ACADEMIC REGULATIONS (R18)

COURSE STRUCTURE AND DETAILED SYLLABUS

For

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

(Effective from 2018-19)

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

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Vision

To produce globally competitive and self- disciplined Computer Engineers with innovative skills, moral values and societal concern by providing education of global standards and research in the field of Computer Science and Engineering.

Mission

M1: To produce globally competent and qualified computer professionals.

M2: To impart high quality professional training with emphasis on basic principles of Computer Science and Engineering and to foster leading edge research in the fast-changing field.

M3: To facilitate the students to work with recent tools and technologies and train the students by inculcating the spirit of ethical values contributing to societal ethics.

Programme Educational Objectives

A graduate of the K.S.R.M.C.E, C.S.E should have a successful career in CSE or a related field, and within three to five years, should

PEO1 - Technical Competence: To disseminate inclusive knowledge of fundamentals of engineering and modern computing practices, through advanced curriculum, enabling the graduates to synthesize novel ideas.

PEO2 - Learning Environment: To sensitize the graduates with the efficacy of continuous learning reinforced through student-centric pedagogy that inculcates creative talents to survive and thrive in the profession.

PEO3 - Sustainable Skills: To nurture professional behavior and industry-specific acumen in the students to effectively operate and sustain in heterogeneous work environments.

PEO4 - Ethical Behavior: To help the students understand the ramifications of emerging computing technologies and ethical application of technical expertise to resolve contemporary challenges for the welfare of the nation.

Programme Outcomes

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

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

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

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

PO5 - Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including predication 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.

Programme Specific Outcomes

PSOs are statements that describe what the graduates of a specific engineering program should be able to do:

PSO1 - Professional Skills: The ability to understand, analyze 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.

KSRM College of Engineering, Kadapa-516003, AP

Regulations for PG Program in Engineering (R18PG)

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Regulations for PG Programs in Engineering (R18 PG)

1.0 Nomenclature

1.1 *Academic Term*: Extent of time during which academic instructions are initiated and completed

1.2 *Academic Year*: Academic Term of, approximately, one year duration that usually starts in June/July and ends in April/May next

1.3 *Semester*: Either of two Academic Terms that make up an Academic Year

1.4 *Major*: A specific field of study

1.5 *Minor*: An area outside of, or complementary to, a Major

1.6 *Subject*: An area of knowledge that is studied as part of a Course

1.7 *Core*: A subject that is mandatory for a Major course of study

1.8 *Elective*: A subject that is selected for study to suit one's individual needs

1.9 *Audit Subject*: A subject that is studied to meet certain requirements but has no credits assigned to it

1.10 *Humanities*: Subjects that describe and interpret human achievements, problems and historical changes at individual and societal levels covering the disciplines of literature, history, and philosophy

1.11 *Social Sciences*: 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

1.12 *Exam*: A test to measure one's progress, knowledge, or ability in a subject

1.13 *Credit*: A numerical weight given to a subject

1.14 *Grade*: A numerical or alphabetic designation measuring the level of achievement in an exam

1.15 *Attendance*: Physical presence of oneself in a classroom/laboratory for purpose of a scheduled academic instruction

1.16 *Course*: A series of subjects that constitute a Major field of study

1.17 *Branch*: Same as Course

1.18 *Program*: Same as Course

1.19 *Specialization*: Same as branch

1.20 *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 R18 PG and come into force from Academic Year 2018-19 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
- 2.3.2 Power Systems
- 2.3.3 Renewable Energy
- 2.3.4 Embedded System & VLSI
- 2.3.5 Artificial Intelligence & Data Science

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 68 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	16
Fourth Semester	16
Total for entire course	**68**

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

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 term. 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 term, 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.

7.3.3 For laboratory/practical subjects, the internal assessment will be based on regular laboratory work over full term. 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 For subjects like seminar, project-work, industrial training, and comprehensive viva-voce, 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 term

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) 40% 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
95-100	A+	10.0	Pass
90-94	A	9.5	Pass
85-89	A-	9.0	Pass
80-84	B+	8.5	Pass
75-79	B	8.0	Pass
70-74	B-	7.5	Pass
65-69	C+	7.0	Pass
60-64	C	6.5	Pass
55-59	C-	6.0	Pass
50-54	D+	5.5	Pass
0-49	F	0.0	Fail
-	I	0.0	Result Withheld
-	X	0.0	Absent for End Exam

8.7 *SGPA*: Semester Grade Point Average indicates the performance of a student in all credit-bearing subjects of a term. SGPA is calculated as the weighted average of

Grade Points of all subjects of the term 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 term under consideration. CGPA is calculated as the weighted average of SGPAs with total credits in each term as the weights

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

9.0 Requirements for Completing Subjects

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

9.2 *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

9.3 *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. A student may request for makeup tests to satisfy this requirement by paying requisite fee

10.0 Requirements for taking End Examinations

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

10.2 A student shall be promoted from current term to succeeding term on satisfying the attendance requirement

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

10.4 Attendance Requirement

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

10.4.2 Total class-periods conducted shall be reckoned from beginning to end of a term as published in academic calendar

10.4.3 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

10.4.4 A minimum aggregate attendance of 75% is required for promotion to succeeding term

10.4.5 A student can appeal to Academic Council 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 Academic Council pardons the deficiency. Academic Council 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

10.4.6 A student earning less than 65% 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 term when opportunity arises. The current term record of the student is cancelled automatically

10.5 A student can forego promotion and opt to repeat the current term on written request. Recommendation of the concerned Faculty Advisor is required for cancellation of promotion. This option shall be exercised before the commencement of the End examinations of the current term

