ACADEMIC REGULATIONS (R22PG)

COURSE STRUCTURE AND DETAILED SYLLABUS

For

M.Tech.- Regular Two Year Post Graduate Degree Programe

(For the batches admitted from 2022-23)

MASTER OF TECHNOLOGY
IN
ARTIFICIAL INTELLIGENCE & DATA SCIENCE

KANDULA SRINIVASA REDDY MEMORIAL COLLEGE OF ENGINEERING

(UGC-Autonomous)

Kadapa 516005, A.P

(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC)

(An ISO 14001:2004 & 9001: 2015 Certified Institution)

E-mail: principal@ksrmce.ac.in **Website:** www.ksrmce.ac.in

VISION AND MISSION OF THE INSTITUTE

VISION

To evolve as center 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 thenation.

MISSION

M-1: To provide high quality education with enriched curriculum blended with impactful teaching-learning practices.

M-2: To promote research, entrepreneurship and innovation through industry collaborations.

M-3: To produce highly competent professional leaders for contributing to Socio-economic development of region and the nation.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION & MISSION

VISION

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

MISSION

M-1: To produce competent and industry ready professionals through well balanced curriculum and innovative pedagogy.

M-2: To provide conducive environment for research by establishing centre of excellence and industry collaborations.

M-3: To instill leadership qualities, ethical values among students through various co-curricular and extracurricular activities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1: To excel in their career as competent software engineer in IT and allied organizations.

PEO2: To pursue higher education and to demonstrate research temper for providing solutions to engineering problems.

PEO3: To contribute for the societal development by exhibiting leadership, through professional, social and ethical values.

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Program Outcomes:

PO1 - Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 - Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 - Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 - Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 - Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 - The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 - Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 - Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO9 - Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 - Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 - Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 - Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1 - Professional Skills: The ability to understand, analyse and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

PSO2 - Problem-Solving Skills: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

PSO3 - Successful Career and Entrepreneurship: The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

K.S.R.M College of Engineering (Autonomous), KADAPA - 516005, AP
Regulations for PG Programs in Engineering (R22 PG)
(Effective from 2022-23)

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1.0 Nomenclature

1.1 *Academic Year*: Academic Term of, approximately, one year duration that usually starts in June/July and ends in April/May next
1.2 *Semester*: Either of two Academic Terms that make up an Academic Year
1.3 *Major*: A specific field of study
1.4 *Minor*: An area outside of, or complementary to, a Major
1.5 *Subject*: An area of knowledge that is studied as part of a Course
1.6 *Core*: A subject that is mandatory for a Major course of study
1.7 *Elective*: A subject that is selected for study to suit one's individual needs
1.8 *Audit Subject*: A subject that is studied to meet certain requirements but has no credits assigned to it
1.9 *Humanities subjects*: Subjects that describe and interpret human achievements, problems and historical changes at individual and societal levels covering the disciplines of literature, history, and philosophy
1.10 *Social Sciences subjects*: Subjects that describe the mental and behavioural activities of individuals, groups, organizations, institutions, and nations covering the disciplines of anthropology, economics, linguistics, political science, and psychology
1.11 *Exam*: A test to measure one's progress, knowledge, or ability in a subject
1.12 *Credit*: A numerical weight given to a subject
1.13 *Grade*: A numerical or alphabetic designation measuring the level of achievement in an exam
1.14 *Attendance*: Physical presence of oneself in a classroom/laboratory for purpose of a scheduled academic instruction
1.15 *Course*: A series of subjects that constitute a Major field of study
1.16 *Branch*: Same as Course
1.17 *Program*: Same as Course
1.18 *Specialization*: Same as branch
1.19 *Degree*: An academic title conferred to honour distinguished achievement

2.0 Short Title and Application

2.1 These rules and regulations may be called as R22PG and come into force from Academic Year 2022-23 and exist until superseded by new regulations
2.2 These rules and regulations are applicable to all post graduate courses in engineering and technology leading to Master's Degree in Technology (M. Tech)
2.3 The Specializations offered, at present, are:
  2.3.1 Geotechnical Engineering, Code - 12
  2.3.2 Power Systems, Code - 07
  2.3.3 Renewable Energy, Code - 99
  2.3.4 Embedded Systems and VLSI, Code - 84
  2.3.5 Artificial Intelligence and Data Science, Code - 98
2.4 The Institute may offer new Specializations in future to which these rules and regulations will be applicable.

3.0 Suspension and Amendment of Rules

3.1 Academic Council has the authority to suspend a rule temporarily.

3.2 Academic Council has the authority to amend a rule.

3.3 For affirmative action on any suspension or amendment of a rule, an affirmative vote of three-fifths of the members present and voting shall be required in Academic Council.

4.0 Requirements for Admission

4.1 At present, admissions into first semester of various Specializations are governed by Government and the Affiliating University. The eligibility criteria and procedure for admission are prescribed by Government and Affiliating University.

4.2 A student is not allowed change of Specialization after admission.

4.3 A student must fulfil medical standards required for admission.

4.4 The selected students are admitted into first semester after payment of the prescribed fees.

5.0 Structure of the M. Tech course

5.1 *Duration*: The duration of M. Tech degree course is four semesters

5.2 *Working Days*: Calendar for any semester shall be announced at least four weeks before its commencement. Minimum number of working days is 90 per semester.

5.3 *Curriculum*: Each Specialization shall have core, elective and audit subjects. The curriculum for each Specialization shall be approved by its corresponding Board of Studies and then by the Academic Council.

5.4 *Credits*: All subjects that are assessed for marks have credits assigned to them. The credits assigned to subjects shall be given in curriculum. The total number of credits for entire course is 70 for all Specializations. The distribution of total credits semester-wise is given in Table 1.

Table 1 Semester-wise Total Credits:

Semester	Total Credits
First Semester	18
Second Semester	18
Third Semester	18
Fourth Semester	16
Total for entire course	**70**

5.5 The curriculum and syllabus is given in Annexure-1 and Annexure-2 respectively

5.6 Responsibility and Advising: It is the responsibility of the student to understand and know the regulations and requirements to earn the degree. Each student admitted in to the degree programs is assigned to a Faculty Advisor who assists the student in designing an effective program of study. Students should consult

their Faculty Advisors for selection of electives and for general advice on academic program.

5.7 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 ElectiveCourses (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.	Research	Research Methodology & IPR	To understand importance and process of creation of patents through research
		Technical Seminar	Ensures preparedness of students to undertake major projects/Dissertation, based on core contents related to specialization
		Co-curricular Activities	Attending conferences, scientific presentations and other scholarly activities
		Dissertation	M.Tech. Project or Major Project
4.	Audit Courses	Mandatory noncredit courses	Covering subjects of developing desired attitude among the learners is on the line of initiatives such as Unnat Bharat Abhiyan, Yoga, Value educationetc.

6.0 Registration and Enrolment

6.1 Prior to opening of each semester, every student shall register for all the credit-bearing and audit subjects listed in curriculum of the semester. Excepting first semester, the registration for a semester shall be done during a specified week after end examinations of previous semester. In first semester, the registration shall be done within six working days from date of opening. Recommendation of Faculty Advisor is needed for registration.

6.2 Late registration will be permitted with a fine, decided from time to time, up to six working days from the last date specified for registration.

6.3 A student will be eligible for registration for a semester if she or he i) is promoted to that semester, ii) has cleared all fees to the Institute, library and hostel of previous semester, and iii) is not disqualified for registration by a disciplinary action of the Institute.

6.4 A student will be enrolled and allowed to attend the classes on successful registration and payment of necessary fees to Institution, library, and hostel.

6.5 Registration and enrolment will be controlled by the Office of the Controller of Examinations.

7.0 Assessment Procedure – Internal Tests and End Examinations

7.1 Performance of students in all subjects is assessed continuously through internal assessment tests and an End examination.

7.2 Allocation of internal assessment and End examination marks.

7.2.1 For theory subjects, the allocation is 40 marks for internal assessment and 60 marks for End examination totalling 100 marks.

7.2.2 For laboratory/project work subjects, the allocation is 50 marks for internal assessment and 50 marks for End examination totalling 100 marks.

7.2.3 For mini-project/mini-project with seminar total 100 marks are allocated for internal assessment. There shall be no end examination for this mini-project.

7.2.4 For all audit subjects the allocation is 40 marks for internal assessment and no allocation for End examination.

7.3 Internal Assessment Examinations

7.3.1 Internal assessment means performance evaluation of students by faculty members who teach the subjects.

7.3.2 For theory subjects, including audit subjects, the internal assessment shall be done by midterm tests. For each subject, two midterm tests will be conducted for 40 marks each and the internal assessment mark is the better of two marks. If any student abstains for any midterm test, she or he will be awarded zero marks for that midterm test. There shall be no choice of questions in midterm tests.

7.3.3 For laboratory/practical subjects, the internal assessment will be based on regular laboratory work over full semester. The assessment will be done by the faculty concerned. The students shall be informed sufficiently early of the procedure to be followed for internal assessment.

7.3.4 There shall be a **Technical Seminar** during II semester for internal evaluation of 100 marks. A student under the supervision of a faculty member shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, two other senior faculty members and faculty guide of the concerned student. The student has to secure a minimum of 50% of marks, to be declared successful. If he fails to obtain the minimum marks, he has to reappear for the same as and when supplementary examinations areconducted. The Technical seminar shall be conducted anytime during the semester as per the convenience of the Project Review Committee and students. There shall be no external examination for Technical Seminar.

7.3.5 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/audit 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.

7.3.6 For subjects like project-work and industrial training, the internal assessment will be done by a concerned Department Committee consisting of two senior faculty members and faculty guide of concerned student. The assessment procedure will be informed sufficiently early to the students.

7.4 End examinations

7.4.1 End examinations shall be conducted after completion of coursework in each semester.

7.4.2 The question papers for theory subjects shall be set by faculty members outside of the Institute. The external faculty members for question paper setting will be selected by the Principal.

7.4.3 Evaluation of answer scripts shall be done by faculty members from outside of the Institute selected by the Principal.

7.4.4 For laboratory subjects, end examination shall be conducted by a committee consisting of two internal examiners. One examiner shall be recommended by Head of Department of concerned Major, and the other examiner shall be appointed by the Principal.

7.4.5 For project work viva-voce, End examination shall be conducted by a committee consisting of one internal examiner, one external examiner, and the concerned guide of the student. Internal examiner shall be appointed by Head of Department of concerned Major, and the external examiner shall be appointed by the Principal.

7.4.6 If a student abstains from End examination of any subject, for any reason, she or he shall be awarded zero marks in that subject.

7.4.7 There is no end examination for audit subjects.

8.0 Method of Assigning Letter Grades and Grade Points

8.1 For all credit-bearing subjects, performance of a student in a subject is indicated by a letter grade that corresponds to absolute marks earned in that subject. Each letter grade is assigned a numeric Grade Point that is used to compute Grade Point Average on a scale of 0 to 10.

8.2 Performance of a student in both internal assessment and End examination will be considered for awarding grades for credit bearing subjects. Total marks earned in a subject is the sum of marks obtained in internal and End examinations in that subject.

8.3 Pass grade A+ to D+ is assigned to a subject based on total marks earned in that subject provided that a student earns at least i) 35% of marks in End examination marks and ii) 50% of marks in internal and End examination marks put together; otherwise fail grade F will be assigned to that subject.

8.4 Grade I will be assigned to a subject if a disciplinary action is pending and is not resolved before publication of results. Office of Controller of Examinations shall resolve the pending disciplinary action within six working days from the date of publication of results and change the grade to any of A+ to D+ or F.

8.5 Grade X will be assigned to a subject if a student abstains for End examination of that subject.

8.6 The absolute marks and corresponding letter grade and grade points are given in Table2

Table 2: Letter Grades and Grade Points

Absolute Marks	Letter Grade	Grade Points	Remark
90-100	S (Out Standing)	10.0	Pass
80-89	A (Excellent)	9.0	Pass
70-79	B (Very Good)	8.0	Pass
60-69	C (Good)	7.0	Pass
50-59	D (Pass)	6.0	Pass
<50	F (Fail)	0.0	Fail
Absent	AB (Absent)	0.0	Fail
---	I	0.0	Result Withheld

8.7 *SGPA*: Semester Grade Point Average indicates the performance of a student in all credit-bearing subjects of a semester. SGPA is calculated as the weighted average of Grade Points of all subjects of the semester with corresponding credits of subjects as weights. Audit subjects are not considered for SGPA calculation.

