory and Advanced topics, PEA 2006.
R3. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann 5th Edition 2025.

Web Resources:

1. http://infolab.stanford.edu/~ullman/mmds.html
2. https://nptel.ac.in/courses/106/105/106105174/
3. https://www.geeksforgeeks.org/data-mining/

2598104	M.Tech. I-SEMESTER GENERATIVE AI (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)	L	T	P	C
		3	0	0	3

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1. Demonstrate knowledge of AI foundations, generative models, and advanced neural architectures.

CO2. Apply generative AI techniques to create solutions for text, image, video, and multimodal tasks.

CO3. Design, fine-tune, and optimize Large Language Models for specific applications.

CO4. Design and apply multi-agent systems and generative AI tools for collaborative problem-solving and creative applications.

CO5. Evaluate ethical, social, and legal implications of Generative AI deployments and propose mitigation strategies.

SYLLABUS:

UNIT-I: FOUNDATIONS OF AI AND GENERATIVE MODELS (09 Periods)

Introduction and historical evolution to Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP)and Deep Learning (DL), Structure of Artificial Neural Networks (ANNs), Mathematical and computational foundations of generative modeling, Overview of generative models and their applications across various domains; Importance of Generative AI in modern applications, Transfer learning and in advancing Generative AI

UNIT-II: ADVANCED NEURAL ARCHITECTURES FOR GENERATIVE AI (09 Periods)

Variational Autoencoders (VAEs): principles and applications, Generative Adversarial Networks (GANs): architecture and working principles; Transformer architecture and attention mechanisms (in detail); Long Short-Term Memory Networks (LSTMs) and the limitations of traditional RNNs/LSTMs, Advanced Transformer architectures and techniques, Pre-training and transfer learning strategies for generative models

UNIT-III: LARGE LANGUAGE MODELS AND PROMPT ENGINEERING (09 Periods)

Overview of Large Language Models (LLMs), GPT architecture, variants, and working principles, Pré- training and fine-tuning GPT models for applications (e.g., chatbots, text generation), Case study: GPT-based customer support chatbot, BERT architecture, pre-training objectives, and fine-tuning, Prompt Engineering: Designing effective prompts, controlling model behavior, and improving output quality, Fine-tuning language models for creative writing and chatbot development.

UNIT-IV: MULTI-AGENT SYSTEMS AND GENERATIVE AI APPLICATIONS (09 Periods)

Introduction to Multi-Agent Systems (MAS),Types of agents: reactive, deliberative, hybrid, and learning agents, Multi-agent collaboration and orchestration for generative tasks, Use cases: autonomous research assistants, cooperative creative generation, distributed problem-solving, Frameworks and tools: AutoGen, CrewAI, Hugging GPT for LLM-powered multi-agent systems, Generative AI applications: Art, Creativity, Image/Video generation, Music composition, Healthcare, Finance, Real-world case studies and deployment challenges.

UNIT-V: FRAMEWORKS, MULTIMODAL APPLICATIONS, AND ETHICS

(09 Periods)

Lang Chain framework: components and LLM application development, Retrieval- Augmented Generation (RAG), Embeddings, Indexing networks, and Vector databases, Generative AI across modalities: Text, Code, Image, and Video generation, Image and Video generation using GANs and VAEs, Multimodal Generative AI: integration and training strategies, Ethical considerations: bias, fairness, trust, and responsible AI deployment, Social and legal implications of Generative AI, Risk mitigation strategies and real-world ethical case studies

Total Periods: 45

Textbooks:

T1. Altaf Rehmani, Generative AI for Everyone: Understanding the Essentials and Applications of This Breakthrough Technology 1st Edition.
T2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook.
T3. Joseph Babcock, Raghav Bali, Generative AI with Python and Tensor Flow 2, 2nd Edition 2024.

Reference Books:

R1. Josh Kalin, Generative Adversarial Networks Cookbook 1st Edition 2021.
R2. Jesse Sprinter, Generative AI in Software Development: Beyond the Limitations of Traditional Coding, 1st Edition 2024.