11.0 Revaluation of End Examination Scripts

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

11.2 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

11.3 A student can apply for revaluation in a subject only once

12.0 Supplementary End Examinations

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

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

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

13.0 Requirements for Award of M. Tech degree

13.1 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

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

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

13.2.2 Secured a CGPA of 4.5 or more

13.2.3 Cleared all dues to the Institute, library and hostel

13.2.4 No disciplinary action is pending against her or him

13.2.5 Satisfied any other stipulation of the affiliating University

13.3 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

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

14.0 Transitory Regulations

14.1 A student who initially joins the Institute in a previous Regulation and has to rejoin in an academic-term 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 rejoin the current Regulations

COURSE STRUCTURE

M.Tech. (Artificial Intelligence & Data Science)-R18 Course Structure

(Applicable from the batch admitted during 2022-23 and onwards)

M.Tech SEM-I

S.No	Subject Code	Subject	L	T	P	IM	EM	Credits
1	1898101	*Professional Core-1* Machine Learning	3	0	0	40	60	3
2	1898102	*Professional Core-2* Artificial Intelligence	3	0	0	40	60	3
3	1898103 1898104 1898105	*Professional Elective-1* 1. Big data Analytics 2. Information Retrieval 3. Privacy Preserving Data Publishing	3	0	0	40	60	3
4	1898106 1898107 1898108	*Professional Elective-2* 1. Data Visualization Techniques 2. Advanced Data Mining 3. Cloud Data Management	3	0	0	40	60	3
5	1898109	Research Methodology & IPR	3	0	0	40	60	2
6	1870AXX	Audit Course-1	2	0	0	40	--	0
7	1898111	AI & Machine Learning Lab	0	0	4	50	50	2
8	1898112	Software Lab-1 (for electives)	0	0	4	50	50	2
		Total:	**17**	**0**	**08**	**340**	**400**	**18**

M.Tech SEM-II

S.No	Subject Code	Subject	L	T	P	IM	EM	Credits
1	1898201	*Professional Core-3* Data Science	3	0	0	40	60	3
2	1898202	*Professional Core-4* Deep Learning	3	0	0	40	60	3
3	1898203 1898204 1898205	*Professional Elective-3* 1. Natural Language Processing 2. Exploratory Data Analysis using R 3. Knowledge Engineering and Data Science	3	0	0	40	60	3
4	1898206 1898207 1898208	*Professional Elective-4* 1. Text Mining 2. Social network Analysis 3. Artificial Intelligence in Cyber Security	3	0	0	40	60	3
5	1870AXX	Audit Course-2	2	0	0	40	--	0
6	1898210	Deep Learning Lab	0	0	4	50	50	2
7	1898211	Software Lab-2 (for Electives)	0	0	4	50	50	2
8	1898212	Mini Project with Seminar	2	0	0	100	--	2
		Total	**16**	**0**	**08**	**400**	**340**	**18**

M.Tech SEM-III

S.No	Subject Code	Subject	L	T	P	IM	EM	Credits
1	1898301 1898302 1898303	*Professional Elective-5* 1. Genetic Algorithms 2. Machine Learning Models and Storage Management 3. Scalable Systems for Data Science	3	0	0	40	60	3
2	1871304 1871305 1871306 1871307 1871308 1871309	*Open Elective* 1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy	3	0	0	40	60	3
3	1898310	*Major Project* Phase-I Dissertation	0	0	20	100	--	10
		Total:	**6**	**0**	**20**	**180**	**120**	**16**

M.Tech SEM-IV

S.No	Subject Code	Subject	L	T	P	IM	EM	Credits
1	1898401	*Major Project* Phase-II Dissertation	0	0	32	50	50	16
		Total:	**0**	**0**	**32**	**50**	**50**	**16**

AUDIT COURSES:

S.No	Subject Code	Subject
1	1870A01	English for Research Paper Writing
2	1870A02	Disaster Management
3	1870A03	Sanskrit for Technical Knowledge
4	1870A04	Value Education
5	1870A05	Constitution of India
6	1870A06	Pedagogy Studies
7	1870A07	Stress Management by Yoga
8	1870A08	Personality Development through Life Enlightenment Skills

OPEN ELECTIVES:

S.No	Subject Code	Subject
1	1871304	Business Analytics
2	1871305	Industrial Safety
3	1871306	Operations Research
4	1871307	Cost Management of Engineering Projects
5	1871308	Composite Materials
6	1871309	Waste to Energy

M.TECH.-
I- SEMESTER SYLLABUS

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">MACHINE LEARNING
(Professional Core-1)</td><td colspan="3">M.Tech AI&DS I Sem</td></tr>
<tr><td colspan="2">Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td colspan="2" rowspan="2">1898101</td><td rowspan="2">PCC</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="5">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="10">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.</td></tr>
<tr><td colspan="10">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="9">Understand the machine learning concepts that are suitable for developing real t applications.</td></tr>
<tr><td>CO 2</td><td colspan="9">Develop Decision tree learning models for given problem.</td></tr>
<tr><td>CO 3</td><td colspan="9">Understand neural network representation for solving a problem.</td></tr>
<tr><td>CO 4</td><td colspan="9">Understand Bayesian learning to developing models to solve real time problem.</td></tr>
<tr><td>CO 5</td><td colspan="9">Apply instance based learning methods for solving real time problems.</td></tr>
</table>

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 (Professional Core-2)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1898102	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

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">BIG DATA ANALYTICS
(Professional Elective-1)</td><td colspan="3">M.Tech AI&DS I Sem</td></tr>
<tr><td colspan="2">Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td colspan="2" rowspan="2">1898103</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="5">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="10">Course Objectives:
• To familiarise 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.</td></tr>
<tr><td colspan="10">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="9">Describe big data and use cases from selected business domains</td></tr>
<tr><td>CO 2</td><td colspan="9">Explain the big data with industrial examples.</td></tr>
<tr><td>CO 3</td><td colspan="9">Install, configure, and run Hadoop and HDFS</td></tr>
<tr><td>CO 4</td><td colspan="9">Perform map-reduce analytics using Hadoop</td></tr>
<tr><td>CO 5</td><td colspan="9">Use Hadoop related tools such as HBase, Pig, and Hive for big data analytics</td></tr>
</table>

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 forEnterprise 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-1)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1898104	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	PRIVACY PRESERVING DATA PUBLISHING (Professional Elective-1)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1898105	PS	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:

- Gaining access to high-quality data is a vital necessity in knowledge-based decision making
- Providing solutions to this problem, the methods and tools of privacy-preserving data publishing enable the publication of useful information while protecting data privacy..
- Privacy-Preserving Data Publishing: Concepts and Techniques presents state-of-the-art information sharing and data integration methods that take into account privacy and data mining requirements.