8.8 *CGPA*: Cumulative Grade Point Average indicates the performance of a student in all terms up to and including the current semester under consideration. CGPA is calculated as the weighted average of SGPAs with total credits in each semester as the weights.

8.9 *Grade Card*: All students shall be issued Grade Cards after the publication of results of a semester. Grade Card is a statement of performance of a student in a semester. It contains information about each registered subject: type of subject, allocated credits, and letter grade earned. SGPA and CGPA will also be indicated.

8.10 CGPA to Percentage Conversion:

$$\text{Percentage} = (\text{CGPA} - 0.5) * 10$$

9.0 Credit Transfer Policy

As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the University shall allow up to a maximum of 40% of the total courses being offered in a particular Programme in a semester through the Online Learning courses through SWAYAM.

9.1 The University 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 theplatform.

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 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

9.7 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.

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

9.9 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 percentage of marks and grades.

Note: Students shall also be permitted to register for MOOCs offered through online platforms other than SWAYAM NPTEL.

10.0 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 shall be given one chance for each Theory subject and for a maximum of **three** Theory subjects for Improvement of Internal evaluation marks.

10.3 The candidate has to re-register for the chosen subjects and fulfil the academic requirements.

10.4 For reregistration the candidates have to apply to the college by paying the requisite fees, before the start of the semester in which re-registration is required

10.5 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.

11.0 Credits for Co-curricular Activities

A Student shall earn 02 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)	1
Participation in International Level Seminar / Conference / workshop/Training programs held outside India (related to the specialization of the student)	2
Academic Award/Research Award from State Level / National Agencies	1
Academic Award/Research Award from International Agencies	2
Research / Review Publication in National Journals (Indexed in Scopus/Web of Science)	1
Research / Review Publication in International Journals with Editorial board outside India (Indexed in Scopus / Web of Science)	2
Vocational Course / Certificate Course (Minimum 36 hours)	2

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.

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 co-curricular activities.

12.0 Requirements for Completing Subjects

12.1 A student shall complete all credit-bearing and audit subjects successfully to be eligible for award of degree.

12.2 *Credit-bearing subjects*: A student is considered to have completed a credit-bearing subject successfully and earned credits if she or he obtains a pass grade from A+ to D+ in that subject. If a student receives fail grade F or X in any subject, she or he must register for supplementary End examination for that subject as and when opportunity arises and improve grade to pass grade

12.3 *Audit subjects*: A student is considered to have successfully completed an audit subject if she or he earns at least 40% of marks in internal assessment marks.

Supplementary exam for audit subjects: If a student fails in audit subject, she or he shall register for supplementary examination in that subject as and when the opportunity arises and pass that subject. The supplementary exam will be conducted for 40 marks covering the entire syllabus and student is deemed to have passed in the subject if she or he earns 16 marks (40% marks) in the supplementary exam, disregard of her or his performance in internal tests.

13.0 Requirements for taking End Examinations

13.1 A student is eligible to take regular End Examinations of current semester if she or he full fills the attendance requirement.

13.2 A student shall be promoted from current semester to succeeding semester on satisfying the attendance requirement.

13.3 A student shall complete all credit-bearing and audit subjects successfully before taking End examination for project viva-voce.

13.4 Attendance Requirement

13.4.1 Attendance of students shall be recorded for credit-bearing and audit subjects as per the workload indicated in curriculum.

13.4.2 Total class-periods conducted shall be reckoned from beginning to end of a semester as published in academic calendar.

13.4.3 Aggregate Percentage of Attendance is calculated using total number of class-periods attended as numerator and total number of class-periods conducted for the concerned subject as the denominator.

13.4.5 A minimum aggregate attendance of 75% is required for promotion to succeeding semester.

13.4.6 A student can appeal to the Principal for condoning deficiency in aggregate attendance if she or he gets 65% or more aggregate attendance presenting a valid reason for deficiency. Such a student will be granted promotion if the Principal pardons the deficiency. Principal has the right to reject the appeal if it is not satisfied with the performance of the student or the reason cited for deficiency of the attendance.

13.4.7 A student earning less than 75% aggregate attendance will be denied promotion. A student who is not promoted on basis of attendance shall be removed from the rolls and shall register for the same semester when opportunity arises. The current semester record of the student is cancelled automatically.

14.0 Revaluation of End Examination Scripts

14.1 Revaluation of End Examination scripts is allowed for theory subjects only by paying requisite fee.

14.2 A Procedure for Revaluation: The script will be revaluated by an examiner appointed by the Principal. The maximum of revaluation and regular end examination marks will be awarded for that subject.

14.3 A student can apply for revaluation in a subject only once.

15.0 Supplementary End Examinations

15.1 Students are eligible to take Supplementary examinations in subjects with fail grade F or X only.

15.2 Supplementary examinations for even semester subjects will be conducted with regular examinations of odd semester subjects and vice versa.

15.3 A student will be allowed to improve grade in any theory subject provided she or he has completed coursework of all semesters but before award of provisional/final degree.

16.0 Requirements for Award of M. Tech degree

16.1 Time Limit for completion of requirements for award of degree is four calendar years from the date of admission. A student who could not complete all the requirements in this time limit shall forego admission and will be removed from the rolls of the Institute.

16.2 A student shall be eligible for award of degree provided she or he has:

16.2.1 Registered and successfully completed all required credit-bearing and audit subjects with a total of 68 credits.

16.2.2 Secured a CGPA of 5.5 or more.

16.2.3 Cleared all dues to the Institute, library and hostel.

16.2.4 No disciplinary action is pending against her or him.

16.2.5 Satisfied any other stipulation of the affiliating University.

16.3 Award of Class: Each student will be given class in degree based on CGPA as given in Table 3.

Table 3 Class of Degree

Class of Degree	Range of CGPA
Second Class	>= 5.5 but <6.5
First Class	>= 6.5 but <7.5
First Class with Distinction	>= 7.5

16.4 Consolidated Grade Card and Degree will issued under the seal of affiliating University.

17.0 Transitory Regulations

17.1 A student who initially joins the Institute in a previous Regulation and has to re-join in any semester of the present Regulations, due to any reason, shall be bound by the rules of the current Regulations. Board of Studies of the concerned Major will specify, extra or otherwise, academic coursework to be undertaken by such students who re-join the current Regulations

Rules for Disciplinary Action for Malpractice / Improper Conduct inExaminations

S. No	Nature of Malpractice/Improper conduct	Punishment
1.	Possesses or keeps accessible, 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 examination hall in which he is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance only in that subject.
2.	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.
3.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject.
4.	Gives / receives assistance or guidance from any other student orally or by communicatingbody language.	Expulsion of both from the examination hall and cancellation of the performance only in that subject.
5.	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 student is appearing.	If copied material is related to the concerned subject and if that material is related to question paper then expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project workof that semester/year, otherwise expulsion from that subject only.
6.	Enters in a drunken state to the examination hall.	Expulsion from the examination hall and cancellation of performance in all subjects of the semester/year including practical examinations and projectwork.
7.	Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination	Expulsion from the examination hall and cancellation of performance in all subjects of the semester / year including practical examinations and projectwork.
8.	Any outsider or impersonator found in and oroutside the examination hall.	Handing him over to the police and registering a case against him.

COURSE STRUCTURE

Annexure – 1 Curriculum
M.Tech - Artificial Intelligence & Data Science (Computer Science & Engineering)

I Semester

S. No.	Course Codes	Course Name	Category	Hours per week			IM	EM	CR
				L	T	P			
1.	2298101	Machine Learning	PCC	3	0	0	40	60	3
2.	2298102	Artificial Intelligence	PCC	3	0	0	40	60	3
3.	2298103 2298104 2298105	**Program Elective Course – I** 1. Big Data Analytics 2. Information retrieval 3. Natural Language Processing	PEC	3	0	0	40	60	3
4.	2298106 2298107 2298108	**Program Elective Course – II** 1. Data Visualization Techniques 2. Distributed Systems 3. Medical Image Processing	PEC	3	0	0	40	60	3
5.	2298109	AI & ML Lab	PCC	0	0	4	50	50	2
6.	2298110	Advanced Python Programming Lab	PCC	0	0	4	50	50	2
7.	2284103	Research Methodology & IPR	MC	2	0	0	40	60	2
8.	2270AXX	**Audit Course – I**	AC	2	0	0	40	0	0
Total				**16**	**0**	**8**	**340**	**400**	**18**

II Semester

S. No.	Course Codes	Course Name	Category	Hours per Week			IM	EM	CR
				L	T	P			
1.	2298201	Data Science	PCC	3	0	0	40	60	3
2.	2298202	Deep Learning	PCC	3	0	0	40	60	3
3.	2298203 2298204 2298205	**Program Elective Course - III** 1. Block Chain Technology 2. Exploratory Data Analysis using R 3. Video Analytics	PEC	3	0	0	40	60	3
4.	2298206 2298207 2298208	**Program Elective Course - IV** 1. Text Mining & Time Series Data Analysis 2. Social Media Analysis 3. Artificial Intelligence in Cyber Security	PEC	3	0	0	40	60	3
5.	2298209	Deep Learning Lab	PCC	0	0	4	50	50	2
6.	2298210	Program Elective Course Lab	PEC	0	0	4	50	50	2
7.	2298211	Technical seminar	PROJ	0	0	4	100	0	2
8.	2270AXX	**Audit Course – II**	AC	2	0	0	40	0	0
Total				**14**	**0**	**12**	**400**	**420**	**18**

III Semester

S. No.	Course Codes	Course Name	Category	Hours per Week			IM	EM	CR
				L	T	P			
1.	2298301 2298302 2298303	**Program Elective Course – V** 1. Reinforcement Learning 2. Federated Machine Learning 3. Intrusion Detection Systems	PEC	3	0	0	40	60	3
2.	22OE993	**Open Elective** Composite Materials	OEC	3	0	0	40	60	3
3.	2298307	Dissertation Phase – I	PROJ	0	0	20	100	0	10
4.	2298308	Co-curricular Activities							2
		Total		**6**	**0**	**20**	**180**	**120**	**18**

IV Semester

S. No.	Course Codes	Course Name	Category	Hours per Week			IM	EM	Credits
				L	T	P			
1.	2298401	Dissertation Phase – II	PROJ	0	0	32	50	50	16
Total									**16**

AUDIT COURSES

S.No	Subject Code	Subject
1	2270A01	English for Research Paper Writing
2	2270A02	Disaster Management
3	2270A03	Sanskrit for Technical Knowledge
4	2270A04	Values for Professional Ethics
5	2270A05	Constitution of India
6	2270A06	Pedagogy Studies
7	2270A07	Stress Management by Yoga
8	2270A08	Personality Development through Life Management Skills

OPEN ELECTIVES

S.No	Subject Code	Subject
1	22OE981	Knowledge Engineering and Data Science
2	22OE982	Cloud Data Management
3	22OE983	Soft Computing

M.TECH.-
I- SEMESTER SYLLABUS

Course Title	MACHINE LEARNING					M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2298101	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs			

Course Objectives:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques.
- To study the various probability-based and generalized learning techniques.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the machine learning concepts that are suitable for developing real t applications.
CO 2	Develop Decision tree learning models for given problem.
CO 3	Understand neural network representation for solving a problem.
CO 4	Understand Bayesian learning to developing models to solve real time problem.
CO 5	Apply instance based learning methods for solving real time problems.

UNIT-I

Introduction to Machine Learning: Introduction, well posed learning problems, Designing a learning system, Perspective and issues in machine learning, Types of Machine Learning, Applications of machine learning.

UNIT-II

Decision Tree Learning – Introduction, Decision Tree Representation, Appropriate Problems for decision tree learning, Hypothesis search space in Decision Tree Learning, Inductive bias in Decision Tree Learning, Issues in Decision Tree Learning.

UNIT-III

Artificial Neural Networks: Introduction, Artificial Neural networks representation, Appropriate Problems for neural network learning, perceptrons, Multilayer Networks and the back propagation Algorithm, Example: Face recognition.

