SCHOOL OF COMPUTER SCIENCE & ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

TEACHING SCHEME& SYLLABUS

MASTER OF TECHNOLOGY

Artificial Intelligence and Data Science

(Batch 2021-23)

JULY-2021

INDEX

VISION

To create knowledge based society with scientific temper, team spirit and dignity of labor toface global competitive challenges.

Mission

To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

Quality Policy

To provide Quality Education through Faculty development, updating of facilities andcontinual improvement meeting University norms and keeping stake holders satisfied.

Knowledge Wheel

At Poornima, the academic atmosphere is a rare blend of modern technical as well as soft skillsand traditional systems of learning processes.

REVISED SYLLABUS OF MASTER OF TECHNOLOGY (B.Tech)

Title of the Programme

1.   Master of Technology (B.Tech)

Nature of the Programme

(i)   M. Tech is two year (full-time programme).

Preamble

3. The revised curriculum for M.Tech is developed keeping in mind the national priorities and international practices. It also attempts to align the programme structure and course contents with student aspirations & recruiter expectations. This syllabus also attempts to align with National Goal of "***Make in India", "Start – Up and Stand – Up India" and "Digital India".***

Need for Revision of the Curriculum

4.   There was a need for revision of the curriculum in view of the dynamism in the industry practices, evolution in technology and the evolving expectations of key stakeholders viz. students, the industry and faculty members at large. It also has relevance due to changed technological, social, cultural and economic environment of the nation.

5. Specifically, the triggers for the comprehensive revamp of the curriculum are

(a)   New Skills & Competencies desired due to dynamic technology environment: Jobs of today were perhaps not created about 5 years ago. This aspect has a direct linkage with contents and structure of syllabus across the Knowledge, Skills and Attitude (KSA) dimensions, which calls for frequent and meaningful updating of the curriculum.

(b)   Concerns expressed by the Industry: The industry has expressed concerns about the need for improvement in the communication skills, inter-personal skills, domain knowledge basics, business environment awareness, technology proficiency, and attitude of the M.Tech graduates. Newer and innovative evaluation methods are necessary to address these concerns of the industry.

(c)   Application Orientation: There is a pressing need to imbibe application oriented thinking, based on sound knowledge of Technical field, principles and concepts. Technical education needs to move out of the classrooms and instead focus on group activity, field work, experiential learning, etc. This can be achieved only through a radical change in the evaluation pattern and course delivery methodology.

(d)   <u>Changing mind-set of the Learner</u>: The profile of the students for the M. Tech programme, their learning styles and the outlook towards higher education has undergone a gradual transformation. The expectations of the students from the M. Tech programme have changed over the last decade.

(e)   <u>Integrate a basket of skill sets</u>: SET-Schools are expected to imbibe varied aspects of 'learning beyond the syllabus through innovative curriculum design, contemporary syllabus, effective delivery and comprehensive evaluation.

(f)   <u>Entrepreneurial aspirations and preparedness for the same</u>: The youth now aspires to become masters of their own and wish to start up their new ventures. These will create further growth opportunities.

6.   Specifically, the following skill sets are in focus:-

(a)   Reading & Listening Skills

(b)   Problem Definition& Problem Solving Skills

(c)   Application of Technology Tools

(d)   Mastery of Analytics (Quantitative Aspects)

(e)   Sensitization to Cross-Functional skills

(f)   Sensitization to Cross-Cultural skills

(g)   Sensitization to Global perspectives

(h)   Peer-based Learning - Working in groups

(i)   Learning by application and doing – Experiential learning

(j)   Team building basics and its orientation

Programme Objectives

7. The M. Tech programme prepares a student for a career in diverse sectors of the industry domestically and globally. The M.Tech programme facilitates learning in theory and practice of different functional areas of technologies and equips the students with an integrated approach to various functions of new technologies. However, the demand for technical skills is not limited to the industry. Technical talent is much sought by the Government Sector, NGOs, non-corporate sector as well.Students also expect to become entrepreneurs. Their aspirations also require a broad based learning encompassing the end to end processes involved in developing

entrepreneurial skills. Schools, Faculty and Students need to move away from the excessive focus on industry and look at needs and demands of broader sections of the society also.