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

CO 1	Apply anonymization methods for sensitive data protection
CO 2	Apply state-of art techniques for data privacy protection.
CO 3	Design privacy preserving algorithms for real-world applications.
CO 4	Identify security and privacy issues in OLAP systems.
CO 5	Apply information metrics for Maximizing the preservation of information in the anonymization process.

UNIT I

Privacy issues, privacy models.

UNIT II

Anonymization operations: and Information metrics.

UNIT III

Anonymization methods for the transaction data, trajectory data, social networks data, and textual data.

UNIT IV

Collaborative Anonymization , Access control of outsourced data, Use of Fragmentation and Encryption to Protect Data Privacy; Security and Privacy in OLAP systems.

UNIT V

Extended Data publishing Scenarios, Anonymization for Data Mining.

Text Books:

1. Benjamin C.M. Fung, Ke Wang, Ada Wai-Chee Fu and Philip S. Yu, Introduction to Privacy-Preserving Data Publishing: Concepts and Techniques, 1st Edition, Chapman & Hall/CRC, 2010.

2. Charu C. Aggarwal, Privacy-Preserving Data Mining: Models and Algorithms, 1st Edition, Springer, 2008.

3. Introduction to Privacy-Preserving Data Publishing, Benjamin C.M. Fung, Ke Wang, Ada Wai-Chee Fu, Philip S. Yu, CRC Press.

Reference Books:

1. Privacy-Preserving Data Publishing: An Overview, Raymond Chi-Wing Wong, Ada Wai-Chee Fu, Morgan & Claypool Publishers.

2. Data Protection and Privacy, Dara Hallinam, Ronald E. Leenes and Scrge Gutwirtch, Bloomsbury Publishing.

Course Title	DATA VISUALIZATION TECHNIQUES (Professional Elective-2)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1898106	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 ofVisualization, 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, Usinggraphics 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, Relativevs. 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	ADVANCED DATA MINING (Professional Elective-2)				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1898107	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:

This course aims the students to develop the abilities of critical analysis to data mining systems and applications, to implement practical and theoretical understanding of the technologies for data mining and to understand the strengths and limitations of various data mining models.

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

CO 1	Understand the fundamentals in data mining.
CO 2	Explore various classification techniques.
CO 3	Implement clustering techniques and to apply it on various datasets.
CO 4	Investigate several web and text mining techniques.
CO 5	Describe temporal and spatial data mining process.

UNIT- I:

Data mining Overview and Advanced Pattern Mining

Data mining tasks – mining frequent patterns, associations and correlations, classification and regression for predictive analysis, cluster analysis , outlier analysis; advanced pattern mining in multilevel, multidimensional space – mining multilevel associations, mining multidimensional associations, mining quantitative association rules, mining rare patterns and negative patterns.

UNIT- II:

Advance Classification

Classification by back propagation, support vector machines, classification using frequent patterns, other classification methods – genetic algorithms, roughest approach, fuzzy set approach.

UNIT- III:

Advance Clustering:

A: Density - based methods: DBSCAN, OPTICS, DENCLUE

B: Grid-Based methods:

STING, CLIQUE; Exception – maximization algorithm; clustering High- Dimensional Data; Clustering Graph and Network Data.

UNIT-IV:

Web and Text Mining

Introduction, web mining, web content mining, web structure mining, we usage mining,
Text mining – unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering.

UNIT- V:

Temporal and Spatial Data Mining

Introduction; Temporal Data Mining – Temporal Association Rules, Sequence Mining, GSP algorithm, SPADE, SPIRIT Episode Discovery, Time Series Analysis, Spatial Mining – Spatial Mining Tasks, Spatial Clustering. Data Mining Applications.

Text Books:

1. Jiawei Hang Micheline Kamber, Jian pei, Morgan Kaufmannn, "Data Mining Concepts and Techniques.

2. Arun K Pujari, "Data Mining Techniques", Universities Press. 35.

3. Pang-Ning Tan, Vipin kumar, "Introduction to Data Mining", Michael Steinbach, Pearson.

4. T.V Sveresh Kumar, B.Esware Reddy, Jagadish S Kalimani, "Data Mining Principles & Applications", Elsevier.

Reference Books:

1. Advanced Data Mining & Applications, Jie Tang, Irwin King, Ling Chen, Jianyong Wang, Springer.
2. Advanced Data Mining Techniques, David L. Olson, Dursun Delen, Springer.

3. Advanced Data Mining, Dr. Meena Agarwal, Dr. C.P. Agarwal, Dr. Adesh Pandey, Nitya Publiacations.

E-Resources:

1.http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann- Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data- Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf.