UNIT-IV

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and Concept Learning, Maximum likelihood and least squared error hypothesis, maximum likelihood and hypothesis for predicting probabilities, Minimum description Length Principle, Bayes optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, An example: learning to classify text, Bayes Belief Networks, The EM Algorithm.

UNIT - V

Instance Based Learning: Introduction, K-Nearest Neighborhood Learning, Locally Weighted representation, Radial Basis Fuctions, Case based reasoning,

Text Books:

1. Machine Learning, Tom M.Mitchell, McGraw-Hill.
2. Introduction to Machine Learning, Ethem Alpaydin, Third Edition, MIT Press
3. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
4. Machine Learning: A Probabilistic Perspective, KevinMurphy,MITPress,2012.

Reference Books:

1. Artificial Neural Network, Robert J. Schalkoff, McGraw Hill.
2. Bayesian Reasoning & Machine Learning, David Barber, Cambridge University Press.
3. Tree-Based Machine Learning, Clinton Sheppard, Create Space Independent Publishing.

Course Title	ARTIFICIAL INTELLIGENCE				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2298102	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs			

Course Objectives:

- To impart knowledge about Artificial Intelligence.
- To give understanding of the main abstractions and reasoning for intelligent systems.
- To enable the students to understand the basic principles of Artificial Intelligence in various applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Solve basic AI based problems.
CO 2	Define the concept of Artificial Intelligence.
CO 3	Apply AI techniques to real-world problems to develop intelligent systems.
CO 4	Select appropriately from a range of techniques when implementing intelligent systems.

UNIT - I

Introduction: The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art. **Intelligent Agents**: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT - II

Solving Problems by Searching: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

UNIT – III

Knowledge representation and reasoning: propositional and predicate logic, Resolution and theorem proving, Temporal and spatial reasoning. Probabilistic reasoning, Bayes theorem.

UNIT – IV

Learning: Learning from example, Learning by advice, Explanation based learning, Learning in problem solving, Classification, Inductive learning, Naive Bayesian Classifier, decision trees.

UNIT – V

Intelligent Systems: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition. Key Application Areas: Expert system, decision support systems, Speech and vision, Natural language processing, Information Retrieval, Semantic Web.

Text books:

1. Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig, Prentice Hall
2. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill.
3. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education.
4. Artificial Intelligence: A New Sythesis" by Nils J Nilsson, Kindle Edition.

Reference Books:

1. SarojKaushik. Artificial Intelligence. Cengage Learning, 2011.
2. Artificial Intelligence, George F Luger, 6th Edition, Pearson
3. Artificial Intelligence, ELA Kumar, Wiley.
4. Artificial Intelligence: A Guide to Intelligent Systems, Michael Negnevitsky, Pearson.

Websites:

https://www.youtube.com/watch?v=pKeVMlkFpRc
www.digimat.in/nptel/courses/video/106106126/L01.html

Course Title	BIG DATA ANALYTICS (Professional Elective Course-I)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298103	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To familiarize the Big Data Platform and its use cases.
- To provide an overview of Apache Hadoop.
- To provide HDFS Concepts and Interfacing with HDFS.
- To familiarise Map Reduce analytics using Hadoop and related tools like Pig, Hive etc.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Describe big data and use cases from selected business domains.
CO 2	Explain the big data with industrial examples.
CO 3	Install, configure, and run Hadoop and HDFS.
CO 4	Perform map-reduce analytics using Hadoop.
CO 5	Use Hadoop related tools such as HBase, Pig, and Hive for big data analytics.

UNIT-I

Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems - Intelligent data analysis, Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.

UNIT-II

Industry Examples of Big Data, Big Data Technology, Information Management, Business Analytics, Data Privacy and Ethics.

UNIT-III

Hadoop: Meet Hadoop, Map Reduce, The Hadoop Distributed File System, YARN, Hadoop I/O

Map Reduce: The Configuration API, Setting up the development environment, Writing a Unit Test with MRI Unit, Running locally on Test Data, Running on a cluster, Tuning a job, MapReduce workflows.

UNIT-IV

Introduction to Pig: Installing and running pig, Comparison with databases, User defined functions, Data processing operators, Pig in practice.

UNIT-V

Hive: Installing Hive, Running Hive, Comparison with traditional databases, HiveQL, Tables, Querying Data and user defined functions.

HBase: Hbasics concepts, Installations, Clients, Building an online query applications, HBase versus RDBMS, Praxis.

Text Books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley,2013.
2. P.J. Sadalage and M. Flower, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistance”, Addision-Wesley Professionals, 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley,2012. Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley,2012.

Reference Books:

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley,2012.
2. Lars George, "HBase: The Definitive Guide", O'Reilley,2011.
3. Alan Gates, "Programming Pig", O’Reilley,2011.
4. Chris Eaton, Dirk De Roos, Tom Deutsch, George Lapis, Paul Zikopoulos,“Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.

Course Title	INFORMATION RETRIEVAL (Professional Elective Course-I)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2298104	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To use different information retrieval techniques in various application areas.
- To apply IR principles to locate relevant information in large collections of data.
- To analyze the performance of retrieval systems when dealing with unmanaged data sources.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basic concepts of the information retrieval.
CO 2	Analyze the involvement of the information retrieval in different applications.
CO 3	Apply data pre-processing, indexing, retrieval methods and concepts.
CO 4	Evaluate the effectiveness and efficiency of different information retrieval systems.

UNIT-I

Boolean retrieval, The term vocabulary and postings lists: Document delineation and character sequence decoding, Determining the vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings and phrase queries, Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, Spelling correction, Phonetic correction.

UNIT-II

Index construction, Index compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression, Scoring, term weighting, and the vector space model: Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring, Variant tf-idf functions.

UNIT-III

Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction, Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results.

UNIT-IV

Relevance feedback and query expansion: The Rocchio algorithm for relevance feedback, Probabilistic relevance feedback, Evaluation of relevance feedback strategies, XML retrieval, Language models, The query likelihood model, Language modeling versus other approaches in IR, Extended language modeling approaches.Text classification: The text classification problem, Naive Baye's text classification, The Bernoulli model.

UNIT-V

Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k nearest neighbor, Linear versus nonlinear classifiers. Web search basics, Web crawling and indexes.

Text Books:

1. Introduction to Information Retrieval , Christopher D. Manning and Prabhakar Raghavan and Hinrich Schütze, Cambridge University Press, 2009.
2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald.
3. Mark T Maybury, Springer. Modern Information Retrieval, Ricardo Baeza-Yates, Pearson Education, 2007.

Reference Books:

1. Information Retrieval: Algorithms and Heuristics, David A Grossman and Ophir Frieder, 2nd Edition, Springer, 2004.
2. Information Retrieval Data Structures and Algorithms, William B Frakes, Ricardo BaezaYates, Pearson Education, 1992.
3. Information Storage & Retrieval, Robert Korfhage, John Wiley & Sons.

Course Title	NATURAL LANGUAGE PROCESSING (Professional Elective Course-I)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2298105	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To introduce the fundamental concepts and theory of Natural Language Processing (NLP) and its practical applications
- To explore Linguistic and statistical approaches to language processing in the three major subfields of NLP

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand approaches to syntax and semantics in NLP
CO 2	Understand approaches to generate, dialogue and summarisation within NLP
CO 3	Understand current methods for statistical approaches to machine translation
CO 4	Understand machine learning techniques used in NLP, including hidden Markov models and unsupervised methods

UNIT-I

Introduction – What is Natural Language Processing (NLP) - Syntax, semantics, pragmatics, and ambiguity in NLP, Regular Expressions, Text Normalisation, Edit Distance.

N-gram Language Models-N-Grams, Evaluating Language Models, Generalisation and Zeros, Smoothing, Kneser-Ney Smoothing, The Web and Stupid Backoff, Perplexity's Relation to Entropy.

UNIT-II

Neural Networks and Neural Language Models-Units, Feed-Forward Neural Networks, Training Neural Nets, Neural Language Models.

Vector Semantics and Embeddings-Lexical Semantics, Vector Semantics, Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, Applications of the tf-idf vector model,Word2vec, Visualizing Embeddings ,Semantic properties of embeddings, Bias and Embeddings, Evaluating Vector Models.

UNIT-III

Sentiment Classification – What is sentiment classification. Machine Learning for Sentiment Classification - Training the Classifier (Naive Bayes, Logistic Regression, Support Vector Machine, Decision Tree, Random Forest), Optimising for Sentiment Analysis - Other text classification tasks – Evaluation of classification models: Precision, Recall, F-measure, Test sets and Cross-validation, Statistical Significance Testing.

UNIT - IV

Part-of-Speech Tagging-English Word Classes, The Penn Treebank Part-of-Speech Tagset, Part-of-Speech Tagging, HMM Part-of-Speech Tagging, Maximum Entropy Markov Models, Bi-directionality, Part-of- Speech Tagging for Morphological Rich Languages. Information Extraction-Named Entity Recognition, Relation Extraction, Extracting Times, Extracting Events and their Times, Template Filling.

UNIT-V

Sequence Processing with Recurrent Networks-Simple Recurrent Neural Networks, Applications of Recurrent Neural Networks, Deep Networks: Stacked and Bidirectional RNNs, Managing Context in RNNs: LSTMs and GRUs, Words, Subwords and Characters
Neural Language Models and Generation Revisited, Encoder-Decoder Networks, Attention, Applications of Encoder-Decoder Networks. Case study: Machine translation, Question Answering.

Text Books:

1. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed).
2. James Allen, "Natural Language Understanding", 2/E, Addison-Wesley, 1994
3. Steven Bird, Natural Language Processing with Python, 1st Edition, O'Reilly, 2009
4. Jacob Perkins, Python Text Processing with NLTK 2.0 Cookbook, Packt Publishing, 2010

Reference Books:

1. Manning C, Schuetze H. Foundations of Statistical Natural Language Processing, MIT Press
2. Natural Language: A Machine Learning Perspective, Yue Zhang, Zhiyang Teng, Cam Bridge University Press.
3. Natural Language Processing in Action Understanding, Analyzing, Generation Text with Python, Hobson Lane, Cole Howard, Hannes Max-Haple, Manning Publications

Course Title	DATA VISUALIZATION TECHNIQUES (Professional Elective Course-II)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298106	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Familiarise how data can be presented to various stakeholders.
- Identify peculiarities in data with the help of visualisation.
- Design dashboards for easy understanding of underlying data.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the necessity of visualisation in data management.
CO 2	Apply visual analytics principles to appropriately preprocess data for visualization
CO 3	Use R functions to generate plots for given data
CO 4	Perform validation of visualisations based on type and purpose of data.
CO 5	Create dashboards and drill-down methods for data visualisation.

UNIT-I

Introduction to visualization - the visualization pipeline, The Value of Visualization, Data - Why Do Data Semantics and Types Matter, Data Types, Dataset Types, Attribute Types, Semantics

UNIT-II

Plotting in R - plot() function, Displaying multivariate data, Using graphics parameters, Matrix plots, Exporting graphs.

Visual Analytics - Optimal visualization types, Binning values, Calculated fields, Table calculations, Level of Detail calculations.

UNIT-III

Validation - Four Levels of Design, Angles of Attack, Threats and Validation Approaches, Validation Examples, Defining Marks and Channels, Using Marks and Channels, Channel Effectiveness, Relative vs. Absolute Judgments.

UNIT-IV

Presenting results to stakeholders, ggplot library in R - layers, geoms, stats, positioning, annotations, scales, axes and legends, facetting, autoplot and fortify (atleast one example of each case to be done).

UNIT-V

Dashboard development - Dashboard design principles, Dashboard interactivity, connected "drill-down" dashboards. Visualization case studies - Textual data, Temporal data.

Text Books:

1. Exploratory Data Analysis Using R, Ronald K. Pearson, CRC Press
2. Data Visualization using power BI, Orange and Excel, Dr. Shirshendu Roy
3. Data Visualization: Charts, Maps & Interactive Graphics, Robert Grant, CRC Press.