Online References:

Fabian Gloeckle et al., Better & Faster Large Language Models via Multi-token Prediction, arXiv:2404.19737v1, 2024.Vaswani et al., Attention Is All You Need, Neur IP

Web Resources:

1. Generative AI Tutorial – Geeks for Geeks
2. Mining Massive Data Sets (Stanford University – Ullman, Rajaraman, Leskovec)
3. Generative AI Learning Collection – GitHub

2598105	M.Tech. I-SEMESTER APPLIED MACHINE LEARNING (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)	L	T	P	C
		3	0	0	3

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1. Demonstrate the fundamental concepts of machine learning

CO2. Apply machine learning techniques for classification, regression, and unsupervised learning tasks.

CO3. Apply linear, distance based, and decision tree-based models

CO4. Implement distance-based and probabilistic models for classification and clustering tasks.

CO5. Analyze probabilistic, neural network models

SYLLABUS:

UNIT-I: INTRODUCTION TO MACHINE LEARNING (09 Periods)

Introduction. Different types of learning, Examples of Machine Learning Applications Supervised Learning: Learning a Class from Examples, Probably Approximately Correct Learning, Learning multiple classes, Model selection and generalization Regression: Linear regression, Multiple Linear regression, Logistic Regression.

UNIT-II: THE INGREDIENTS OF MACHINE LEARNING (09 Periods)

Tasks, Models, Features Binary classification and related tasks: Classification, Assessing classification performance, Visualizing classification performance Beyond binary classification: multi-class classification, Regression, Unsupervised and descriptive learning

UNIT-III: DECISION TREE LEARNING (09 Periods)

Introduction, Decision tree representation, Appropriate problems for decision tree learning, the basic decision tree learning algorithm, Inductive bias in decision tree, Issues in decision tree learning. Linear models: The least-squares method, Multivariate linear regression, the perceptron, Support vector machines, soft margin SVM, Going beyond linearity with kernel methods.

UNIT–IV: DISTANCE BASED MODELS (09 Periods)

Introduction, Neighbours and exemplars, Nearest Neighbours classification, K-Means algorithms, Clustering around medoids Probabilistic Models: Using Naïve Bayes Model for classification, Expectation Maximization, Gaussian Mixture models

UNIT–V: ARTIFICIAL NEURAL NETWORKS (09 Periods)

Introduction, Neural network representation, appropriate problems for neural network learning, Multilayer networks and the back propagation, Advanced topics in Artificial Neural Networks Reinforcement Learning: Introduction, Learning tasks, Q-learning

Total Periods: 45

Textbooks:

T1. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 1st Edition 2012.

T2. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education 1st Edition.

Reference Books:

R1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems 3rd Edition 2022.

R2. Stephen Marsland, Machine Learning – An Algorithmic Perspective, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2nd Edition, 2014
R3. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press 4th Edition 2020.
R4. T. Hastie, R. Tibshirani and J. Friedman, Elements of Statistical Learning, Springer Series, 2nd edition 2009.

Web Resources:

1. https://stanford.edu/~shervine/teaching/cs-229/.
2. https://scikit-learn.org/stable/user_guide.html
3. https://developers.google.com/machine-learning/crash-course

2598106	M.Tech. I-SEMESTER MEDICAL IMAGING WITH AI (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)	L	T	P	C
		3	0	0	3

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1. Explain medical imaging modalities and their fundamental characteristics.

CO2. Apply preprocessing and feature extraction techniques to medical images.

CO3. Implement deep learning architectures for classification, segmentation, and anomaly detection.

CO4. Evaluate AI methods for medical imaging tasks such as cancer detection, brain analysis, and organ segmentation.

CO5. Analyze ethical, privacy, and regulatory challenges in deploying AI for healthcare.

SYLLABUS:

UNIT-I: INTRODUCTION TO MEDICAL IMAGING (08 Periods)

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 (09 Periods)

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 (09 Periods)

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.

UNIT-IV: DEEP LEARNING IN MEDICAL IMAGING (09 Periods)

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 (09 Periods)

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.

Total Periods: 45

Textbooks:

T1. S. Kevin Zhou, Hayit Greenspan, Dinggang Shen, Deep Learning for Medical Image Analysis, Academic Press 2nd Edition, 2023.
T2. Ayman El-Baz, Jasjit S. Suri, Big Data in Multimodal Medical Imaging, CRC Press 1st Editon 2019.
T3. Klaus D. Toennies, Guide to Medical Image Analysis, Springer 2nd Edition 2017.