2. https://books.google.co.in/books?id=O6F9iwsqZQwC&printsec=frontcover&dq=temporal+and+spatial+data+mining+%2Bpdf&hl=en&sa=X&ved=0ahUKEwimv9qA1LncAhWIr48KHTIfAK0Q6AEITzAF#v=onepage&q&f=false

3. http://nptel.ac.in/courses/106106093/35

4. https://freevideolectures.com/course/2280/database-design/35

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">CLOUD DATA MANAGEMENT
(Professional Elective-2)</td><td colspan="3">M.Tech AI&DS I Sem</td></tr>
<tr><td colspan="2">Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td colspan="2" rowspan="2">1898108</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="5">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="10">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.</td></tr>
<tr><td colspan="10">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="9">Demonstrate the concepts and technologies of Cloud Computing</td></tr>
<tr><td>CO 2</td><td colspan="9">Understand the security aspects associated with Cloud Computing</td></tr>
<tr><td>CO 3</td><td colspan="9">Demonstrate the virtual server component of Cloud Computing</td></tr>
<tr><td>CO 4</td><td colspan="9">Understand Cloud storage and usage monitoring along with security mechanism</td></tr>
</table>

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	RESEARCH METHODOLOGY & IPR				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1898109	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	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

Course Title	AI & MACHINE LEARNING LAB				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1898111	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	SOFTWARE LAB-1				M.Tech AI&DS I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1898112	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

A minimum of 10 experiments shall be given from Professional Elective-1 / Professional Elective-2.

M.TECH.-II- SEMESTER SYLLABUS

Course Title	DATA SCIENCE (Professional Core-3)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1898201	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 (Professional Core-4)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1898202	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 familiarise and master the tools of Artificial Intelligence
- To explore in depth deep neural architectures for learning and inference
- To evaluate the performance of neural architectures in comparison to other machine learningmethods

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

CO 1	Understand basic Neural Network architectures
CO 2	Apply fundamental principles, theory and approaches for learning with deep neural networks
CO 3	Analyse main variants of deep learning and their typical applications
CO 4	Analyse how deep learning fits within the context of other Machine Learning approaches

UNIT-I

Neural networks- Perceptrons, sigmoid units; Learning in neural networks - output vs hidden layers; linear vs nonlinear networks; linearmodels (regression) - LMS algorithm.

Perceptrons classification - limitations of linear nets and perceptrons - multi-Layer Perceptrons (MLP)- activation functions - linear, softmax, tanh, ReLU; error functions - feed-forward networks.

UNIT-II

Backpropagation - recursive chain rule - Learning weights of a logistic output neuron - loss functions - learning via gradient descent - optimization momentum method; Adaptive learning rates RmsProp - mini-batch gradient descent - bias-variance trade off, regularization - overfitting - inductive bias regularization - drop out - generalization.

Deep neural networks - convolutional nets case studies using Keras/Tensorflow.

UNIT-III

Introduction to deep reinforcement learning - neural nets for sequences - Recurrent Nets, LSTM.

Introduction to Deep unsupervised learning autoencoders - PCA to autoencoders - Deep Generative Models - Generative Models and Variational Inference - Autoregressive Models and Invertible Transformations.

UNIT-IV

Adversarial Learning - Unifying Variational Autoencoders and Generative Adversarial Networks - Adverserial Autoencoders - Evaluation of Generative Models.

UNIT - V

Geometry of Deep Generative Models - Application - Model based Reinforcement Learning.

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville. Deep Learning, Second edition, MITPress,2016.
2. Duda R.O., Hart P.E., Stork D.G., Pattern Classification, Second edition, Wiley - Interscience,2001
3. Theodoridis, S., Koutroumbas, K. Pattern Recognition, Fourth edition, Academic Press,2008.
4. Russell S., Norvig N., Artificial Intelligence: A Modern Approach, Prentice Hall Series inArtificial Intelligence,2003

Reference Books:

1. Bishop C.M. Neural Networks for Pattern Recognition, Oxford University Press,1995
2. HastieT.,Tibshirani R.and FriedmanJ .,The Elements of Statistical Learning, Springer,2001
3. Koller D.and Friedman N. Probabilistic Graphical Models, MITPress, 2009

Course Title	NATURAL LANGUAGE PROCESSING (Professional Elective-3)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1898203	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) andits 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	EXPLORATORY DATA ANALYSIS USING R (Professional Elective-3)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1898204	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 andStatistics", 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)

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">KNOWLEDGE ENGINEERING AND DATA SCIENCE
(Professional Elective-3)</td><td colspan="3">M.Tech AI&DS II Sem</td></tr>
<tr><td colspan="2">Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td colspan="2" rowspan="2">1898205</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="5">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="10">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</td></tr>
<tr><td colspan="10">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="9">Understand and describe the concepts central to the creation of knowledge bases and ex systems.</td></tr>
<tr><td>CO 2</td><td colspan="9">Conduct an in-depth examination of an existing expert system with an emphasis on basicmethods of creating a knowledge base.</td></tr>
<tr><td>CO 3</td><td colspan="9">Demonstrate proficiency with statistical analysis of data.</td></tr>
<tr><td>CO 4</td><td colspan="9">Build and assess data-based models.</td></tr>
</table>

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	TEXT MINING (Professional Elective-4)				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1898206	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:

- Apply text processing techniques to prepare documents for statistical modeling
- Apply relevant machine learning models for analysing textual data and correctly interpretingthe results
- Use machine learning models for text prediction
- Evaluate the performance of machine learning models for textual data

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

CO 1	Describe basic concepts and methods in text mining, for example text representation, classification and clustering, and topic modelling
CO 2	Use the text mining concepts and methods to model real-world problems into text miningtasks, develop technical solutions, and evaluate the effectiveness of the solutions.
CO 3	Communicate text mining process, result, and major findings to various audience includingboth experts and laypersons.

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 miningalgorithms.

UNIT-II

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-III

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.

UNIT-IV

Document summarization - Extraction- based summarizationmethods.

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

UNIT- V

Text visualization - introduction to mathematical and programmingtools.

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 EducationIndia, 2000.
3. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, "Introduction to Information Retrieval". Cambridge University Press, 2007.
4. Text Mining: Applications and Theory, Michael W. Berry, Jacob Kogan, Wiley.