Reference Books:

1. Handbook of Data Visualization, C. Chen, W. Hardle, A. Unwin, Springer.
2. Data Visualization Principles & Practice, Alexandru C. Telea, 2nd Edition, CRC Press.
3. Interactive Data Visualization, Foundations, Techniques & Applications, Matthew O. Ward, Georges Gainstein and Daniel Keins, CRC Press.

Course Title	DISTRIBUTED SYSTEMS (Professional Elective Course-II)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2298107	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To make the student to understand the features of distributed systems.
- Creating awareness among students on processes and synchronization among processes.
- Learn the concepts of consistency models, replication and fault tolerance in distributed systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify the core concepts of distributed systems.
CO 2	Understand the concepts of threads and communication mechanisms for processes.
CO 3	Develop the clock synchronization, mutual exclusion and election algorithms.
CO 4	Analyze the consistency and replication models.
CO 5	Understand the fault tolerance mechanisms in distributed systems.

UNIT - I

Introduction: Definition of a distributed system, Goals, Types of distributed systems.

Architectures: Architecture styles, System architectures.

UNIT - II

Processes: Threads, virtualization, clients, servers, code migration.

Communication: Fundamentals, Remote Procedure Call, Message oriented communication, Stream oriented communication, Multicast communication.

UNIT - III

Synchronization: Clock synchronization, Logical clocks, Mutual exclusion, Election Algorithms.

UNIT - IV

Consistency and Replication: Introduction, Data centric consistency models, Client centric consistency models, Replica management, Consistency protocols.

UNIT - V

Fault Tolerance: Introduction to fault tolerance, Process resilience, Reliable client server communication, Reliable group communication, Distributed commit, Recovery.

Text Books:

1. Andrew S. Tanenbaum, Marteen Van Steen, "Distributed Systems: Principles and Paradigms", 2nd Edition, PHI.
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems – Concepts and Design", Fourth Edition, Pearson Education.
3. Andrew S. Tanenbaum, "Distributed Operating System", Pearson Education.
4. Pradeep K. Sinha, "Distributed Operating Systems – Concepts and Design", PHI publications.

Reference Books:

1. Distributed Systems and Algorithm Analysis, Randy Chew, Theodove Johnson, Pearson.
2. Distributed Systems and Paradigms, Andrew. S. Tanenbaum, Maarten Van Steen, 2nd Edition, Pearson.
3. Distributed Systems: Computing over Network, Joel M. Crichlow, 2nd Edition, PHI.

Course Title	MEDICAL IMAGE PROCESSING (Professional Elective Course-II)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2298108	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Learn the fundamental Image Processing techniques and Characteristics of medical images.
- Study the different types of filters for medical images.
- Understand future extraction and statistical measurements for images.
- Study Image restoration and Image Segmentation.
- Understand Soft computing techniques for image processing

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Recall the fundamental Image Processing Techniques and Understand Characteristics of different types of medical Images.
CO 2	Analyse different types of noise reduction filters for medical image processing.
CO 3	Apply statistical measurements on images and extract related information.
CO 4	Understand image restoration and Segmentation techniques.
CO 5	Apply Soft Computing Techniques for Images.

UNIT-I

Introduction: What is image? Digital Image, Image resolution and aspect ratio, Components of Digital image processing, Sampling and Quantisation, Applications areas, Vision Fundamentals.

Biomedical image processing: Various modalities of medical imaging, Problems with medical images, Image enhancement and other modalities of medical imaging.

UNIT-II

Noise reduction filters for medical images: Sources of noise and filters used for noise reduction, Spatial domain filters: Low pass filter, High Pass filter, High boost filter, Frost filter, Variance filter, Median filter. Frequency Domain filters: Convolution Theorem, Smoothing Domain filters, Sharpening Domain filters, Homomorphic filtering.

UNIT-III

Feature extraction & Statistical measurement: Selection of features, Shape related features, Fourier Descriptors, Texture Analysis, Breast Tissue Detection.

UNIT – IV

Medical Image restoration: Image restoration, Degradation model, Estimation of degradation function, Blur model, Medical image restoration, Blur identification, Super-resolution model, Applications of image restoration.

Biomedical Image Segmentation: Image Segmentation, Points detection, Line detection, Edge detection methods, Histogram-Based image segmentation, Segmentation using Split and Merge method, Region Growing Method, Watershed method, K-means clustering method.

UNIT-V

Soft Computing Techniques: Fuzzy-Based Techniques, Neural Network based techniques, Genetic Algorithm-Based Techniques.

Content-Based Medical Image Retrieval: Content-Based Image Retrieval, Content-Based Medical Image Retrieval.

Text Books:

1. Medical Image Processing- Concepts and Applications, G.R. Sinha, Bhawati Charan Patel, PHI Learning Pvt Ltd.
2. Medical Image Processing Reconstruction and Analysis-Concepts and Methods, Jiri Jan, 2nd Edition, CRC Press.
3. Hand Book of Medical Image Processing and Analysis, Issac N. Bankman, Academic Press.

Reference Books:

1. Guide to Medical Image Analysis-Methods and Algorithms, Klaus D. Toennies, Springer.
2. Digital Image Processing for Medical Applications, Geoff Dougherty, Cambridge University Press.
3. Medical Image Systems- An Introductory Guide, Andreas Maier. Stefan Steidl,Vincent Christlein, Joachim Hornegger, Springer.

Course Title	AI & ML LAB				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298109	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	4	2	50	50	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To understand state-space search algorithms, and choose the appropriate algorithm.
- To analyse a problem so that appropriate problem solving techniques may be applied.
- To understand Decision tree algorithm for solving real time problems.
- To understand Artificial Neural network and Probability based machine learning algorithms.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Solve basic AI based problems.
CO 2	To understand and implement control strategy.
CO 3	To implement Classification based machine learning algorithms.
CO 4	To implement Instants based and Neural networks machine learning algorithms.

List of Lab Experiments

1. Write a python program to implement tic-tac-toe game.
2. Write a python program to implement water jug problem.
3. Write a python program to implement Hill Climbing.
4. Write a python program to implement A* algorithm.
5. Write a python program to implement Constraint Satisfactory Problem.
6. Implement the following Data Preprocessing tasks using python.
    a. Importing the Data set
    b. Missing Data
    c. Splitting the dataset into the Training set and Test set
    d. Feature Scaling
7. Implement decision tree algorithm using python.
8. Implement Naive Bayes using python.
9. Implement k-nearest neighbor's classification using python.
10. Implement Artificial Neural networks algorithm using python.

Text Books:

1. Machine Learning, Tom M.Mitchell, McGraw-Hill
2. A Complete Introduction to the Python Language, Mark Summer Field, 2ndEdition
3. Python The Complete Reference, Martin C.Brown, Brandon A.Nordin
4. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis

Reference Books:

1. Artificial Neural Network, Robert J. Schalkoff, McGraw Hill.
2. Bayesian Reasoning & Machine Learning, David Barber, Cambridge University Press.
3. Tree-Based Machine Learning, Clinton Sheppard, Create Space Independent Publishing.

Course Title	ADVANCED PYTHON PROGRAMMING				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298110	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	4	2	50	50	100
					End Exam Duration: 3Hrs		

List of Experiments:

Week-1: Study and implementation of various Basic Slicing and Advanced Indexing operations of NumPy arrays using Python over example data series?

Week-2: Implement the program using python Aggregations like Min, Max, and etc.?
Example: Consider the heights of all US presidents and find the Average Height of prime ministers of America? This data is available in the file "*president_heights.csv"*.
Week-3: Write a python Program using Numpy Comparisons, Masks, and Boolean Logic?
Example: Consider the series of data that represents the amount of precipitation each day for a year in a given city and count the Rainy Days.
Week-4: Write a python Program using Numpy Fancy Indexing in single and multiple dimensions by selecting Random Points?
Week-5: Study and implementation of various Pandas operations on
i) Data sets ii) Data Frames iii) Crosstab iv) Group by
v) Filter vi) Missing values
Week-6: Implement the python program using pandas
i) Program to Combining Datasets using Merge.
ii) Program to Combining Datasets using joins.
Week-7: Implement the python program using pandas
i) Program using Pandas on Pivot Tables.
ii) Program using Pandas to Vectorized String Operations.
Week-8: Program using Pandas to Working with Time Series
Example: Visualizing Seattle Bicycle Counts data set.

Week-9: Implement the python program for the following matplotlib features
i) Color bars.
ii) Annotation
iii) Matplotlib to Text.
iv) Histograms
v) Scatter Plots
vi) Box plot

Week 10: Write the python program to implement various sub packages of Scipy.

Week11: Write a Python program to create a parent class and child class along with their own methods. Access parent class members in child class to implement the following sceneries.

a) Constructors & destructors

b) Polymorphism

Example:

Create a class ATM and define ATM operations to create account, deposit, check_balance, withdraw and delete account. Use constructor to initialize members.

Week-12: Implement the various data cleaning steps of example data sets using python nympy and pandas

Week13: Implement the feature selection of data set using appropriate sklearn libraries.

Text Books:

1. Robert Johansson, "Numerical Python: A Practical Techniques Approach for Industry" published by Apress.
2. Daniel Y. Chen, "Pandas for Everyone: Python Data Analysis", First Edition by Addison-Wesley Professional
3. Alvaro Fuentes, "Become a Python Data Analyst" by Packt publishing
4. Paul Barry, "Head First Python a Brain Friendly Guide", O'Reilly, 2nd Edition, 2016.

Reference Books:

1. Advanced Python Programming By Dr. Gabriele Lanaro, Quan Nguyen, SakisKasampalis by Packt publishing
2. Advanced Python Development: Using Powerful Language Features in Real World Applications By Matthew Wilkes ApressJuly 2020
3. Expert Python Programming - Fourth Edition By Michal Jaworski and Tarek ZiadePackt PublishingMay 2021
4. Modern Python Cookbook - Second Edition By Steven F. Lott Packt PublishingJuly 2020.

Course Title	RESEARCH METHODOLOGY & IPR				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2284103	MC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	2	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Understand research technology.
- Be aware of the technical principles of research, ethical challenges and approval processes.
- Describe quantitative, qualitative and mixed methods approaches to research
- Identifying the components of a literature review process.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand research problem formulation
CO 2	Analyze research related information
CO 3	Follow research ethics
CO 4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
CO 5	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO 6	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

UNIT I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II

Effective literature studies approaches, analysis Plagiarism, Research ethics.

UNIT III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. atent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

Text Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students".
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction".
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners".
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

Reference Books:

1. Mayall , "Industrial Design", McGraw Hill, 1992.
2. Niebel , "Product Design", McGraw Hill, 1974.
3. Asimov , "Introduction to Design", Prentice Hall, 1962.
4. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

M.TECH.-
II- SEMESTER SYLLABUS

Course Title	DATA SCIENCE					M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2298201	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs			

Course Objectives:

- Provide you with the knowledge and expertise to become a preficent data scientist.
- R-Programming code to statistically analyze a dataset.
- Evaluating Data visualizations.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understanding how data is collected, managed and stored for data science
CO 2	Understanding the key concepts in data science
CO 3	Learning R-Programming
CO 4	Understanding social networks

UNIT I

Introduction: What Is Data Science? Big Data and Data Science Hype, Getting Past the Hype, Why Now? The Current Landscape (with a Little History), A Data Science Profile, Thought Experiment: Meta-Definition, What Is a Data Scientist, Really?

Statistical Inference, Exploratory Data Analysis, and the Data Science Process: Statistical Thinking in the Age of Big Data, Exploratory Data Analysis, The Data Science Process, Thought Experiment: How Would You Simulate Chaos? Case Study: RealDirect

UNIT II

Algorithms: Machine Learning Algorithms, Three Basic Algorithms : Linear Regression, k-Nearest Neighbors (k-NN), k-means.

Spam Filters, Naive Bayes, and Wrangling: Learning by Example: Why Won't Linear Regression Work for Filtering Spam? How About k-nearest Neighbors? Naive Bayes: Bayes Law, A Spam Filter for Individual Words, A Spam Filter That Combines Words: Naive Bayes, Comparing Naive Bayes to k-NN, Web APIs and Other Tools.