8. Specifically the objectives of the M.Tech Programme are:-

(a) To equip the students with requisite knowledge, skills &right attitude necessary to provide effective leadership in a global environment.

(b) To develop competent Technical professionals with strong ethical values, capable of assuming a pivotal role in various sectors of the Indian Economy &Society, aligned with the national priorities.

(c) To develop proactive thinking so as to perform effectively in the dynamic socio-economic and business ecosystem.

(d) To harness entrepreneurial approach and skillsets.

Highlights of the New Curriculum

9. The New Curriculum intends to add immense value to all stakeholders by effectively addressing their requirements in more than one way by:-

(a) Enhancing the brand value of the Technical programme of Poornima University, Jaipur.

(b) Providing the much needed flexibility to carve a niche for themselves.

(c) Emphasizing the centrality of the student and teacher-student relationship in the learning process.

(d) Focusing on 'Continuous Evaluation' i.e. continuous evaluation throughout the programme.

(e) Empowering the Schools through cafeteria approach – by providing Generic Core, Subject Core, Generic Elective, and Subject Elective Courses. This shall provide in-built flexibility in the curriculum to help the Schools to offer tailor made courses preferred by students, from a wider basket of courses.

(f) More weightage is given on Continuous Evaluation Pattern.

(g) Emphasizing Experiential learning aspect through Lab Credit Courses.

(h) Supplementing traditional classroom teaching/learning with focus on group activity, field work, experiential learning, self-study, projects, Industry Exposure Programmes etc.

(i) A thorough revamp of Systems and Operations Specializations to make them more meaningful and attractive to M.Tech students.

(j) Providing opportunity to students to choose courses from other electives to explore cross-functional issues.

(j)   Emphasizing on Research, Inter-personal, Analytical, Cross-Cultural, Entrepreneurial Skills, and Global aspects of managerial careers throughout the curriculum.

Pattern

10.   The Programme comprises of 4 Semesters for M.Tech, adopts the Choice Based Credit System (CBCS) and Grading System.

Choice Based Credit System

11.   Choice Based Credit System (CBCS) offers wide ranging choice for students to opt for courses based on their aptitude and their career goals. CBCS works on the fundamental premise that students are mature individuals, capable of making their own decisions.

12.   CBCS enables a student to obtain a degree by accumulating required number of credits prescribed for that degree. The number of credits earned by the student reflects the knowledge or skill acquired him / her. Each course is assigned a fixed number of credits based on the contents to be learnt & the expected effort of the student. The grade points earned for each course reflects the student's proficiency in that course. CBCS is a process of evolution of educational reforms that would yield the result in subsequent years and after a few cycles of its implementation.

Key Features of CBCS

13.   (a) **Enriching Learning Environment**. A student is provided with an academically rich, highly flexible learning system blended with abundant provision for skill practice and activity orientation that he/she could learn in depth without sacrificing his/her creativity. There is a definite movement away from the traditional lectures and written examination.

(b)   **Learn at your own pace**: A student can exercise the option to decide his/her own pace of learning- slow, normal or accelerated plan. Students can select courses according to their aptitude, tastes and preferences.

(c)   **Continuous Learning & Student Centric Continuous Evaluation.**CBCS makes the learning process continuous and the evaluation process is not only made continuous but also made learnercentric. The evaluation is designed to recognize the capability and talent of a student.

(d)   **Active Student-Teacher Participation**. CBCS leads to quality education with active teacher-student participation. This provides avenues to meet student's scholastic needs and aspirations.

(e)   **Industry Institute Collaboration**. CBCS provides opportunities for meaningful collaboration with industry and foreign partners to foster innovation, by introduction of

electives and half credit courses through the cafeteria approach. This will go a long way in capacity building of students and faculty.

(f) **Interdisciplinary Curriculum**. Cutting edge developments generally occur at the interface of two or more discipline. Interdisciplinary approach enables integration of concepts, theories, techniques, and perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline.

(g) **Employability Enhancement**. CBCS shall ensure that students enhance their skill/employability by taking up project work, entrepreneurship and vocational training.

(h) **Faculty Expertise**. CBCS shall give the Schools the much needed flexibility to make best use of the expertise of available faculty.