References:

R1. Geert Litjens et al., A Survey on Deep Learning in Medical Image Analysis, Medical Image Analysis, Volume 42, Pages 60–88, 2017.
R2. Ronneberger et al., U-Net: Convolutional Networks for Biomedical Image Segmentation, Volume 9351, Pages 234–241, 2015.
R3. Esteva et al., A Guide to Deep Learning in Healthcare, Nature Medicine, Volume 25, Issue 1, Pages 24–29, January 2019.
R4. Kaggle datasets and grand challenges: BraTS, ISLES, CheXpert.
R5. Online resources: Medical Imaging with Deep Learning (MIDL) conference papers.

Web Resources:

1. https://github.com/open-dicom/awesome-dicom
2. https://dynamicduniya.com/tutorials/machine-learning/feature-engineering-data-preprocessing/dimensionality-reduction-techniques
3. https://apxml.com/courses/cnns-for-computer-vision/chapter-4-image-segmentation-techniques

2598107	M.Tech. I-SEMESTER SMART SENSOR NETWORKS AND IOT (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)	L	T	P	C
		3	0	0	3

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1. Explain the fundamental concepts, applications, and research areas of IoT across various domains.

CO2. Analyse IoT reference architectures, functional and deployment views, and real-world design constraints including hardware, technical, and operational limitations.

CO3. Demonstrate practical knowledge of IoT devices, programming, operating systems, communication protocols, network security, and database management.

CO4. Apply IoT principles to industrial automation and enterprise integration using frameworks such as SOCRADES and IMC-AESOP.

CO5. Evaluate case studies in commercial building automation and emerging IoT trends, including edge/fog computing, predictive maintenance, and digital twin technologies.

SYLLABUS:

UNIT-I: INTRODUCTION AND APPLICATIONS (10 Periods)

smart transportation, smart cities, smart living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNIT-II: REAL-WORLD DESIGN CONSTRAINTS (06 Periods)

Introduction, Technical Design constraints, hardware, Data representation and visualization, Interaction and remote control.

UNIT-III: IOT PHYSICAL DEVICES & ENDPOINTS (09 Periods)

What is an IOT Device, Exemplary Device Board, Linux on Raspberry, Interface and Programming & IOT Device. Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, **Routing:** Transport Protocols, Network Security, Middleware, Databases

UNIT-IV: INDUSTRIAL AUTOMATION (08 Periods)

Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation-Introduction.

UNIT-V: CASE STUDY (07 Periods)

Phase one-commercial building automation today.

Phase two commercial building automation in the future. Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT.

Total Periods: 40

Textbooks:

T1. Mandler, B., Barja, J., Mitre Campista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publication 2016.

T2. Arsheep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Orient Blackswan Private Limited - New Delhi, 1st Edition, 2015.

T3. Hanes David, Salgueiro Gonzalo, Grossetete Patrick, Barton Rob, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, Pearson Paperback, 1st Edition, 2017.

Web Resources:

1. Cyber-Physical Systems and Smart Cities – ResearchGate (PDF)
2. IoT Data Visualization and Dashboards – ThingsBoard
3. IMC-AESOP Project: Service-Oriented Industrial IoT

2598108	M.Tech. I-SEMESTER COMPUTING FOR DATA ANALYTICS (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)	L	T	P	C
		3	0	0	3

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1. Demonstrate the data analytics lifecycle and identify the roles and responsibilities of data scientists in business analytics projects.

CO2. Apply statistical techniques such as measures of central tendency, variation, skewness, and kurtosis for data summarization and interpretation.

CO3. Analyze probability distributions (binomial, Poisson, normal, exponential, gamma, etc.) and apply them in modeling uncertain events.

CO4. Perform hypothesis testing and predictive analytics using t-tests, chi-square tests, regression, correlation, and multiple correlation methods.

CO5. Design forecasting models (moving average, exponential smoothing, seasonal trends) and conduct design of experiments (ANOVA, Latin square, factorial design) for analytical problem solving.

SYLLABUS:

UNIT-I: DATA ANALYTICS LIFE CYCLE (09 Periods)

Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.

UNIT–II: STATISTICS (10 Periods)

Sampling Techniques - Data classification, Tabulation, Frequency and Graphic representation - Measures of central value - Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median, Quartiles, Deciles, Percentile - Measures of variation – Range, IQR, Quartile deviation, Mean deviation, standard deviation, coefficient variance, skewness, Moments & Kurtosis.