UNIT III

Data Visualization and Fraud Detection: Data Visualization History, What Is Data Science, Redux? A Sample of Data Visualization Projects, Mark's Data Visualization Projects, Data Science and Risk, Data Visualization at Square, Ian's Thought Experiment Data Visualization for the Rest of Us.

UNIT IV

R-Programming : What is R? Why use R for analytics? How to run R? First R example, functions a short Programming example, some important R data structures, vectors, matrices, lists, R programming structures.

UNIT V

Social Networks and Data Journalism: Social Network Analysis at Morning Analytics, Social Network Analysis, Terminology from Social Networks, Thought Experiment Morningside Analytics, More Background on Social Network Analysis from a Statistical Point of View, Data Journalism.

Text Books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.

2. Norman matloff ,"The art of R programming". No Starch Press, 2009.

3. Thomas A. Runkler, "Data Analytics: Models and Algorithms for Intelligent Data Analysis", Springer Science & Business Media, 2012.

4. Mark Gardener, "Beginning R- The Statistical Programming Language", John Wiley & Sons, Inc.,

Reference Books:

1. Data Science, John D. Kelleher, Brendan Tierney, MIT Press.

2. R in Action Data Analysis and Graphics with R, Robert I. Kabacoff, Manning Publications, 2011.

3. Practical Statistics for Data Scientists, Peter Bruce, Andrew Bruce, O'Reilly Meida.

Course Title	DEEP LEARNING				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298202	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To introduce students to the basic concepts and techniques of Deep Learning
- To understand the theoretical foundations, algorithms, and methodologies of Neural Networks.
- To design and develop deep learning models for solving real-time problems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand neural network representation for solving a real-time problem
CO 2	Develop Convolutional Neural Networks models to solve real-world problems
CO 3	Develop Recurrent Neural Network models for solving the given problems.
CO 4	Apply Autoencoders for analyzing and finding the solution for the given problem.
CO 5	Apply RBM models for solving real-time problems.

UNIT-I

Fundamentals of Neural Networks: Introduction, Types of Machine Learning: Classification problem, The regression problem, overfitting and underfitting, Bias and variance, Overview of Artificial Neural Networks: Biological Neuron, Types of Artificial Neural Networks, Optimization Techniques, What is Deep Learning?

UNIT-II

Convolutional Neural Networks: Introduction, Components of CNN Architecture: Convolutional Layer, Pooling or Downsampling Layer, Flattening Layer, Fully Connected Layer, Rectified Linear Unit(ReLU) Layer, Exponential Linear Unit, Architectures of CNN, Applications of CNN.

UNIT-III

Recurrent Neural Network: **Basic Concepts**: Introduction: RNN versus CNN, Feedforward Neural Network versus RNN, Simple Recurrent Neural Network: Training RNN, Backpropagation through Time, RNN Topology, Bidirectional and Stateful RNNs, Long Short-Term Memory (LSTM), LSTM Implementation, Gated Recurrent Unit (GRU), Deep Recurrent Neural Network.

UNIT-IV

Autoencoder: Introduction: Features of Autoencoder, Types of Autoencoder: Vanilla autoencoder, Multilayer autoencoder, Stacked autoencoder, Deep autoencoder, Denoising autoencoder, Convolutional autoencoder, Regularized autoencoder.

UNIT - V

Restricted Boltzmann Machine: Boltzmann Machine, RBM Architecture, Example, Types of RBM.

Open Source Frameworks for Deep Learning: Frameworks: Tensor Flow, Keras, Py Torch.

Text Books:

1. Dr. S. Lovelyn Rose, Dr. L. Ashok Kumar, Dr. D. Karthika Renuka, "Deep Learning Using Python", Wiley India Pvt Ltd, 2019
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning" , Second edition, MIT Press, 2016.
3. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media,2017.
4. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.

Reference Books:

1. Introduction to Machine Learning, Ethem Alpaydin, Third Edition, MIT Press.
2. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
3. Machine Learning: A Probabilistic Perspective, KevinMurphy, MITPress,2012

Course Title	BLOCKCHAIN TECHNOLOGY (Professional Elective Course - III)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298203	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Gain knowledge on Blockchain Fundamentals and Working Principle
- Understand the basic concept of Cryptographic Hash Functions, Hash Pointers
- Learn Elliptic Curve Digital Signature Algorithm.
- Get an insight into the working of the Bitcoin network, wallet, Bitcoin mining and distributed consensus for reliability.
- Gain knowledge about Bitcoin storage, Transaction and Usage
- Be familiar with Bitcoin Mining Hardware, Pools, strategies and basics of Anonymity.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Learn Blockchain Fundamentals and Working Principle.
CO 2	Apply Cryptographic Hash Functions, Hash Pointers.
CO 3	Implement Elliptic Curve Digital Signature Algorithm.
CO 4	Work on Bitcoin network, wallet, Bitcoin mining and distributed consensus for reliability.
CO 5	Use Bitcoin Transaction, Payment Services and Exchange Market Services.
CO 6	Design Bitcoin Mining Hardware, Pools and strategies

UNIT-I

Block Chain Fundamentals: Tracing Blockchain's Origin, Revolutionizing the Traditional Business Network, How Blockchain Works, What Makes a Blockchain Suitable for Business? Introduction to Cryptography: Cryptographic Hash Functions, SHA256, Hash Pointers and Data Structures, Merkle tree.

UNIT-II

Digital Signatures: Elliptic Curve Digital Signature Algorithm (ECDSA), Public Keys as Identities, A Simple Crypto currency. Learning

UNIT-III

Centralization vs. Decentralization, Distributed Consensus, Consensus without identity using a block chain, Incentives and proof of work. Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network.

UNIT-IV

Storage of and Usage of Bitcoins: Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

UNIT-V

Bitcoin Mining: The Task of Bitcoin miners, Mining Hardware, Mining pools, Mining incentives and strategies. Bitcoin and Anonymity: Anonymity Basics, Mixing, Zerocoin and

Text Books:

1. Blockchain for dummies, Manav Gupta, 2nd IBM Limited Edition, Published by John Wiley & Sons, Inc, 2018.
2. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, 2016.

Reference Books:

1. Blockchain: Blueprint for a New Economy, Melanie Swan, O'Reilly Media, 1/e, 2015.
2. Mastering Bitcoin: Programming the Open Blockchain, Andreas M. Antonopoulos, O'Reilly, 2/e, 2017.

Course Title	EXPLORATORY DATA ANALYSIS USING R (Professional Elective Course - III)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2298204	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs			

Course Objectives:

- Learn how to create graphical and numerical summaries of two categorical variables.
- Learn how to graphically summarize numerical data.
- Learn to explore and summarize a real world dataset.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand Exploratory Data Analysis.
CO 2	Implement Graphics using R.
CO 3	Exploring a new dataset.
CO 4	Understand working process with External Data.
CO 5	Understand Linear Regression Models.

UNIT-I

Data, Exploratory Analysis, and R:

Why do we analyze data?, The view from data, exploratory analysis, Computer software, and R, Representative R session.

UNIT-II

Graphics in R:

Exploratory vs. explanatory graphics, Graphics systems in R, The plot function, Adding details to plots, A few different plot types.

UNIT-III

Exploratory Data Analysis: A First Look:

Exploring a new dataset, Summarizing numerical data, Anomalies in numerical data, Visualizing relations between variables.

UNIT – IV

Working with External Data:

File management in R, Manual data entry, interacting with the Internet, Working with CSV files, working with other file types, Merging data from different sources.

UNIT-V

Linear Regression Models:

Modeling the whiteside data, Over fitting and data splitting, Regression with multiple predictors, Using categorical predictors, Interactions in linear regression models regression.

Text Books:

1. Ronald K. Pearson, “Exploratory Data Analysis using R” CRC Press.
2. Nathan Yau, "Visualize This: The Flowing Data Guide to Design, Visualization and Statistics", Wiley, 2011
3. W. N. Venables. D. M. Smith and the R Core Team, "An Introduction to R", 2013
4. Robert I. Kabacoff ,"R in Action Data analysis and graphics with R" Manning Publications Co 2011.

Reference Books:

1. Aczel−Sounderpandian: "*Complete Business Statistics*" 7th Edition Complete Business Statistics, Seventh Edition McGraw−Hill Primis.
2. Pierre Lafaye de Micheaux, Remy Drouilhet and Benoit Liquet – “ The R Software Fundamentals of Programming and Statistical Analysis”, Springer.
3. Seema Acharya - *"Data Analytics Using R"* ,Jan 01, 2018, Seema Acharya-MC GRAW HILL INDIA (2018)

Course Title	VIDEO ANALYTICS (Program Elective Course - III)					M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2298205	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs			

Course Objectives:

- To understand the need for video Analytics
- To understand the basic configuration of video analytics
- To understand the functional blocks of a video analytic system
- To get exposed to the various applications of video analytics

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Design video analytic algorithms for security applications
CO 2	Design video analytic algorithms for business intelligence
CO 3	Design custom made video analytics system for the given target application

UNIT-I

VIDEO ANALYTIC COMPONENTS

Need for Video Analytics-Overview of video Analytics- Foreground extraction- Feature extraction-classifier - Preprocessing- edge detection- smoothening- Feature space-PCA-FLD-SIFT features

UNIT-II

FOREGROUND EXTRACTION

Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations- erosion-Dilation-Tracking in a multiple camera environment

UNIT-III

CLASSIFIERS

Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier- Bayesian classifier-HMM based classifier

UNIT-IV

VIDEO ANALYTICS FOR SECURITY

Abandoned object detection- human behavioral analysis -human action recognition- perimeter security- crowd analysis and prediction of crowd congestion.

UNIT-V

VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE & TRAFFIC MONITIRING AND ASSISTANCE

Customer behavior analysis - people counting- Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning

Reference Books:

1. Graeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor) Video-Based Surveillance Systems: Computer Vision and Distributed Processing , Kluwer academic publisher, 2001.

2. Nilanjan Dey (Editor), Amira Ashour (Editor) and Suvojit Acharjee (Editor), Applied Video Processing in Surveillance and Monitoring Systems (IGI global) 2016

3. Zhihao Chen (Author), Ye Yang (Author), Jingyu Xue (Author), Liping Ye (Author), Feng Guo (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014

4. Caifeng Shan (Editor), Fatih Porikli (Editor), Tao Xiang (Editor), Shaogang Gong (Editor) Video Analytics for Business Intelligence, Springer, 2012.

<table>
<tr><td>Course Title</td><td colspan="5">TEXT MINING & TIME SERIES DATA ANALYSIS
(Program Elective Course - IV)</td><td colspan="3">M.Tech AI&DS II Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">2298206</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hours</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• Understand the basics of text mining and time series analysis.
• Learn how to preprocess and clean text data.
• Become familiar with various text mining techniques such as tokenization, stemming, and sentiment analysis.
• Understand time series data and its properties.
• Learn how to perform time series analysis techniques such as trend analysis, forecasting, and anomaly detection.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Analyze unstructured textual data and perform pre-processing techniques such tokenization, part of speech tagging and chunking.</td></tr>
<tr><td>CO 2</td><td colspan="8">Build and apply various text categorization techniques, clustering techniques, sentiment analysis and topic modelling.</td></tr>
<tr><td>CO 3</td><td colspan="8">Build and apply various classification techniques.</td></tr>
<tr><td>CO 4</td><td colspan="8">Model and Analyze time series data using various statistical techniques such as ARIMA and SARIMA models.</td></tr>
<tr><td>CO 5</td><td colspan="8">Understand the challenges of time series analysis and apply appropriate techniques for dealing with missing data and outliers.</td></tr>
</table>

UNIT-I

Basic techniques in natural language processing - tokenziation, part-of-speech tagging, chunking, syntax parsing, named entity recognition. Case study: Public NLP toolkits.

Document representation - representing unstructured text documents with appropriate format and structure, automated text mining algorithms.

Text categorization - supervised text categorization algorithms, Naive Bayes, kNN, Logistic Regression, SVM, Decision Trees.

Text clustering - connectivity-based (or hierarchical) clustering, centroid-based (k-means) clustering.

UNIT-II

Topic modeling - general idea of topic modeling, basic topic models, Probabilistic Latent Semantic Indexing, Latent Dirichlet Allocation (LDA). Applications - classification, imagine annotation, collaborative filtering, and hierarchical topical structure modeling.