Reference Books:

1. Text Mining: Classification, Clustering and Applications, Ashok N. Srivastava, Mehran Sahami, CRC Press.
2. Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining, ChengXiang Zhai, Sean Massung, Morgan & Clay Pool Publishers.
3. The Text Mining Hand Book: Advanced Approaches in Analyzing Unstructured Data, Ronen Feldman, James Sanger, Cambridge Press.
4. Natural Language Processing with Python, Steven Bird, Ewan Klein & Edward Loper, O'Reilly.

<table>
<tr><td colspan="2">Course Title</td><td colspan="4">SOCIAL NETWORK ANALYSIS
(Professional Elective-4)</td><td colspan="3">M.Tech AI&DS II Sem</td></tr>
<tr><td colspan="2">Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td colspan="2" rowspan="2">1898207</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="5">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="10">Course Objectives:
• To familiarise the components of the social network.
• To model and visualise the social network.
• To mine the users in the social network.
• To familiarise the evolution of the social network.
• To know the applications in real time systems.</td></tr>
<tr><td colspan="10">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="9">Work on the internal components of the social network</td></tr>
<tr><td>CO 2</td><td colspan="9">Model and visualise the social network</td></tr>
<tr><td>CO 3</td><td colspan="9">Mine the behaviour of the users in the social network</td></tr>
<tr><td>CO 4</td><td colspan="9">Predict the possible next outcome of the social network</td></tr>
</table>

UNIT-I

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

UNIT-II

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

UNIT-III

Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

UNIT-IV

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing

UNIT- V

Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models. Case Study of Google Page Rank and Facebook Graphs.

Text Books:

1. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, Computational Social NetworkAnalysis: Trends, Tools and Research Advances, Springer, 2012
2. Borko Furht, Handbook of Social Network Technologies and Applications, Springer, 1stedition, 2011.
3. 1.Charu C. Aggarwal, Social Network Data Analytics‖, Springer; 2014
4. 2.Giles, Mark Smith, John Yen, Advances in Social Network Mining and Analysis, Springer,2010.

Reference Books:

1. Guandong Xu , Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniquesand applications, Springer, 1st edition, 2012
2. Peter Mika, Social Networks and the Semantic Web, Springer, 1st edition, 2007.
3. Przemyslaw Kazienko, Nitesh Chawla, Applications of Social Media and Social Network Analysis, Springer, 2015

<table>
<tr><td>Course Title</td><td colspan="5">ARTIFICIAL INTELLIGENCE IN CYBER SECURITY
(Professional Elective-4)</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">1898208</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:
• 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</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">Deploy artificial intelligence based solutions for preventing cyber attacks</td></tr>
<tr><td>CO 2</td><td colspan="8">Understand the basic underlying architecture used for intrusion detection</td></tr>
<tr><td>CO 3</td><td colspan="8">Understand the heuristic methods used for cyber security</td></tr>
</table>

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 detectionsystems 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.

<table>
<tr><td>Course Title</td><td colspan="5">DEEP LEARNING LAB</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">1898210</td><td rowspan="2">PCC</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>0</td><td>0</td><td>4</td><td>2</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="5"></td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• Implement the various deep learning algorithms in Python.
• Learn to work with different deep learning frameworks like Keras, Tensor flow, PyTorch, Caffeetc.</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">Expert knowledge in solving real world problems using state of art deep learning techniq</td></tr>
</table>

List of Experiments

1. Basic image processing operations : Histogram equalization, thresholding, edge detection, dataaugmentation, morphological operations

2. Implement SVM/Softmax classifier for CIFAR-10 dataset: (i) using KNN, (ii) using 3 layer neuralnetwork

3. Study the effect of batch normalisation and dropout in neural network classifier

4. Familiarisation of image labelling tools for object detection, segmentation

5. Image segmentation using Mask RCNN, UNet, SegNet

6. Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN, etc.)

7. Image Captioning with Vanilla RNNs

8. Image Captioning with LSTMs

9. Network Visualisation: Saliency maps, Class Visualisation

10. Generative Adversarial Networks

11. Chatbot using bi-directional LSTMs

12. Familiarisation of cloud based computing like Google colab

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville. Deep Learning, Second edition, MITPress,2016.
2. Duda R.O., Hart P.E., Stork D.G., Pattern Classification, Second edition, Wiley - Interscience,2001
3. Theodoridis, S., Koutroumbas, K. Pattern Recognition, Fourth edition, Academic Press,2008.
4. Russell S., Norvig N., Artificial Intelligence: A Modern Approach, Prentice Hall Series inArtificial Intelligence,2003

Reference Books:

1. Bishop C.M. Neural Networks for Pattern Recognition, Oxford University Press,1995
2. HastieT.,Tibshirani R.and FriedmanJ .,The Elements of Statistical Learning, Springer,2001
3. Koller D.and Friedman N. Probabilistic Graphical Models, MITPress, 2009

Course Title	SOFTWARE LAB-2				M.Tech AI&DS II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1898211	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

A minimum of 10 experiments shall be given from Professional Elective-3 / Professional Elective-4.

<table>
<tr><td colspan="2">Course Title</td><td colspan="4">MINI PROJECT WITH SEMINAR</td><td colspan="3">M.Tech AI&DS II Sem</td></tr>
<tr><td colspan="2">Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td colspan="2" rowspan="2">1898212</td><td rowspan="2">PROJ</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td><td>100</td><td>--</td><td>100</td></tr>
<tr><td colspan="5">Internal Assessment</td><td colspan="4"></td></tr>
<tr><td colspan="9">Course Objectives:
• Acquire and apply new knowledge as needed, using appropriate learning strategies.</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">Demonstrate a technical knowledge of their selected project topic.</td></tr>
<tr><td>CO 2</td><td colspan="8">Understand problem identification, formulation and solution.</td></tr>
<tr><td>CO 3</td><td colspan="8">Design engineering solutions to complex problems utilizing a systems approach.</td></tr>
<tr><td>CO 4</td><td colspan="8">Communicate with engineers and the community at large in written an oral form.</td></tr>
<tr><td>CO 5</td><td colspan="8">Demonstrate the knowledge, skills and attitudes of a professional engineer.</td></tr>
</table>

M.TECH.-III SEMESTER SYLLABUS

Course Title	GENETIC ALGORITHMS (Professional Elective-5)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1898301	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 familiarise the basic background of genetic algorithm
- To explain how NP problems can be tried solving using genetic algorithm strategies

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

CO 1	Explain the of the principles underlying Evolutionary Computation in general and Gen Algorithms in particular.
CO 2	Apply Evolutionary Computation Methods to find solutions to complex problems
CO 3	Summarise current research in Genetic Algorithms and Evolutionary Computing

UNIT-I

A brief history of evolutionary computation-biological terminology- search space -encoding, reproduction-elements of genetic algorithm- genetic modeling- Comparison of GA and traditional search methods.