UNIT-III: PROBABILITY AND HYPOTHESIS TESTING (09 Periods)

Random variable, distributions, joint probability function, marginal density function. Random vectors - Some special probability distribution - Binomial, Poison, Geometric, uniform, exponential, normal, gamma and Erlang - Normal distribution.

UNIT-IV: PREDICTIVE ANALYTICS (09 Periods)

Sampling distribution – Estimation - point, confidence - Test of significance, 1& 2 tailed test, uses of t-distribution, F-distribution, $\chi 2$ distribution - Predictive modeling and Analysis - Regression Analysis, Correlation analysis, Rank correlation coefficient, Multiple correlation.

UNIT-V: TIME SERIES FORECASTING AND DESIGN OF EXPERIMENTS

(08 Periods)

Forecasting Models for Time series: MA, SES, TS with trend, season - Design of Experiments, one way classification, two-way classification, ANOVA, Latin square, Factorial Design.

Total Periods: 45

Textbooks:

T1. Chris Eaton, Dirk Deroos, Tom Deutsch et al., Understanding Big Data, Mc Graw Hill, 2012 1st Edition.

T2. Alberto Cordoba, Understanding the Predictive Analytics Lifecycle, Wiley, 1st Edition 2014.

T3. Eric Siegel, Thomas H. Davenport, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley, 2016.

Reference Books:

R1. James R Evans – Business Analytics – Methods, Models and Decisions, 3rd Edition Pearson 2013.
R2. R. N. Prasad, Seema Acharya - Fundamentals of Business Analytics, Wiley, 2nd Edition 2015.
R3. S M Ross - Introduction to Probability and Statistics for Engineers and Scientists‖, Academic Foundation, 6th Edition 2011.
R4. David Hand, Heiki Mannila, Padhria Smyth - Principles of Data Mining, PHI 2013 1st Edition.
R5. Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman - Forecasting methods and applications Wiley 3rd Edition2013(Reprint).

Web Resources:

1. Data Analytics Lifecycle – Tutorialspoint
2. Statistics & Probability – OpenStax Introductory Statistics
3. Time Series Forecasting & Experimental Design – StatsDirect

2598151	M.Tech. I-SEMESTER ARTIFICIAL INTELLIGENCE AND INTELLIGENT SYSTEMS LAB (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)	L	T	P	C
		0	0	4	2

COURSE OUTCOMES:

CO1. To install and work with various AI tools and environments.
CO2. To preprocess data and create annotated datasets for AI applications
CO3. To implement search and knowledge representation techniques in AI.
CO4. Develop programming solutions for given problem scenario.
CO5. To apply machine learning algorithms for classification and clustering tasks.
CO6. To use Python libraries for data science and parallel algorithm development**.**

LIST OF PROGRAMS:

1. Installation and working on various AI tools viz. Python, R tool, GATE, NLTK, MATLAB, etc.
2. Data preprocessing and annotation and creation of datasets.
3. Learn existing datasets and Treebanks
4. Implementation of searching techniques in AI.
5. Implementation of Knowledge representation schemes.
6. Natural language processing tool development.
7. Application of Machine learning algorithms.
8. Application of Classification and clustering problem.
9. Working on parallel algorithms.
10. Scientific distributions used in python for Data Science - Numpy, scifi, pandas, scikit learn, statsmodels, nltk.

Web Resources:

1. AI Lab Manual – Studocu
2. Open Source Data Annotation Tools – Data Stack Hub
3. GitHub – NLP Datasets (Treebanks & Corpora)
4. Sanfoundry – Search Algorithms in AI
5. Sanfoundry – Knowledge Representation in AI
6. GitHub – NLP Explorer
7. GeeksforGeeks – Supervised & Unsupervised Learning
8. Kaggle – Clustering Datasets
9. Krython – Parallel Algorithms: MapReduce Pattern
10. AlmaBetter – Popular Python Libraries

2598152	M.Tech. I-SEMESTER STATISTICAL FOUNDATIONS FOR DATA SCIENCE USING R LAB (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)	L	T	P	C
		0	0	4	2

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1. To write and execute basic R programs using RStudio.
CO2. Perform descriptive and inferential statistical analysis on datasets.
CO3. Visualize data using various graphical techniques in R.
CO4. Conduct hypothesis testing and regression modeling using R.
CO5. Interpret statistical outputs and summarize insights for decision making.
CO6. To analyze real-world datasets and present findings using R Markdown.