Programme Structure in Choice Based Credit System

14.14.

PROGRAMME			
SEMESTER			
COURSES			
CORE COURSES		*ELECTIVE COURSES*	
Generic Core	*Subject Core*	*Generic Elective*	*Subject Elective*

Time Schedule

15. An academic year is divided into two Semesters – Odd and Even. Odd Semester shall have I and III whereas Even semester shall have IIand IV. In each semester, courses are offered in 15 teaching weeks and the remaining 5 weeks are to be utilized for conduct of examinations and evaluation purposes.

16. For students, each week has 42 working hours spread over 5/6 days consisting of lectures, tutorials, assignments, class participation, library work, special counseling, Sports, project work, field visit, youth welfare and social activities.

17. Course. A "Course" is a component of programme, i.e. in the new system; papers will be referred to as courses. Each course is identified by a unique course code. While designing curriculum, course can have defined weightage. These weightages are called credits.

Each course, in addition to having a syllabus, has learning objectives and learning outcomes. A course may be designed to comprise lectures/ tutorials/ laboratory work/ field work/ project work/vocational training /viva voce etc. or a combination of some of these.

Core Courses

18.   The Curriculum comprises of Core Courses and Elective Courses. Core courses are the foundation courses of technical education. They are compulsory for all the students. Core courses are of two types: Generic Core & Subject Core.

(a)   **Generic Core.**This is the course which should compulsorily be studied by a candidate as a core requirement to complete the requirement of a degree in a said discipline of study. Therefore, Generic Core courses are mandatory and fundamental in nature. These courses cannot be substituted by any other courses. Such courses are also known as Hard Core Courses. A Hard core course may be a Theory, Practical, Seminar, Field based or Project Work based subject which is a compulsory component in the Programme Structure.

(b)   **Subject Core:** A Core course may be a Subject Core if there is a choice or an option for the candidate to choose from a broad category (grouping) of subjects (specializations). These are also known as Soft Core Courses.

19.   Following specializations shall be offered

S.No.	Course	Year of Starting
1	B.Tech. (Civil Engg.)	2012
3	B.Tech. (Mechanical Engg.)	2012
4	B.Tech. (Electrical Engg.)	2012
5	B. Tech. (Electronics & Communication Engg.)	2012
6	M. Tech. (Computer Engg.)	2012
7	M. Tech. (VLSI Design)	2012
8	M. Tech. (Power System)	2012
9	M. Tech. (Digital Communication)	2012
10	M. Tech. (Structural Engineering)	2012
11	M. Tech. (Transportation Engg.)	2012
12	M. Tech. (Thermal Engineering)	2012
13	M. Tech. (Industrial Auto. & Control)	2012
14	M. Tech. (Product Design & Manufacturing)	2012
15	Ph. D (in relevant Streams)	2012

For B. Tech Course:

21. Generic Core courses in Semester I and II provide foundations of Technical and Science Knowledge.

22. Generic Core courses in Semester III and IV focus on functional areas, principles and technical hand on experiences.

23. Generic Core courses in the Semester V and VI are integrative in nature along with the Core subjects, Technical Seminars and Industrial Training Seminar-I.

24. Generic Core courses in the Semester VII and VIII are integrative in nature along with the Core subjects, Technical report writing, Minor Project work, Industrial Training Seminar-II and Major Project/Dissertation.

For M.Tech Course:

25. Generic Core courses in Semester I and II provide strong foundations of Technical and Science Knowledge.

26. Generic Core courses in Semester III and IV focus on functional areas, research paper publications, thesis writing and technical software based analysis experiences.

Elective Course

27. Elective course is a course which can be chosen from a pool of courses. It may be:-

    (a) Very Specialized or advanced course focusing on a specific aspect

    (b) Supportive to the discipline of study

    (c) Providing an extended scope

    (d) Enabling an exposure to some other discipline/domain

    (e) Nurturing candidate's proficiency/skill.

28. **Open Elective (Generic Elective)**. An elective course which is common across disciplines / subjects is called a generic or open elective. 'Open Elective' courses develop generic proficiencies amongstthe students.