Document summarization - Extraction- based summarization methods.

Sentiment analysis - concept, sentiment polarity prediction, review mining, aspect identification.

UNIT-III

Characteristics of Time Series: Introduction, The nature of time series data, Time series statistical models, Measure of Correlation: Autocorrelation and Cross-correlation, Stationary time series**,** Estimation of correlation.

Time Series Regression and Exploratory Data Analysis: Classical Regression in the time series context, Exploratory Data Analysis, Smoothing in the time series context.

UNIT-IV

ARIMA Models: Introduction, Autoregressive moving average models, Difference equation, Autocorrelation and partial autocorrelation, Forecasting, Estimation, Integrated models for nonstationary data, Building ARIMA models, Multiplicative Seasonal ARIMA models.

UNIT- V

Spectral Analysis and Filtering: Introduction, Cyclical behaviour and periodicity, The spectral density, Periodogram and Discrete Fourier transform, Nonparametric spectral estimation, Multiple series and Cross-Spectra, Linear filters, Dynamic Fourier Analysis and wavelets, Lagged Regression models, Spectral analysis of multidimensional dseris.

Text Books:

1. Charu C. Aggarwal and Cheng Xiang Zhai, “Mining Text Data”, Springer, 2012.
2. Daniel Jurafsky and James H Martin, “Speech & Language Processing”, Pearson Education India, 2000.
3. Robert H. Shumway and David S. Stoffer, “Time series Analysis and Its Applications with R Examples”, 3rd edition, Springer.

Reference Books:

1. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, “Introduction to Information Retrieval”. Cambridge University Press, 2007.
2. Michael W. Berry, Jacob Kogan ,”Text Mining: Applications and Theory” , Wiley.

Course Title	SOCIAL MEDIA ANALYSIS (Program Elective Course - IV)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298207	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Understand Social Media Ecosystem: Provide students with an in-depth understanding of the social media landscape, including popular platforms, user behaviors, and emerging trends.
- Data Collection and Preprocessing: Teach students how to collect and preprocess social media data from various sources, including text, images, and videos.
- Sentiment Analysis: Familiarize students with sentiment analysis techniques to gauge public opinion and sentiment trends on social media.
- Network Analysis: Introduce students to social network analysis, helping them understand the structure of online communities, identify influencers, and detect trends.
- Topic Modeling and Text Mining: Equip students with the skills to perform topic modeling and text mining on social media data to discover prevalent topics and trends.
- Image and Video Analysis: Teach students how to analyze and extract insights from images and videos shared on social media platforms.
- Social Media Analytics Tools: Provide hands-on experience with popular social media analytics tools and platforms.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand and analyze social media platforms, Types of data available on social media and preprocess social media data from various sources, including text, images, and videos.
CO 2	Analyze the sentiment analysis techniques to gauge public opinion, sentiment trends on social media and structure of social networks.
CO 3	Equip students with the skills to perform topic modeling and text mining on social media data to discover prevalent topics and trends.
CO 4	Analyze and extract insights from images and videos shared on social media platforms.
CO 5	Apply popular social media analytics tools and platforms.

UNIT-I

Introduction to Social Media Analysis:

Overview of social media platforms and their importance, Ethical considerations in social media data analysis, Types of data available on social media.

Data Collection and Preprocessing: Web scraping techniques for collecting social media data**,** Handling different data formats (text, images, videos)**,** Data cleaning, normalization, and text preprocessing.

UNIT-II

Sentiment Analysis:

Understanding sentiment analysis, Text classification techniques for sentiment analysis, Practical applications of sentiment analysis in marketing and brand management.

Network Analysis: Introduction to social network analysis**,** Analyzing the structure of social networks**,** Identifying influencers and communities on social media.

UNIT-III

Topic Modeling and Text Mining:

Introduction to topic modeling, Latent Dirichlet Allocation (LDA) and other topic modeling algorithms, Extracting and visualizing topics from social media text data.

UNIT-IV

Image and Video Analysis:

Analyzing images and videos from social media, Object detection, image classification, and video summarization, Applications in content moderation and recommendation systems.

UNIT-V

Social Media Analytics Tools and Platforms: Overview of popular social media analytics tools and platforms**,** Hands-on experience with tools like R, Python libraries (e.g., tweepy, textblob), and social media APIs**,** Building custom dashboards for social media data visualization

Emerging Trends and Ethical Considerations: Exploring emerging trends in social media analysis (e.g., deep learning for social media, real-time analytics)**,** Discussing ethical considerations, privacy issues, and responsible data use in social media analysis.

Text Books:

1. "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More" by Matthew A. Russell.
2. "Social Media Mining: An Introduction" by Reza Zafarani, Mohammad Ali Abbasi, and Huan Liu.
3. "Sentiment Analysis: Mining Opinions, Sentiments, and Emotions" by Bing Liu.

Reference Books:

1. "Text Mining and Analysis: Practical Methods, Examples, and Case Studies Using SAS" by Goutam Chakraborty, Murali Pagolu, and Satish Garla.
2. "Python for Data Analysis" by Wes McKinney.

Course Title	ARTIFICIAL INTELLIGENCE IN CYBER SECURITY (Program Elective Course - IV)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2298208	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To equip students realise the scope of artificial intelligence in preventing security threats.
- To automate the process of detection using artificial intelligence tools
- To give an overview to the intrusion techniques

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Deploy artificial intelligence based solutions for preventing cyber attacks
CO 2	Understand the basic underlying architecture used for intrusion detection
CO 3	Understand the heuristic methods used for cyber security

UNIT-I

Time series analysis, Stochastic time series model, ANN time series model, Support Vector time series models, Time series decomposition, Time series analysis in cybersecurity.

Time series trends and seasonal spikes, Predicting DDoS attacks - ARMA, ARIMA, ARFIMA. Voting ensemble.

UNIT-II

Using data science to catch email fraud and spam, **Anomaly detection** using K-means, Using windows logs and active directory data. Decision tree and Context-based malicious event detection.

Statistical and machine learning approaches to detection of attacks on computers - Techniques for studying the Internet and estimating the number and severity of attacks, network based attacks, host based attacks. Statistical pattern recognition for detection and classification of attacks, and techniques for visualizing network data, etc.

UNIT-III

Using **heuristics** to detect malicious pages, Using machine learning, logistic regression, and SVM to detect malicious URLs. Multiclass classification to detect malicious URLs.

Levenshtein distance to differentiate malicious URLs from others. Using TensorFlow for intrusion detection. Machine learning to detect financial fraud - imbalanced data and credit card frauds, managing under- sampled data for logistic regression. Adam gradient optimiser for deep learning. Feature extraction and cosine similarity to quantify bad passwords.

UNIT-IV

Overview of intrusions, system intrusion process, dangers of system intrusions, history and state of the art of intrusion detection systems (IDSs): anomaly detection, misuse detection, types of IDS: Network- Based IDS. Host-Based IDS, Hybrid IDS,

UNIT- V

Intrusion Prevention Systems (IPS): Network-Based IPS, Host-Based IPS, Intrusion Detection Tools, the limitations and open problems of intrusion detection systems, advanced persistent threats, case studies of intrusion detection systems against real-world threats and malware.

Text Books:

1. Soma Halder, Sinan Ozdemir, "Hands-on Machine Learning for Cybersecurity", Packt Publishing.
2. Roberto Di Pietro, Luigi V. Mancini, Intrusion Detection System, Springer ,2008
3. Anderson, Ross (2001). Security Engineering: A Guide to Building Dependable Distributed Systems. New York: John Wiley & Sons. pp. 387–388. ISBN 978-0-471-38922-4.
4. Anderson, James P., "Computer Security Threat Monitoring and Surveillance," Washing, PA, James P. Anderson Co., 1980.

Reference Books:

1. Artificial Intelligence and Cyber Security: Advances and Innovations, Ishaani Priyadarshini, Rohith Sharma, CRC Press.
2. Artificial Intelligence for Cyber Security: Methods, Issues and Possible Horizons or Opportunities, Sanjay Misra, Amit Kumar Tyagi, Springer.
3. Hans on Artificial Intelligence for Cyber Security, Alessandro Parisi, Packt Publisher.

Course Title	DEEP LEARNING LAB				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exams	Total
2298209	PCC	0	0	4	2	50	50	100
					End Exam Duration: 3Hrs			

Course Objectives:

- Implement the various deep learning algorithms in Python.
- Learn to work with different deep learning frameworks like Keras, Tensor flow, PyTorch, etc..

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Build Artificial Neural models to solve real time problems.
CO 2	Build and Analyze the CNN , RNN and LSTM models.
CO 3	Implement Auto-encoder and Boltzmann model for solving real time applications.

List of Experiments

1. Implement Perceptron Algorithm using Python.

2. Implement Multi Layer Perceptron(MLP) using Python.

3. Implement Artificial Neural Network (ANN) using Python.

4. Implement CNN for classification of images.

5. Implement RNN using python.

6. Implement LSTM using python.

7. Implement auto-encoder using python.

8. Implement Boltzmann machine algorithm using python.

9. Implement logistic regression using python.

10. Implement K-means clustering using python.

References:

1. Dr. S. Lovelyn Rose, Dr. L. Ashok kumar, Dr. D. Karthika Renuka, Deep Learning using Python", Wiley India Pvt. Ltd.

2. Francois Chollet, "Deep learning with Python" – Manning Publications.

Course Title	PROGRAM ELECTIVE COURSE LAB - II				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2298210	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	4	2	50	50	100
					End Exam Duration: 3Hrs			

List of Experiments

A minimum of 10 experiments shall be given from Professional Elective-III/ Professional Elective-IV.

Course Title	TECHNICAL SEMINAR				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298211	PR	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	4	2	100	-	100
Internal Assessment:								

Course Objectives:

- Identify and compare technical and practical issues related to the area of course specialization.
- Outline annotated bibliography of research demonstrating scholarly skills.
- Prepare a well-organized report employing elements of technical writing and critical thinking.
- Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Establish motivation for any topic of interest and develop a thought process for technical presentation.
CO 2	Organize a detailed literature survey and build a document with respect to technical publications.
CO 3	Analysis and comprehension of proof-of-concept and related data.
CO 4	Effective presentation and improve soft skills.
CO 5	Make use of new and recent technology for creating technical reports.

GUIDELINES FOR TECHNICAL SEMINAR

Seminar is an important component of learning in an Engineering College, where the student gets acquainted with preparing a report & presentation on a topic.

PARAMETERS OF EVALUATION:

1. The seminar shall have topic approved by the faculty.
2. The seminar is evaluated for 100 marks for internal.
3. The students shall be required to submit the rough drafts of the seminar.
4. Faculty shall make suggestions for modification in the rough draft. The final draft shall be presented by the student.
5. Presentation schedules will be prepared by Department in line with the academic calendar.

The Seminars shall be evaluated as follows:

Rough Draft:

In this stage, the student should collect the information from various sources on the topic and collate them in a systematic manner. He/ She may take the help of the concerned faculty.
The report should be typed in "MS-Word" file with "Times New Roman" font, with font size of 16 for main heading, 14 for sub-headings and 12 for the body text. The seminar report contains relevant diagrams, pictures and illustrations. It should normally contain 10 to 15 pages.

1.	Topic, name of the student & faculty	1 Page
2.	List of contents	1 Page
3.	Introduction	1 Page
4.	Descriptions of the topic (point-wise)	5 – 10 Pages
5.	Conclusion	1 Page
6.	References/Bibliography	1 Page

The soft copy of the rough draft of the seminar presentation in MS Power Point format along with the draft report should be submitted to the concerned faculty, within stipulated time.

The evaluation of the technical seminar report shall generally be based upon the following: Within one week of the submission of the rough draft, the students are to submit the final draft incorporating the suggestions made by the faculty.

Presentation:

After finalization of the final draft, the students shall be allotted dates for presentation (in the designated seminar classes) and they shall then present it in presence of students, Faculty & Technical Seminar In- charge.

The student shall submit 3 copies of the Report neatly bound. The students shall also distribute the title and abstract of the seminar in hard copy to the Technical Seminar In-charge. The final presentation has to be delivered with 18-25 slides. The time duration for presentation is 15 to 20 minutes.