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LIST OF EXPERIMENTS:

Exp. No.	Title	Description / Learning Outcome
1	**Introduction to R and RStudio**	Basic syntax, variables, data types, operators, and RStudio interface
2	**Data Structures in R**	Using vectors, lists, matrices, arrays, and data frames
3	**Data Import and Cleaning**	Reading data from CSV, Excel, JSON, databases; handling missing values and outliers
4	**Descriptive Statistics**	Mean, median, mode, variance, standard deviation, correlation, covariance
5	**Data Visualization in R**	Using base R and ggplot2 for histograms, boxplots, scatter plots, bar charts
6	**Probability Distributions**	Implementing and visualizing Binomial, Poisson, Normal, and Exponential distributions
7	**Sampling and Central Limit Theorem**	Random sampling, sample mean distribution, and verifying CLT through simulation
8	**Hypothesis Testing – I**	t-test, z-test, chi-square test for mean and proportion
9	**Hypothesis Testing – II**	ANOVA and post-hoc analysis using R
10	**Correlation and Regression Analysis**	Simple and multiple linear regression modeling
11	**Non-Linear and Logistic Regression**	Implementing logistic regression for binary classification
12	**Case Study / Mini Project**	Apply statistical analysis to a real-world dataset (e.g., COVID, finance, healthcare, education) and prepare a report in R Markdown

Software & Tools:

- R ($\geq$ 4.0 version)
- RStudio IDE
- Libraries: ggplot2, dplyr, tidyr, readr, caret, stats, MASS

Reference Books:

R1. R for Data Science, Garrett Grolemund & Hadley Wickham, O'Reilly Media 2nd Edition.
R2. The Art of R Programming, Norman Matloff, No Starch Press 1st Edition.
R3. Introductory Statistics with R, Peter Dalgaard, Springer 2nd Edition.
R4. Using R for Introductory Statistics, John Verzani, CRC Press 2nd Edition.

Web Resources:

1. RStudio Cloud Guide
2. R Data Structures – Tutorials Point
3. R for Data Science – Data Import
4. Quick-R Descriptive Statistics
5. ggplot2 Reference
6. R Probability Distributions
7. R Sampling Tutorial
8. R Hypothesis Tests – Quick-R
9. R ANOVA Tutorial
10. R Regression Models
11. R Logistic Regression Guide
12. R Markdown Guide

2598153	M.Tech. I-SEMESTER FULL STACK DEVELOPMENT USING MERN (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)	L	T	P	C
		0	1	2	2

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1. Apply fundamental web technologies (HTML, CSS, JavaScript, ES6) to design responsive web pages

CO2. Develop server-side applications using Node.js and Express.js with REST API integration.

CO3. Perform database operations using MySQL and MongoDB and integrate them with backend services

CO4. Design and implement dynamic, component-based user interfaces using ReactJS

CO5. Demonstrate problem-solving, debugging, and version control skills in web development projects.

SYLLABUS:

Module 1: Web Development Fundamentals

Fundamentals of Web Design, Webpage and Website, Web application HTML Typography, Images, Tables, Lists, Hyperlinks etc. CSS Syntax and usage, CSS Selectors, CSS on body, CSS on Text, CSS on Links, CSS on Tables, CSS on Lists, CSS on Forms, CSS on Images, CSS on DIV, W3.CSS Framework

List of Experiments:

- **HTML & CSS Basics** – Create a personal portfolio webpage using HTML (headings, lists, tables, hyperlinks, forms) and style it with CSS selectors.
- **Responsive Layout** – Develop a responsive webpage using DIV, CSS box model, and W3.CSS framework.
- **Styled Components** – Design a webpage for a college event with images, tables, and styled navigation menu using CSS.

Module 2: JavaScript and ECMA Script 6

JavaScript Fundamentals - Grammar and types, Control flow and error handling - Loops, Function - Objects, Arrays, Promises - ES6 Let and const, Template literals - Arrow Function, Default parameter, Async Await

List of Experiments:

- **JavaScript Fundamentals** – Build a simple calculator app using functions, loops, and control flow.
- **Array & Object Manipulation** – Write a program using ES6 features (let/const, arrow functions, template literals) to manage student records.
- **Async Programming** – Create a webpage that fetches and displays random user data from a public API using Promises and Async/Await.