    (a) Open elective (Generic Elective) courses, in Semester III, facilitate self-development and skill building.

29. **Subject Elective/ Department Elective**. A 'Discipline centric' elective is called 'Subject/ Department Elective.

30. *Open Elective:* A subject elective course chosen generally from an unrelated discipline/ subject, with an intention to seek cross-functional exposure is called an Open Elective. A Subject Elective offered in a discipline / subject may be treated as an Open Elective by other discipline / subject and vice versa.

Pre-requisites for successful implementation of CBCS

31. The success of the CBCS also requires certain commitments from both the students and the teachers.

(a) The student should be regular and punctual to his/ her classes, studious in carrying out the assignments and should maintain consistency in his tempo of learning. He should make maximum use of the available library, internet and other facilities.

(b) The teachers are expected to be alert and punctual and strictly adhere to the schedules of teaching, tests, seminars, evaluation and notification of results.

(c) All teachers should notify the tentative schedule of teaching and tests of the entire semester, including the dates of tests, dates of score notification and all other schedules, which can be planned in advance.

(d) The teachers are expected to adhere to unbiased and objective evaluation and marking of continuous evaluation scores (internal examinations) which will not only maintain the confidence of the students, but, at the same time, ensure that merit is given due credit.

(e) Transparency, objectivity and quality are the key factors that will sustain a good CBCS system.

(f) At the post-graduate level, and in a professional programme, the syllabus is tobe looked upon as the bare minimum requirement to be fulfilled and sufficient emphasis shall be laid on contemporary aspects, going beyond the syllabus.

Credits

32. **Credit**. The definition of 'credits' can be based on various parameters—such as the learning hours put in, learning outcomes and contact hours, the quantum of content/syllabus prescribed for the course. The credit system requires that a student progresses in the academic programmes not in terms of time (years or semesters), but in terms of courses.

33. Each course is assigned a certain credit, depending on the estimated effort put in by a student. When the student passes that course, he/she earns the credits associated with that course. In the Credit system the emphasis is on the hours put in by the learner and not on the workload of the teacher. Each credit can be visualized as a combination of 3 components viz. Lecture (L) + Tutorial (T) + Practical / Project Work (P) i.e. LTP Pattern.

34.   The effort of the learner for each Credit Point may be considered under two parts:-

   (a)   One part consisting of the hours actually spent in class room / practical / Project work/ field work instructions.

   (b)   The other part consisting of notional hours spent by the Learner in self-study, in the library, peer interactions, case study, writing of technical report, research paper and assignments, projects etc. for the completion of that course.

35.   Every course offered shall have three components associated with the teaching-learning process of the course, in example,

   (a)   Lecture – L: Classroom sessions delivered by faculty in an interactive mode.

   (b)   Tutorial- T: Session consisting of participatory discussion/ solving tutorial problems/ self-study by students and such other novelmethods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture sessions.

   (c)   Practice - P: Practice session /Project Work consisting of Hands-on experience / Field Studies / Case studies that equip students to acquire the much required skill component.

36.   In terms of credits, for a period of one semester of 15 weeks:-

   (a)   Every ONE hour session per week of L amounts to 1 credit per semester

   (b)   AONE hours per week of T amounts to 0.5 credit per semester

   (c)   A minimum of TWO hours per week of P amounts to 1 credit per semester,

37.   The teaching / learning as well as evaluation are to be interpreted in a broader perspective as follows:-

   (a)   <u>Teaching – Learning Processes</u>: Classroom sessions, Group Exercises, Seminars, Small Group Projects, Self-study, etc.

   (b)   <u>Evaluation</u>: Tutorials, Class Tests, Presentations, Field work, Assignments, Term papers, etc.

38.   A course shall have either or all the three components, i.e. a course may have only lecture component, or only practice component or a combination of any two or all the three components. The total credits earned by a student at the end of the semester upon successfully completing a course are 'L + T + P'. The credit pattern of the course is indicated as L: T: P. If a course is of 3 credits then the different credit distribution patterns in L: T: P format could be 3:1:1, 3: 0 : 1, 0: 0: 1, 3: 0: 1, etc. In no instance the credits of a course can be greater than the number of hours (per week for 15 weeks) allotted to it.