UNIT-II

Steady state algorithm - fitness scaling - inversion.
Genetic programming - Genetic Algorithm in Problem solving, Implementing GP.

UNIT-III

Genetic Algorithm in engineering and optimization- natural evolution - simulated annealing and Tabu search.

UNIT - IV

Genetic Algorithm in scientific models and theoretical foundations- computer implementation - low level operator and knowledge based techniques in Genetic Algorithm.

UNIT-V

Applications of Genetic based machine learning-Genetic Algorithm and parallel processors, constraint optimization, uses of GA in solving NP hard problems, multilevel optimization, real life problem.

Text Books:

1. Melanie Mitchell, "An introduction to Genetic Algorithm", Prentice-Hall of India, New Delhi,Edition: 2004.
2. David.E.Golberg, "Genetic algorithms in search, optimization and machine learning", Addition-Wesley-1999.
3. Nils.J.Nilsson, "Artificial Intelligence- A new synthesis", Original edition-1999.
4. Practical Genetic Algorithms, Randy L. Haupt, Sue Ellen Haupt, 2nd Edition, Wiley.

Reference Books:

1. Genetic Algorithms, K.F. Man, K.S Tang and S. Kwong, Springer.
2. Genetic Algorithms and Genetic Programming: Modern Concpet and Practical Applications, Michael Affenzeller, Stephan Winkler, Stefan Wanger, Andreas Beham, CRC Press.
3. Principles of Soft Computing,S.N. Sivanandam, S.N. Deepa, Wiley India Edition.
4. S.Rajasekaran G.A Vijayalakshmi Pai, "Neural Networks, Fuzzy logic and Genetic Algorithms Synthesis and Applications", Prentice Hall of India, New Delhi-2003.

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">MACHINE LEARNING MODELS AND STORAGE MANAGEMENT
(Professional Elective-5)</td><td colspan="3">M.Tech AI&DS III Sem</td></tr>
<tr><td colspan="2">Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td colspan="2" rowspan="2">1898302</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="5">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="10">Course Objectives:
• To familiarise the conventional and non-conventional methods of Machine Learning.
• To familiarise and manage data organisation and access for different scales of processing.
• Familiarise the lifecycle of machine learning process in normal and parallelised scenarios.</td></tr>
<tr><td colspan="10">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="9">Apply database query languages to perform Machine Learning tasks.</td></tr>
<tr><td>CO 2</td><td colspan="9">Understand performance improvement of machine learning processes using hardware, data,and resource acceleration.</td></tr>
<tr><td>CO 3</td><td colspan="9">Perform ML tasks by following standardised life cycle stages.</td></tr>
<tr><td>CO 4</td><td colspan="9">Understand how machine learning can be parallelised using different data structures.</td></tr>
</table>

UNIT-I

Machine Learning through database queries and UDFs, Sampling based methods, Multi-table ML, Learning over joins, Statistical relational learning, Deeper integration and specialised DBMSs. Scope of optimization, planning rewrites, automatic operator fusion. Case Study : Google Big Query

UNIT-II

Execution strategies - Data parallel and task parallel execution, Model-parallel execution, Hybrid strategies, Hardware accelerators. Case Study : GPU, TPU

Data Access - Caching and Buffer pool management, Data compression, NUMA awareness, Indexing.

UNIT-III

Resource provisioning, scheduling, and configuration. Failure management and transient resources. Case Study : AutoML

UNIT - IV

Managing ML life cycle, Data sourcing and cleaning, Feature engineering and Deep learning, Model selection, management, anddeployment. Benchmarking ML systems.

UNIT-V

Parallel machine models and pseudocode, Parallel algorithm analysis, Processing in parallel - arrays, linked lists, queue-like structures. Unbounded arrays. Hash tables and associative arrays, Universal hashing, probing, perfect hashing, parallel hashing. Case Study: IBM Parallel Machine Learning Toolbox.

Text Books:

1. Matthias Boehm, Arun Kumar, Jun Yang, "Data Management in Machine Learning Systems", Morganand Claypool.
2. Peter Sanders, Kurt Mehlhorn, Martin Dietzfelbinger, Roman Dementiev, "Sequential and Parallel Algorithms and Data Structures: The Basic Toolbox", Springer 2019.
3. Ron Bekkerman, Mihkail Bilenko, John Langford, "Scaling up Machine Learning - Parallel andDistributed Approaches", Cambridge University Press.

Reference Books:

1. Data Management in Machine Learning Systems, Matthias Boehm, Arun Kumar, Jun Yang, Morgan & Clay Pool Publishers.

2. The Artificial Intelligence Infrastructure Workshop, Chinmay Arankalle, Gareth Dwyer, Bas Geerdink, Kunal Gera, Kevin Liao, Anand N.S. Packet Publishers.