Module 3: Node.js

overview, Node.js - basics and setup - Node.js console, Node.js command utilities - Node.js modules, concepts - Node.js events, database access - Node.js with Express.js, Express.js Request/Response - Express.js Get, Express.js Post - Express.js Routing, Express.js Cookies - Express.js File Upload, Middleware - Express.js Scaffolding, Template

List of Experiments:

- **Node.js Basics** – Write a Node.js script to create a local server and display "Hello World" in the browser.
- **Express.js Routing** – Build a REST API with Express.js that handles GET and POST requests for a student information system.
- **File Handling** – Develop a Node.js application to upload, read, and display a text/JSON file using Express middleware.

Module 4: MySQL and MongoDB

MySQL Concepts - Create, Read, Update, Delete Operation - SQL and NoSQL concepts - Create and manage MongoDB - Migration of data into MongoDB - MongoDB with NodeJS - Services offered by MongoDB

List of Experiments:

- **MySQL CRUD** – Create a MySQL database for employee records and perform Create, Read, Update, Delete (CRUD) operations.
- **MongoDB CRUD with Node.js** – Build a Node.js application that connects to MongoDB and manages student data.
- **Migration Project** – Write a script to migrate data from MySQL to MongoDB and display it through a Node.js API.

Module 5: React JS

ReactJS introduction and overview - ReactJS installation and environment setup - Introducing JSX, Rendering Elements - Components and Props - State and Lifecycle - Handling Events - Conditional Rendering - Lists and Keys, Forms - Lifting State Up

List of Experiments:

- **React Components** – Build a React app to display a list of courses using functional components and props.
- **State & Events** – Create a counter and a form component in React using useState and event handling.
- **Conditional Rendering & Lists** – Develop a React to-do list application with add/delete functionality and conditional rendering of completed tasks.

Textbooks:

T1. Alex Banks, Eve Porcello – Learning React: Modern Patterns for Developing React Apps, O'Reilly 2nd Edition 2020.
T2. Stoyan Stefanov – React Up & Running: Building Web Applications, O'Reilly 2nd Edition 2021.
T3. Mario Casciaro, Luciano Mammino – Node.js Design Patterns, Packt 4th Edition 2023.
T4. Seyed M.M. Iravani – Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics, O'Reilly 5th Edition 2018.

Reference Books:

R1. Robin Wieruch – The Road to React, Leanpub 2025.
R2. Carl Rippon – React 18 Design Patterns and Best Practices, Packt 4th Edition.
R3. Kirupa Chinnathambi – Learning React: A Hands-On Guide to Building Web Applications, Addison-Wesley 2nd Edition.
R4. Ethan Brown – Web Development with Node and Express: Leveraging the JavaScript Stack, O'Reilly 2nd Edition.
R5. Kristina Chodorow – MongoDB: The Definitive Guide, O'Reilly 3rd Edition.
R6. Ben Forta – SQL in 10 Minutes, Sams Teach Yourself, Sams Publishing 5th Edition.

Web Resources:

1. Build a Responsive Portfolio Website Using HTML & CSS – Geeks for Geeks
2. Async/Await Tutorial – JavaScript.info
3. Node.js Express File Upload REST API Example – Bezkoder
4. Node.js CRUD Operations Using Mongoose & MongoDB – Geeks for Geeks
5. React State and Lifecycle – Official Docs

		L	T	P	C
2599171	**M.Tech., I-SEMESTER** **RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS** (Common to AIDS, PS, Geo-Tech, RE, ES&VLSI) **(MANDATORY COURSE)**	**2**	**0**	**0**	**2**

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO1. Demonstrate the research process, types and methods, use data correctly, follow ethical rules, and use proper citation styles.

CO2. Apply appropriate data collection methods, identify data types and sources, ensure quality, and follow ethical practices using suitable tools.

CO3. Apply multivariate analysis and experimental design to study cause-effect relationships, ensure measurement validity, and write structured research papers and proposals.

CO4. Demonstrate the concept, evolution, and types of Intellectual Property Rights (IPR), recognize global IPR practices and institutions like WIPO, WTO, and UNESCO, and identify key agreements, trade secrets, and biodiversity-related rights.