39.   (a)   <u>Full Credit Course</u>: A course with weightage of 3 credits is considered as a full course. (Except for Major Project/Dissertation which are full credit courses with 12 Credits each.)

      (b)   <u>Half Credit Course</u>: A course with weightage of 2 credits is considered as a half course.

40.   The B. Tech programme is a combination of

      (a)   Full Credit Courses (100 Marks each) :Minimum 3 Credits each

      (b)   Half Credit Courses (100 Marks each) :Maximum 2 Credits each

Rationale for adoption of the Credit and Grading System

41.   (a)   **Learner's Perspective**.   The current practice of evaluation of student's performance at the end of a semester is flawed. The students are expected to express their understanding or mastery over the content included in their curriculum for a complete semester within a span of three hours and their efforts over the semester are often completely ignored. It also promotes to an unhealthy practice of cramming before the examinations and focusing on marks rather than on learning.

      (b) **Evaluation Perspective**: The present system of evaluation does not permit the flexibility to deploy multiple techniques of assessment in a valid and reliable way. Moreover, the current practice of awarding numerical marks for reporting the performance of learners suffers from several drawbacks and is a source of a variety of errors. Further, the problem gets compounded due to the variations in the marks awarded in different subjects. The 'raw score' obtained by the learner, is, therefore, not a reflection of his true ability.

42.   In view of the above lacunae, it is desirable that the marking system used for the declaration of results is replaced by the grading system. The system of awarding grades provides a more realistic picture of learner's ability than the prevailing marking system. Excellence in quality education can be achieved by evaluating the true ability of the learners with the help of continuous evaluation.

Salient Features of the Grading System

43.   (a) In this system, students (learners) are placed in ability bands that represent a range of scores. This ability range may be designated with alphabetical letters called as 'GRADE'.

      (b)   Grading reflects an individual learner's performance in the form of a certain level of achievement.

(c)   The Grading system ensures natural classification in qualitative terms rather than quantitative terms since it expresses a range /band of scores to which a learner belongs such as O, A, B, C, D, E& F.

(d)   Grades can be interpreted easily and directly and can be used to prepare an accurate 'profile' of a learner.

(e)   A properly introduced grading system not only provides for a comparison of the learners' performance but it also indicates the quality of performance with respect to the amount of efforts put in and the amount of knowledge acquired at the end of the course by the learners.

Basics of Credit and Grading System

44.   Grading is a method of reporting the result of a learner's performance subsequent to his evaluation. It involves a set of alphabets which are clearly defined and designated and uniformly understood by all the stake holders. Grading is carried out in a variety of ways. The classification of grades depends upon the reference point.

45.   With 'Approach towards Grading' as the reference point, Grading may be classified as:

(a)   Direct grading. When the performance exhibited by the examinees is assessed in qualitative terms and the impressions so obtained by the examiners are directly expressed in terms of letter grades, it is called, 'Direct Grading'.

(b)   Indirect grading.When the performance displayed by the examinees is first assessed in terms of marks and subsequently transformed into letter grades by using different modes, it is called, 'Indirect Grading.'

46.   With 'Standard of Judgment', as the reference point Grading may be classified as:-

(a)   Absolute grading: The method that is based on a predetermined standard which becomes a reference point for the learner's performance is called 'Absolute Grading'. This involves direct conversion of marks into grades irrespective of the distribution of marks in a subject.

(b)   Relative grading: Relative Grading is popularly known as grading on the curve. The curve refers to the normal distribution curve or some symmetric variant of it. This method amounts to determining in advance approximately what percentage of learners can be expected to receive different grades, such as O,A,B,C,D,E,F. In this grading system the grade is not determined by the learner's performance but on the basis of group performance.

47.   Absolute grading has several advantages such as

(a)   The procedure is simple and straightforward to use

(b)   Each grade is distinctly understandable

(c)   The learner has the freedom to strive for the attainment of the highest possible grade and it enables the learners to know their strengths and weaknesses.

48.   The few limitations in Absolute Grading method are that:-

(a)   The distribution of scores is taken at its face value regardless of the errors of measurement creeping in due to various types of subjectivity.