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">SCALABLE SYSTEMS FOR DATA SCIENCE
(Professional Elective-5)</td><td colspan="3">M.Tech AI&DS III Sem</td></tr>
<tr><td colspan="2">Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td colspan="2" rowspan="2">1898303</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="5">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="10">Course Objectives:
• Teach the fundamental systems aspects of designing using Big Data platforms
• Explore distributed program models and abstractions</td></tr>
<tr><td colspan="10">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="9">Distinguish distributed programming models for Big Data like Map Reduce, Stre processing and Graph processing.</td></tr>
<tr><td>CO 2</td><td colspan="9">Design and develop applications on Big Data platforms and their optimisations on commodityclusters and Clouds.</td></tr>
<tr><td>CO 3</td><td colspan="9">Scale data science algorithms and analytics using Big Data platforms.</td></tr>
</table>

UNIT-I

Introduction to Distributed Systems, evolution, characteristics, design issues, user requirements, Distributed computing models- workstation model, workstation-server model, processor–pool model.Protocols for distributed systems -VMTP and FLIP.

UNIT-II

Distributed file system: Components of DFS, design issues, interfaces, implementation, File Caching and Replication. Sun Network File System – architecture and implementation, Google File System. Naming- Namespace and contexts and name resolution.

UNIT-III

Network Protocols, Naming, RPC, RMI, Web Services, CORBA, A message passing model for Inter-Process Communication, Coordination algorithms, Leader Election, Bully Algorithm, Maxima Finding on a Ring.

UNIT-IV

Hadoop Architecture - Clusters, HDFS, YARN, Basic file system operations in HDFS, File permissions in HDFS, Functional Programming Model of MapReduce, Job Chaining, Submitting MapReduce job to YARN.

UNIT- V

Parallel Data Mining Agents, Parallel Data Access, Parallel Data Analysis, Parallel GA in Big Data Analysis, Evolutionary Algorithm Based Techniques to Handle Big Data, Statistical and Evolutionary Feature Selection Techniques Parallelized Using MapReduce Programming Model, **The Role of Grid Technologies**: A Next Level Combat with Big Data.

Text Books:

1. Techniques and Environments for Big Data Analysis : Parallel, Cloud, and Grid Computing,Studies in Big Data Vol 17, 2016
2. Web based Parallel / Distributed Medical Data Mining Using Software Agents – Hillol Kargupta, Brian Stafford, Ilker Hamzaoglu, Los Alamos National Labs, 1997
3. Data Analytics with Hadoop: An Introduction for Data Scientists, Benjamin Bengfort, Jenny Kim, O'Reilly.
4. George Coulouris, Jean Dellimore and Tim Kindberg, Distributed Systems – Concepts anddesigning, Pearson Education Asia, Fifth Edition 2006, New Delhi.

Reference Books:

1. Sunita Mahajan, Seema shah, Distributed Computing ,Oxford University Press, first edition,2010
2. Pradeep. K, Sinha, Distributed Operating Systems ,PHI Edition, first Edition,1997.
3. Distributed Systems An Algorithmic Approach, Sukumar Ghosh, CRC Press, 2007

OPEN ELECTIVES

1. Business Analytics
2. Industrial Safety
3. Operations Research
4. Cost Management of Engineering Projects
5. Composite Materials
6. Waste to Energy

Course Title	BUSINESS ANALYTICS (Open Elective)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1871304	OEC	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 the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data. Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

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

CO 1	Students will demonstrate knowledge of data analytics.
CO 2	Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
CO 3	Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
CO 4	Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

UNIT II

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT III

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT IV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model,
Overbooking Model, Cash Budget Model.

UNIT V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Text Books:

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications", Pearson FT Press.

2. James Evans, "Business Analytics", persons Education.

3. Essentials of Business Analytics: An Introduction to the Methodology and its Applications, Bhimsankarm Pochiraju, Sridhar Seshadri, Springer.

Reference Books:

1. Business Analytics: Data Analysis and Decision Making, S. Christian Albright, Wayne L. Winstone, 6th Edition, Cengage Learning.

2. An Introduction to Business Analytics, Ger Koole, MG Books.

Course Title	INDUSTRIAL SAFETY (Open Elective)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1871305	OEC	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 Know about Industrial Safety Program, Fundamentals of Maintenance Engineering to understand Wear and Corrosion and their preventions.
- To Analyze Fault tracking, Periodic and preventive Maintenance.

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

CO 1	Analyze the Industrial Safety, Drinking water layouts, fire prevention, etc
CO 2	Understand the Wear and Corrosion and their Preventions.
CO 3	Analyze faults in machine tools and their general causes.
CO 4	Understand Periodic and preventive maintenance

UNIT I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, Electrical motors, Types of faults in machine tools and their general causes.

UNIT V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

Text Books:

1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services.
2. H. P. Garg, S. Chand and Company, "Maintenance Engineering".
3. Audels, "Pump-hydraulic Compressors", Mcgrew Hill Publication.
4. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London.

Reference Books:

1. D.A. Crowl and J.F. Louvar, Chemical Process Safety: Fundamentals with Applications, Prentice Hall, 2011.
2. Fawcett H.H and W.S. Wood, Safety and Accident Prevention in Chemical Operations, 2nd Edition, John Wiley and Sons inc.

Course Title	OPERATIONS RESEARCH (Open Elective)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1871306	OEC	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 Apply various optimization Techniques for Decision Making.

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

CO 1	Understand Optimization Techniques.
CO 2	Define and formulate Linear programming problems.
CO 3	Solve Non-Linear programming problems.
CO 4	Understand Scheduling, Sequencing and Geometric programming.

UNIT I

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT II

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT III

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT IV

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation.

Text Books:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
4. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010.

Reference Books:

1. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008.
2. Panner selvam, Operations Research: Prentice Hall of India 2010
3. Operations Research: Principles and Applications, G. Srinivasan, PHI.

Course Title	COST MANAGEMENT OF ENGINEERING PROJECTS (Open Elective)					M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1871307	OEC	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 the concepts of Project management for planning to execution of Projects.

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

CO 1	Understand project characteristics and various stages of project.
CO 2	Analyze the learning and understanding techniques for project planning, scheduling and execution control.