CO5. Demonstrate the concept, features, and benefits of patents; identify types of patent applications and the filing process; and explain the roles of patent agents, licensing, and patent regulations.

SYLLABUS:

UNIT-I: FUNDAMENTALS OF RESEARCH METHODOLOGY **(09 Periods)**

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.

UNIT-II: DATA COLLECTION AND SOURCES **(09 Periods)**

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.

UNIT-III: DATA ANALYSIS AND REPORTING **(09 Periods)**

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.

UNIT-IV: UNDERSTANDING INTELLECTUAL PROPERTY RIGHTS **(09 periods)**

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.

UNIT-V: PATENTS **(09 Periods)**

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

Total Periods: 45

Textbooks:

T1. Stuart Melville and Wayne Goddard, Research Methodology: An introduction for Science & Engineering students, Juta and Company Ltd, 2004
T2. Catherine J. Holland, Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets, Entrepreneur Press, 2007.

References Books:

R1. Cooper Donald R, Schindler Pamela S and Sharma JK, Business Research Methods, Tata McGraw Hill Education, 2012, Eleventh Edition,
R2. David Hunt, Long Nguyen, Matthew Rodgers, Research Methodology: A Step-by-Step Guide for Beginners, Wiley, 2007.
R3. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, Cengage, 2024, Sixth Edition,
R4. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, The Craft of Research, University of Chicago Press, 2024, Fifth Edition.
R5. Professional Programme Intellectual Property Rights, Law and practice, The Institute of Company Secretaries of India, Statutory body under an Act of parliament, September, 2013.

Web Resources:

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

2599181	M.Tech., I-SEMESTER ENGLISH FOR RESEARCH PAPER WRITING (Common to AIDS, PS, Geo-Tech, RE, ES&VLSI) (AUDIT COURSE-I)	L	T	P	C
		2	0	0	2

COURSE OUTCOMES:

On successful completion of the course, student will be able to

CO6. Demonstrate proficiency in academic English by applying MAP principles, using clear, precise, and objective language, structuring coherent paragraphs, integrating references, and employing paraphrasing and appropriate tone in writing.

CO7. Exhibit critical reading skills to analyze academic texts, differentiate between article types, identify arguments and methodologies, evaluate findings, and make effective notes.

CO8. Apply advanced grammar and punctuation to construct clear, accurate, and complex sentences with proper voice, tense consistency, subject-verb agreement, and unambiguous references.

CO9. Revise and refine written work by editing for clarity, coherence, and grammar; proofread for accuracy; and apply effective strategies for professional correspondence and creative writing.

CO10. Demonstrate digital literacy by critically evaluating online content, using AI tools ethically in research writing, generating accurate citations, and practicing plagiarism-free writing with awareness of fair practices.

SYLLABUS:

UNIT-I: FUNDAMENTALS OF ACADEMIC ENGLISH (05 Periods)

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: READING SKILLS FOR RESEARCHERS (06 Periods)

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: GRAMMAR REFINEMENT FOR RESEARCH WRITING (06 Periods)

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: MASTERY IN REFINING WRITTEN CONTENT/EDITING SKILLS (07 Periods)

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.

UNIT-V: TECHNOLOGY AND LANGUAGE FOR RESEARCH (06 Periods)

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

Total Periods: 30

Textbooks:

T1. Routledge, Bailey. S. Academic Writing: A Handbook for International Students. London and New York: 2015.

T2. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

Reference books:

R1. Craswell, G., Writing for Academic Success, Sage Publications, 2004.

R2. Peter Elbow, Writing With Power, E-book, Oxford University Press, 2007

R3. Oshima, A. & Hogue, A., Writing Academic English, Addison-Wesley, New York, 2005