(b)   Besides, the cut-offs of different categories are also arbitrarily decided.

49.   It is proposed to use the Indirect and Absolute Grading System for the B. Tech and M. Tech programme, i.e. the assessment of individual Courses in the concerned examinations will be on the basis of marks, but the marks shall later be converted into Grades by a defined mechanism wherein the overall performance of the Learners can be reflected after considering the Credit Points for any given course. However, theoverall evaluation shall be designated in terms of Grade.

Session Duration

50.   Each teaching-learning, Assessment session shall be of 60 minutes. Batch size for tutorials shall be 50% of the normal class size, subject to a minimum of 30 students.

Registration

51.   It is mandatory for every student, to register every semester, for the courses opted under CBCS system, for that semester. Such registration forms the basis for a student to undergo continuous evaluation, online evaluation and end-semester examination. Application forms for University examinations are to be filled up based on the choices finalized during the registration process and submitted to the University along with the prescribed examination fee.

Examination

52.   (a)   Pattern of Examination: The evaluation scheme comprises of

(i)   University Evaluation

(ii)   Continuous Evaluation

53.   for each full credit course

(a)   60 marks shall be evaluated by the University and

(b)   40 marks shall be evaluated by the respective Department

54.   For each half credit course:-

(a)   60 marks shall be evaluated by the respective Department.

(b)   40 marks shall be evaluated by the University.

University Evaluation

55.   There shall be University evaluation for each full credit course as per the time table announced by the University. The evaluation by the University for Full Credit Courses shall be in Written Mode (subjective – concept plus case study / application oriented type) for 100 marks.

56.   **Instructions to External Paper Setters / Chairman/ Examiners**. The syllabus for each course is organized in 5 units. The end-semester University evaluation shall cover the entire syllabus prescribed for the course. For University evaluation (ESE-Written Examination – subjective type of 60 marks) of each full credit course, the question pattern shall be as follows:-

   (a)   Pattern of Question Paper.   There shall be five questions each of 12 marks

   (b)   All questions shall be compulsory with internal choice within the questions. i.e. There shall be 2 questions from each unit of the curriculum with an internal option.

   (c)   A Question may be subdivided into sub-questions a, b, c… and the allocation of marks depend on the weightage of the topic.

ILLUSTRATIVE PATTERN OF QUESTION PAPER

Q. 1 (A)... based on Unit 1

                OR
   (B)... based on Unit 1.

Q.2. (A)... based on Unit 2

                OR
   (B)... based on Unit 2

   (A) based on Unit 3

                OR
   (B)... based on Unit 3

   (A)... based on Unit 4

                OR
   (B)... based on Unit 4

   (A)... based on Unit 5

                OR

Q.5 (B)... based on Unit 5

57.   Questions shall assess knowledge, application of knowledge, and the ability to synthesize knowledge. The paper setter shall ensure that questions covering all skills and all units are set. She/he shall also mandatorily submit a detailed scheme of evaluation along with the question paper. Questions shall be of three categories of difficulty level – low difficulty, average difficulty and high difficulty.

58.   The duration of written examination shall be 3 hours. Students shall be provided a single answer sheet of 16 pages.

Continuous Evaluation

59.   A continuous assessment system in semester system (also known as internalassessment/comprehensive assessment) is spread through the duration of course and is done by the teacher teaching the course or by the department.

60.   The continuous assessment provides a feedback on teaching learning process. The feedback after being analyzed is passed on to the concerned student for implementation and subsequent improvement. As a part of continuous evaluation, the learners shall be evaluated on a continuous basis by the Department to ensure that student learning takes place in a graded manner.

61.   Continuous evaluation components should be designed in such a way that the faculty can monitor the student learning & development and intervene wherever required. The faculty must share the outcome of each continuous evaluation component with the students, soon after the evaluation, and guide the students for betterment.

62.   Individual faculty member shall have the flexibility to design the continuous evaluation components in a manner so as to give a balanced assessment of student capabilities across Knowledge, Skills & Attitude (KSA) dimensions based on variety of assessment tools.