The evaluation of the Presentation shall generally be based upon the following.

1.	Punctuality in submission of Seminar Report	20 Marks
2.	Reports and Contents of Presentation	20 Marks
3.	Depth of the students' knowledge in the subject	20 Marks
4.	Relevance and interest the topic creates	15 Marks
5.	Ability to involve the spectators	15 Marks
6.	Question answer session	10 Marks
	Total	**100 Marks**

WHO WILL EVALUATE?

The presentation of the seminar topics shall be made before an internal evaluation committee comprising the Head of the Department or his/her nominee, seminar in-charge and a senior faculty of the department.

M.TECH.-

III- SEMESTER SYLLABUS

Course Title	REINFORCEMENT LEARNING (Program Elective Course - V)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298301	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Learn the theoretical foundations of reinforcement learning (Markov decision processes & dynamic programming).
- Learn the algorithmic foundations of reinforcement learning (temporal difference and Monte- Carlo learning).
- Gain experience in framing low-dimensional problems and implementing solutions using tabular reinforcement learning.
- Learn about the motivation behind deep reinforcement learning and its relevance to high- dimensional applications, such as playing video games, and robotics.
- Discover the state-of-the-art deep reinforcement learning algorithms such as Deep Q Networks (DQN), Proximal Policy Optimisation (PPO), and Soft Actor Critic (SAC)

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Describe the core principles of autonomous systems learning.
CO 2	Calculate mathematical solutions to problems using reinforcement learning theory.
CO 3	Compare and contrast a range of reinforcement learning approaches.
CO 4	Propose solutions to decision making problems using knowledge of the state-of-the-art.
CO 5	Evaluate the performance of a range of methods and propose appropriate improvements.

UNIT – I

Introduction to Reinforcement Learning and its Mathematical Foundations, The Markov Decision Process Framework, Markov Reward Processes, The Policy, Markov Decision Processes

UNIT – II

Dynamic Programming, Model-Free Learning & Control, Monte-Carlo Learning, Temporal Difference Learning

UNIT – III

Motivation for function approximation, High-dimensional state and action spaces, Continuous state and action spaces

UNIT – IV

Deep Q-learning, Q update through back propagation, Experience replay buffer, Target and Q networks

UNIT – V

Policy gradients: The REINFORCE algorithm, Policy update through back propagation, Proximal Policy Optimization Advanced topics: Soft Actor Critic, Learning from demonstration, Model-based reinforcement learning

Text Books:

1. Optimal Control, Linear Quadratic Methods, Anderson and Moore. (1989).
2. Optimal control and reinforcement learning, Bertsekas. (2019)
3. Predictive control for linear and hybrid systems, Borrelli, Bemporad, and Morari. (2017).

Reference Books:

1. Reinforcement Learning, Sutton and Barto (2018).
2. Adaptive Filtering Prediction and Control, Goodwin and Kwai. (1984).

Course Title	FEDERATED MACHINE LEARNING (Program Elective Course - V)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2298302	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Understanding of the fundamental concepts, principles of federated machine learning & Basics of Privacy and Security in Federated Learning.
- Familiarize students with key FedML algorithms, including federated averaging, federated learning with deep neural networks, and federated transfer learning.
- Introduce students to popular FedML frameworks and tools like TensorFlow Federated (TFF), PySyft, and Google's FLoC.
- Expose students to various real-world applications of federated learning, with a focus on domains such as healthcare, finance, and edge computing.
- Encourage critical thinking and research skills by exploring open problems and emerging trends in the FedML field.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Recall machine learning concepts and Techniques. Understand and analyze the basic concepts of federated machine learning.
CO 2	Familiarize students with key FedML algorithms, including federated averaging, federated learning with deep neural networks, and federated transfer learning.
CO 3	Develop FedML algorithms using appropriate frameworks and tools, and evaluate their performance on distributed data.
CO 4	Apply FedML techniques to real-world problems, particularly in domains like healthcare or IoT.
CO 5	Identify research questions and challenges in Federated Machine Learning and contribute to the field through research projects or papers.

UNIT – I

Introduction to Machine Learning and Federated Learning

Overview of machine learning concepts and techniques, Introduction to federated learning and its significance, Historical context and real-world applications.

Basics of Privacy and Security in Federated Learning: Privacy challenges in federated learning, Differential privacy and its role in federated learning, Security threats and safeguards.

UNIT-II

Federated Learning Algorithms

Federated averaging, Federated learning with deep neural networks, Federated transfer learning.

Communication and Optimization in Federated Learning: Communication-efficient federated learning, Optimization techniques for federated learning, Model aggregation methods.

UNIT-III

Federated Learning Frameworks and Tools

TensorFlow Federated (TFF), PySyft and PyTorch, Google's Federated Learning of Cohorts (FLoC)

UNIT-IV

Federated Learning in Specific Domains: Healthcare applications, Federated learning in finance, Federated learning for IoT and edge devices.

UNIT-V

Challenges and Future Directions

Open problems and research directions in federated learning, Ethical considerations and bias in federated learning, Scalability and deployment issues.

Text Books:

1. "Federated Learning: Strategies, Applications, and Challenges" by Qiang Yang, Wei Li, and Zhaoyang Lv.
2. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy.
3. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.

Reference Books:

1. "Distributed Machine Learning" by Qirong Ho and Alex Smola.
2. Machine Learning, Tom M.Mitchell, McGraw-Hill.
3. Dr. S. Lovelyn Rose, Dr. L. Ashok Kumar, Dr. D. Karthika Renuka, “Deep Learning Using Python”, Wiley India Pvt Ltd, 2019

Course Title	INTRUSION DETECTION SYSTEMS (Program Elective Course - V)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2298303	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.
- Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems
- Analyze intrusion detection alerts and logs to distinguish attack types from false alarms

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Explain the fundamental concepts of Network Protocol Analysis and demonstrate the skill to capture and analyze network packets.
CO 2	Use various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems.

UNIT-I

History of Intrusion detection, Audit, Concept and definition , Internal and external threats to data, attacks, Need and types of IDS, Information sources Host based information sources, Network based information sources.

UNIT-II

Intrusion Prevention Systems, Network IDs protocol based IDs ,Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis , techniques Responses requirement of responses, types of responses mapping responses to policy Vulnerability analysis, credential analysis non credential analysis.

UNIT-III

Introduction to Snort, Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes.

UNIT-IV

Working with Snort Rules, Rule Headers, Rule Options, The Snort Configuration File etc. Plugins, Preprocessors and Output Modules, Using Snort with MySQL.

UNIT-V

Using ACID and Snort Snarf with Snort, Agent development for intrusion detection, Architecture models of IDs and IPs.

Text Books:

1. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003.

Reference Books:

1. Christopher Kruegel,Fredrik Valeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.
2. Carl Endorf, Eugene Schultz and Jim Mellander " Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.
3. Stephen Northcutt, Judy Novak : "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.

Course Title	DISSERTATION PHASE - I				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2298307	PROJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	20	10	100	0	100
Exam Duration: 2 Hours								

Course Objectives:

-

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Students will learn to survey the relevant literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.
CO 2	Students will be able to use different experimental techniques.
CO 3	Students will be able to use different software/ computational/analytical tools
CO 4	Students will be able to design and develop an experimental set up/ equipment/testing.
CO 5	Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them
CO 6	Students will be able to either work in a research environment or in an industrial environment.

Syllabus Contents:

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student

Course Title	CO-CURRICULAR ACTIVITIES					M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2298308		L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	0	2	-	-	-

Course Objectives:

- To promote the development of non-academic skills among students.
- To provide exposure to a range of co-curricular activities.
- To encourage students to pursue their interests and passions outside of the classroom.
- To enhance teamwork, leadership, and communication skills.
- To develop a sense of community and camaraderie among students.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate an understanding of the importance of the Co-curricular Activities in personal and professional development.
CO 2	Identify different types of Co-curricular Activities and how they complement academic pursuits.
CO 3	Develop effective communication, leadership, teamwork, problem solving and creative skills.
CO 4	Participate in a range of cultural, physical, professional development, entrepreneurial and community service activities.
CO 5	Apply the skills developed through co-curricular activities to personal and professional context.

Week 1: Introduction to Co-Curricular Activities

- Importance of co-curricular activities in personal and professional development
- Different types of co-curricular activities
- How co-curricular activities complement academic pursuits

Week 2: Communication Skills

- Importance of communication skills in personal and professional life
- Different forms of communication
- Techniques to improve communication skills

Week 3: Leadership Skills

- What is leadership?
- Different styles of leadership
- Techniques to develop leadership skills

Week 4: Teamwork Skills

- Importance of teamwork in personal and professional life
- Characteristics of effective teams
- Techniques to develop teamwork skills

Week 5: Problem-Solving Skills

- Importance of problem-solving skills in personal and professional life
- Different approaches to problem-solving
- Techniques to improve problem-solving skills

Week 6: Creative Skills

- Importance of creativity in personal and professional life
- Different forms of creativity
- Techniques to develop creativity skills

Week 7: Cultural Activities

- Importance of cultural activities in personal and professional development
- Different forms of cultural activities
- Techniques to develop cultural awareness and sensitivity

Week 8: Physical Activities

- Importance of physical activities in personal and professional development
- Different forms of physical activities
- Techniques to develop physical fitness and well-being

Week 9: Professional Development Activities

- Importance of professional development activities in personal and professional growth
- Different forms of professional development activities
- Techniques to develop skills for career growth

Week 10: Entrepreneurial Activities

- Importance of entrepreneurial activities in personal and professional development
- Different forms of entrepreneurial activities
- Techniques to develop entrepreneurial skills

Week 11: Community Service Activities

- Importance of community service activities in personal and professional development
- Different forms of community service activities
- Techniques to develop community involvement and engagement

M.TECH.-
IV- SEMESTER SYLLABUS

Course Title	DISSERTATION PHASE - II				M.Tech AI&DS IV Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2298401	PROJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	32	16	50	50	100

Course Objectives:

-

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Students will develop attitude of lifelong learning and will develop interpersonal skills to deal with people working in diversified field will.
CO 2	Students will learn to write technical reports and research papers to publish at national and international level.
CO 3	Students will develop strong communication skills to defend their work in front of technically qualified audience

Syllabus Contents:

It is a continuation of Project work started in semester IV. He has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailedproject report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. . The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.

AUDIT COURSE-I & II SYLLABUS

Course Title	ENGLISH FOR RESEARCH PAPER WRITING (Audit Course)				M.Tech AI&DS I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2270A01	AC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand Writing skills and level of Readability.
CO 2	Analyze what to write in each section.

UNIT I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT II

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.

UNIT III

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT IV

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

UNIT V

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Text Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

Reference Books:

1. Adrian Wallwork, English for Academic Research: Grammar Usage and Style, Springer.

Course Title	DISASTER MANAGEMENT (Audit Course)				M.Tech AI&DS I/II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2270A02	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand foundations of hazard, disasters and natural/social phenomena.
CO 2	Analyze Repercussions of disasters and hazards.
CO 3	Understand key concepts in disaster risk reduction and humanitarian response.

UNIT I

Introduction to Disaster: Definition, Factors and Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II

Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III

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 IV

Disaster Preparedness and Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT V

Risk Assessment

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'sParticipation In Risk Assessment. Strategies for Survival.

Disaster Mitigation

Meaning, Concept and Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

Text Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

Reference Books:

1. Fundamentals of Disaster Management, Shekhawat R.S, Bhatnagar Harshul.
2. Disaster management, Ruthra, Lakshmi Publications.
3. Disaster Management and Preparedness, Nidhi Gauba Dhawan, Ambrina Sardar Khan, CBS Publishers.

Course Title	SANSKRIT FOR TECHNICAL KNOWLEDGE (Audit Course)				M.Tech AI&DS I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2270A03	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours							

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
- Learning Sanskrit to improve brain functioning.
- Learning Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand Sanskrit grammar and Composition.
CO 2	Understand the roots of technical information about Sanskrit literature.
CO 3	Understand Technical concepts of Engineering.

UNIT I

Alphabets in Sanskrit,

Past/Present/Future Tense,

Simple Sentences

UNIT III

Order

Introduction of roots

Technical information about Sanskrit Literature

UNIT III

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Text Books:

1.Dr.Vishwas, "Abhyaspustakam" – Samskrita-Bharti Publication, New Delhi.