UNIT I

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

UNIT III

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.

UNIT IV

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Text Books:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting

Reference Books:

1. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
2. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co.
3. The Engineer's Cost Handbook, Richard E. Westney, P.E, CRC Press.

Course Title	COMPOSITE MATERIALS (Open Elective)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1871308	OEC	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:

- Train student on Composite materials-definition, Advantages and classification.
- Equip students with knowledge on composite strengthening addition of components and their production rules.

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

CO 1	Identify and understand the behavior of composite materials
CO 2	Apply the choices made for using certain type of composites in certain applications with reference to composite properties.
CO 3	Analyze the manufacturing of metal matrix composites and polymer matrix composites.

UNIT I

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT V

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books:

1. R.W.Cahn, "Material Science and Technology" – Vol 13 – Composites,– VCH, West Germany.
2. Callister, Jr., Adapted by R. Balasubramaniam, "Materials Science and Engineering, An introduction". WD, John Wiley & Sons, NY, Indian edition, 2007.
3. ed-Lubin, "Hand Book of Composite Materials".
4. K.K.Chawla, "Composite Materials".

Reference Books:

1. Deborah D.L. Chung, "Composite Materials Science and Applications".
2. Danial Gay, Suong V. Hoa, and Stephen W. Tasi, "Composite Materials Design and Applications".
3. Mathews F.L and Rawlings R.D, Composite materials: Engineering and Science, Chapman and Hall, London, England, 1st Edition.
4. Mallick, P.K, Composite Materials Technology: Process and Properties, Hanser, New York.

Course Title	WASTE TO ENERGY (Open Elective)				M.Tech AI&DS III Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1871309	OEC	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 Create awareness in students of energy conservation.
- To Identify use of different types of Bio waste energy resources.
- To Understand different types of Bio waste energy conservations.
- To detect different waste conservation into different forms of energy.

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

CO 1	Understand different types of energy from waste to produce electrical power.
CO 2	Estimate the use of bio waste to produce electrical energy.
CO 3	Understand different types of bio waste and its energy conversions.
CO4	Analyze the bio waste utilization and to avoid the environmental pollution.

UNIT I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Text Books:

1. Biogas Technology- Transfer and Diffusion, M.M. Halwagi, Elsevier.
2. C. Y. WereKo-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons, 1996.
3. Introduction to Biomass Energy Conservations, Sergio Capareda.

Reference Books:

1. Desai, Ashok V, "Non Conventional Energy", Wiley Eastern Ltd., 1990.
2. Khandelwal, K. C. and Mahdi, S. S, "Biogas Technology - A Practical Hand Book" -, Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Challal, D. S., "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1991.

<table>
<tr><td colspan="2">Course Title</td><td colspan="4">DISSERTATION PHASE-I</td><td colspan="3">M.Tech AI&DS III Sem</td></tr>
<tr><td colspan="2">Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td colspan="2" rowspan="2">1898310</td><td rowspan="2">MAJOR PROJ</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>0</td><td>0</td><td>20</td><td>10</td><td>100</td><td>--</td><td>100</td></tr>
<tr><td colspan="5">Internal Assessment</td><td colspan="4"></td></tr>
<tr><td colspan="9">Course Objectives:
• Acquire and apply new knowledge as needed, using appropriate learning strategies.</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">Demonstrate a technical knowledge of their selected project topic.</td></tr>
<tr><td>CO 2</td><td colspan="8">Understand problem identification, formulation and solution.</td></tr>
<tr><td>CO 3</td><td colspan="8">Communicate with engineers and the community at large in written an oral form.</td></tr>
<tr><td>CO 4</td><td colspan="8">Demonstrate the knowledge, skills and attitudes of a professional engineer.</td></tr>
</table>

M.TECH.-

IV- SEMESTER SYLLABUS

<table>
<tr><td>Course Title</td><td colspan="4">DISSERTATION PHASE-II</td><td colspan="3">M.Tech AI&DS IV 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">1898401</td><td rowspan="2">MAJOR PROJ</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>0</td><td>0</td><td>32</td><td>16</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="5">Internal Assessment</td><td colspan="4">External Assessment</td></tr>
<tr><td colspan="9">Course Objectives:
• Acquire and apply new knowledge as needed, using appropriate learning strategies.</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">Demonstrate a technical knowledge of their selected project topic.</td></tr>
<tr><td>CO 2</td><td colspan="8">Design engineering solutions to complex problems utilizing a systems approach.</td></tr>
<tr><td>CO 3</td><td colspan="8">Communicate with engineers and the community at large in written an oral form.</td></tr>
<tr><td>CO 4</td><td colspan="8">Demonstrate the knowledge, skills and attitudes of a professional engineer.</td></tr>
</table>

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	
1870A01	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:

- 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.

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">DISASTER MANAGEMENT
(Audit Course)</td><td colspan="3">M.Tech AI&DS I/II Sem</td></tr>
<tr><td colspan="2">Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td colspan="2" rowspan="2">1870A02</td><td rowspan="2">Audit Course</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>2</td><td>0</td><td>0</td><td>0</td><td>40</td><td>--</td><td>40</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2 Hours</td><td colspan="5"></td></tr>
<tr><td colspan="10">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.</td></tr>
<tr><td colspan="10">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="9">Understand foundations of hazard, disasters and natural/social phenomena.</td></tr>
<tr><td>CO 2</td><td colspan="9">Analyze Repercussions of disasters and hazards.</td></tr>
<tr><td>CO 3</td><td colspan="9">Understand key concepts in disaster risk reduction and humanitarian response.</td></tr>
</table>

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	
1870A03	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 of Sanskrit to improve brain functioning.
- Learning of 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 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	VALUE EDUCATION (Audit Course)				M.Tech AI&DS I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1870A04	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:

- 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	
1870A05	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:

- 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	
1870A06	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:

- 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	
1870A07	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 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	
1870A08	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 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.