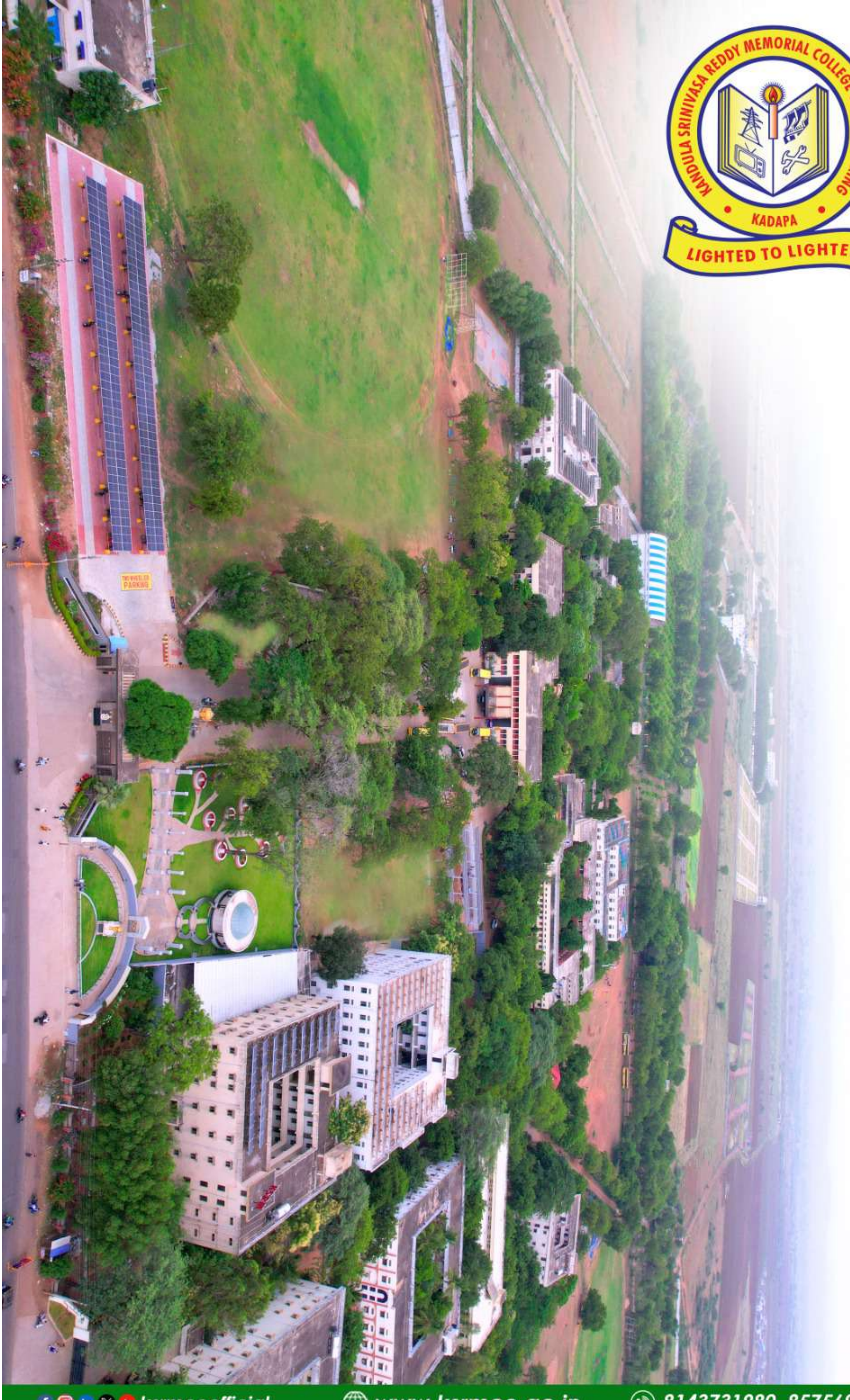
R4. Swales, J. & C. Feak, Academic Writing for Graduate Students: Essential Skills and Tasks, Michigan University Press, 2012.

R5. Goldbort R., Writing for Science, Yale University Press (available on Google Books), 2006

R6. Day R., How to Write and Publish a Scientific Paper, Cambridge University Press, 2006

Web Resources:

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ge04/
2. https://onlinecourses.swayam2.ac.in/ntr24_ed15/preview
3. "Writing in the Sciences" – Stanford University (MOOC on Coursera) https://www.coursera.org/learn/sciwrite
4. Academic Phrasebank – University of Manchester http://www.phrasebank.manchester.ac.uk
5. OWL (Online Writing Lab) – Purdue University, https://owl.purdue.edu *(Resources on APA/MLA formats, grammar, structure, paraphrasing)*
6. Zotero or Mendeley (Reference Management Tools) – Useful for managing citations and sources.



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