2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication.

3. Suresh Soni , "India's Glorious Scientific Tradition", Ocean books (P) Ltd., New Delhi.

Course Title	VALUES FOR PROFESSIONAL ETHICS (Audit Course)					M.Tech AI&DS I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2270A04	AC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Knowledge of self-development
CO 2	Learn the importance of Human values
CO 3	Developing the overall personality

UNIT I

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.

Moral and non- moral valuation. Standards and principles.

Value judgements

UNIT II

Importance of cultivation of values.

Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.

Honesty, Humanity. Power of faith, National Unity.

Patriotism.Love for nature, Discipline

UNIT III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.

Punctuality, Love and Kindness.

Avoid fault Thinking.

Free from anger, Dignity of labour.

Universal brotherhood and religious tolerance.

True friendship.

Happiness Vs suffering, love for truth.

Aware of self-destructive habits.

Association and Cooperation.

Doing best for saving nature

UNIT IV

Character and Competence –Holy books vs Blind faith.

Self-management and Good health.

Science of reincarnation.

Equality, Nonviolence ,Humility, Role of Women.

All religions and same message.

Mind your Mind, Self-control.

Honesty, Studying effectively

Text Books:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.
2. John Haffai, Lead on & How to win over worry, World Book Publisher.
3. Swami Vivekananda, Call to the Youth for Nation Building, Advaita Ashrama, Calcutta.
4. Swami Vivekananda, Youth and Modern India, Rama Krishna Mission, Chennai.

Reference Books:

1. M.G. Chitakra, Education and Human values, A.P.H. Publishing corporation, New Delhi.

Course Title	CONSTITUTION OF INDIA (Audit Course)				M.Tech AI&DS I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2270A05	AC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik
- Revolution in 1917 and its impact on the initial drafting of the Indian Constitution

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Discuss the growth of the demand for civil right s in India for the bulk of Indians before the arrival of Gandhi in Indian politics
CO 2	Discuss the intellectual origins of the frame work of argument that informed the conceptualization of sociall reforms leading to revolution in India
CO 3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO 4	Discuss the passage of the Hindu Code Bill of 1956

UNIT I

History of Making of the Indian Constitution:

History, Drafting Committee, (Composition & Working)

Philosophy of the Indian Constitution:

Preamble, Salient Features

UNIT II

Contours of Constitutional Rights & Duties:

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT III

Organs of Governance:

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions.

Executive:

President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT IV

Local Administration:

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Pachayati raj: Introduction, PRI: Zila Pachayat.

Elected officials and their roles, CEO Zila Pachayat: Position and role.

Block level: Organizational Hierarchy (Different departments),

Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT V

Election Commission:

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners.

State Election Commission: Role and Functioning.

Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Title	PEDAGOGY STUDIES (Audit Course)					M.Tech AI&DS I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2270A06	AC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
CO 2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
CO 3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT I

Introduction and Methodology:

Aims and rationale, Policy background, Conceptual framework and terminology

Theories of learning, Curriculum, Teacher education.

Conceptual framework, Research questions**.**

Overview of methodology and Searching.

UNIT II

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.

Curriculum, Teacher education.

UNIT III

Evidence on the effectiveness of pedagogical practices

Methodology for the in depth stage: quality assessment of included studies.

How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Theory of change.

Strength and nature of the body of evidence for effective pedagogical practices.

Pedagogic theory and pedagogical approaches.

Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV

Professional development: alignment with classroom practices and follow- up support

Peer support

Support from the head teacher and the community.

Curriculum and assessment

Barriers to learning: limited resources and large class sizes

UNIT V

Research gaps and future directions

Research design, Contexts, Pedagogy

Teacher education

Curriculum and assessment

Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

Reference Books:

1. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
2. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

Web Links:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Title	STRESS MANAGEMENT BY YOGA (Audit Course)				M.Tech AI&DS I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2270A07	AC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- To achieve overall health of body and mind.
- To overcome stress

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Develop healthy mind in a healthy body thus improving social health also
CO 2	Improve efficiency.

UNIT I

Definitions of Eight parts of yog. (Ashtanga)

UNIT II

- Yam and Niyam. Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III

- Asan and Pranayam

i)Various yog poses and their benefits for mind & body
ii)Regularization of breathing techniques and its effects- Types of pranayam

Text Books:

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur.
2. Swami Vivekananda, "Rajayoga or conquering the Internal Nature" .
3. Advaitashrama (Publication Department), Kolkata.
4. Acharya Yatendra, Yoga & Stress Management, Finger Print Publishing.

Course Title	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS (Audit Course)				M.Tech AI&DS I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2270A08	AC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- To learn to achieve the highest goal happily.
- To become a person with stable mind, pleasing personality and determination.
- To awaken wisdom in students.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO 2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO 3	Study of Neetishatakam will help in developing versatile personality of students

UNIT I

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT II

- Approach to day to day work and duties.
- Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT III

- Statements of basic knowledge.
- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-

Verses 17, Chapter 3-Verses 36,37,42,

- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

Text Books:

1. “Srimad Bhagavad Gita” by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath,Rashtriya Sanskrit Sansthanam, New Delhi.
3. Enlightenment: Personality Development and management, Sagir Ahmed, Independently Published.

Open Electives

Course Title	KNOWLEDGE ENGINEERING AND DATA SCIENCE (Open Elective)			M.Tech AI&DS III Sem
Course Code	Category	Hours/Week	Credits	Maximum Marks

22OE981	PEC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs			

Course Objectives:

- To explore the practical application of intelligent technologies into the different domains
- To give students insight and experience in key issues of data and knowledge processing

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand and describe the concepts central to the creation of knowledge bases and ex systems.
CO 2	Conduct an in-depth examination of an existing expert system with an emphasis on basicmethods of creating a knowledge base.
CO 3	Demonstrate proficiency with statistical analysis of data.
CO 4	Build and assess data-based models.

UNIT-I

Formalisms - Logic as a programming language, Logic as a knowledge language, Logic as a database language, lambda calculus, Data, information and knowledge, Knowledge based systems.

Items and Objects - unified representation, structure of data, information, and knowledge items, structure of object, data, information, and knowledge objects. Algebra of objects.

UNIT-II

Schema and normalization - r-schema and i-schema, o-schema, t- schema, Classical normal forms.

Analysis - conceptual view of objects, c-coupling map, constraints. Functional model - functional view, f-coupling map, constraints. Layout- internal view, i-coupling.

UNIT-III

Evidence and Knowledge, Abductive Reasoning, Probabilistic Reasoning, Belief functions, Baconian and Fuzzy probability, Evidence based reasoning. Ontology of problem solving tasks, Building knowledge based agents. Agent Design and Development using Learning Technology.

UNIT - IV

Problem solving through analysis and synthesis, Inquiry driven analysis and synthesis for Evidence-based reasoning, Believability assessment.

UNIT-V

Ontology Design and Development, Reasoning with ontologies and rules - Reduction and synthesis rules, Rule and ontology matching, Partially learned knowledge, Reasoning with partially learned knowledge. Generalization and specialization for knowledge based agents, Rule learning - Analogy-based generalization, Hypothesis learning.

Text Books:

1. John Debenham, "Knowledge Engineering - Unifying Knowledge Base and Database Design", Springer 2007.
2. Jude Hemnath, Madhulika Bhatia, Oana Geman, "Data Visualization and Knowledge Engineering", Springer 2020.
3. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, "Knowledge Engineering - Building Cognitive Assistants for Evidence Based Reasoning", Cambridge University Press,2016.

Reference Books:

1. Data Science and Knowledge Engineering for Sensing Decision support , Jun Liu, Jie Lu, Yong Xu, Luis Martinez, Etiennne E- Kerre, World Scientific Publications.
2. An Introduction to Knowledge Engineering, Simon Kendal, Malcolm Creen, Springer.
3. Knowledge Engineering and Management, Guus Schreiber, Hans Akkermans, Anjo Anjewierden, Robert De Hoog, Nigel Shadbolt, Walter Van de Velde and Bob Wielings, Universities Press.

Course Title	CLOUD DATA MANAGEMENT	M.Tech AI&DS III Sem

	(Open Elective)							
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
22OE982	**PEC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					**End Exam Duration: 3Hrs**			

Course Objectives:

- Familiarise the different types of cloud infrastructures.
- Manage cloud infrastructure in terms of organisation, scale, and security.
- Appraise different cloud offerings based on replication and availability.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate the concepts and technologies of Cloud Computing
CO 2	Understand the security aspects associated with Cloud Computing
CO 3	Demonstrate the virtual server component of Cloud Computing
CO 4	Understand Cloud storage and usage monitoring along with security mechanism

UNIT-I

Cloud infrastructures; public, private, hybrid. Service provider interfaces; Saas, Paas, Iaas. VDC environments; concept, planning and design, business continuity and disaster recovery principles. Managing VDC and cloud environments and infrastructures. Scalability and Cloud Services- Large Scale Data Processing- Databases and Data Stores- Data Archival.

UNIT-II

Data Security - Storage strategy and governance; security and regulations. Designing secure solutions; the considerations and implementations involved. Securing storage in virtualized and cloudenvironments. Monitoring and management; security auditing and SIEM.

UNIT-III

Data Location and Control - Architecture of storage, analysis and planning. Storage network design considerations; NAS and FC SANs, hybrid storage networking technologies (iSCSI, FCIP, FCoE), design for storage virtualization in cloud computing, host system design considerations.

UNIT – IV

Global storage management locations, scalability, operational efficiency. Global storage distribution; terabytes to petabytes and greater. Policy based information management; metadata attitudes; file systems or object storage.

UNIT-V

Securing data for transport, Designing backup/recovery solutions to guarantee data availability in a virtualized environment. Design a replication solution, local remote and advanced. Investigate Replication in NAS and SAN environments. Data archiving solutions; analyzingcompliance and archiving design considerations.

Text Books:

1. Cloud data management, Liang Zhao, Sherif Sakr Anna Liu, Athman Bouguettaya, Springer
2. Cloud data development and Management, Lee Chao, CRC Press.
3. Cloud Data Management interface, The ultimate Step by Step Guide, Geradus Blockdyk, Create Space Independent Publisher.

Reference Books:

1. Data management in the Cloud: Challenged and Opportunities, Divyakanth Agarwal, Sudipto Das, Amr El Abbadi, Morgan & Claypool Publishers.
2. Data Management in the Cloud, George Bowlin, Create Space Independent Publisher.
3. Data Management in Cloud, Grid and P2P Systems, Abdelkader Hameurlain, Farookh Khadeer Hussain, Franck Morvan, A Min Joa, Springer.

Course Title	SOFT COMPUTING (Open Elective)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
22OE983	OE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hours					End Exam Duration: 3Hrs		

Course Objectives:

- To learn the key aspects of Soft computing and Neural networks.
- To study the fuzzy logic components.
- To gain insight onto neuro fuzzy modeling and control.
- To know about the components and building block hypothesis of genetic algorithm.
- To gain knowledge in machine learning through Support Vector Machines.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Discuss on machine learning through neural networks
CO 2	Apply knowledge in developing a Fuzzy expert system
CO 3	Model Neuro Fuzzy system for clustering and classification
CO4	Discover knowledge to develop Genetic Algorithm and Support vector machine based machine learning system

UNIT I

Introduction to Soft Computing: Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics.

UNIT II

Genetic Algorithms: Introduction to Genetic Algorithms (GA) – Applications of GA - Building block hypothesis- Representation – Fitness Measures – Genetic Operators-. GA based Machine Learning.

UNIT III

Neural Networks: Machine Learning using Neural Network, Adaptive Networks – Feed Forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance Architectures – Advances in Neural Networks.

UNIT IV

Fuzzy Logic: Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions- Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

UNIT V

Neuro-Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.

Text Books:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2002.

2. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.

3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall,1996.

4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

Reference Books:

1. David E.Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1989.
2. Mitchell Melanie, "An Introduction to Genetic Algorithm", MIT Press, 1996.
3. S.N.Sivanandam, S.N.Deepa, "Introduction to Genetic Algorithms", Springer, 2008 edition