Suggested Components for Continuous Evaluation

63.   Suggested components for Continuous Evaluation (CE) are:-

   (a)   Case Study / Case let / Situation Analysis – (Group Activity or Individual Activity)

   (b)   Class Test

   (c)   Open Book Test

   (d)   Field Visit / Study tour and report of the same

   (e)   Small Group Project & Internal Viva-Voce

   (f)   Learning Diary

   (g)   Scrap Book

(h)   Group Discussion

(i)   Role Play / Story Telling

(j)   Individual Term Paper / Thematic Presentation

(k)   Written Home Assignment

(l)   Industry Analysis – (Group Activity or Individual Activity)

(m)   Literature Review / Book Review

(n)   Model Development / Simulation Exercises – (Group Activity or Individual Activity)

(o)   In-depth Viva

(p)   Quiz

(q)   Student Driven Activities

®   News-paper reading

64.   There shall be a minimum of three continuous evaluation components per full credit course as well as for each half credit course. The faculty shall announce in advance the units based on which each continuous evaluation shall be conducted. The Department shall however have the liberty to conduct additional components (beyond three). However the total outcome shall be scaled down to 40 / 60 marks for full credit and 60 / 40 for half credit courses respectively. Marks for the continuous evaluation must be communicated by the Department to the Exam Department of the University as per the schedule declared by the University. Detailed record of the Continuous Evaluation shall be maintained by the Department. The same shall be made available to the University, on demand.

65.   At the end of Continuous Evaluation (out of 40 / 60 marks) the student may get an opportunity to improve the marks if he / she gets less than (30% / 25%) of marks

66.   <u>Safeguards for Credibility of Continuous Evaluation</u>: The following practices are encouraged to enhance transparency and authenticity of continuous evaluation:-

(a)   Involving faculty members from other department

(b)   Setting multiple question paper sets and choosing the final question paper in a random manner.

(c)   One of the internal faculty members (other than the course teacher) acting as jury during activity based evaluations.

(d)   Involvement of Industry personnel in evaluating projects / field based assignments.

(e)   Involvement of alumni in evaluating presentations, role plays, etc.

(f)   100% moderation of answer sheets, in exceptional cases.

Summer Internship Project

67.   At the end of Sixth Semester each student shall undertake a Summer Internship Project (SIP) for 8 /10 weeks. It is mandatory for the student to seek advance written approval from the faculty guide and the Dean of the School about the topic and organization before commencing the SIP. The SIP may or may not have a Functional Focus, i.e. the student may take up a SIP in his/her intended area of specialization or in any other functional area of management. Ideally the SIP should exhibit a cross-functional orientation. The student shall submit a written structured report based on work done during this period on the basis of suggested guidelines and research methodology. SIP may be a research project – based on primary/ secondary data or may be an operational assignment involving working by the student on a given task/assignment/project/ etc. in an organization / industry. It is expected that the SIP shall sensitize the students to the demands of the workplace. The learning outcomes and utility to the organization must be specifically highlighted. The report should be well documented and supported by:-

(a)   Introduction/ Executive Summary.

(b)   Objectives of the Training.

(c)   Company/ Organization profile (including Organization Chart)

(d)   Research Methodology (Statement of Problem, Hypothesis (if any), Research Design.

(e)   Technical prospective, Data Interpretation &Technology used by Industry.

(f)   Relevant activity charts, tables, graphs, diagrams, etc.

(g)   Suggestions & Recommendations

(h)   Conclusions

(i)   References in appropriate referencing styles. (APA, MLA, Harvard, Chicago Style etc.)

(j)   Appendix (Questionnaire, Data Sheets etc.)

68.   It should reflect the nature and quantum of work undertaken by the student. The report must reflect 8/10 weeks of work and justify the same.

69.   The student shall submit TWO hard copies & one soft copy (CD) of the project report before 10th September in Semester VII. One hard copy is to be returned to the student by the Department after the External Viva-Voce. The Department shall conduct an internal viva-voce for evaluation of the SIP for 60 marks. The Panel shall comprise of the Internal Faculty Guide & One additional faculty nominated by the Dean.

70. There shall be an external viva-voce for the SIP for 40 marks. The examiner's panel for the same shall include one external faculty member nominated by the University and one internal faculty member nominated by the Dean. The external viva-voce shall be conducted for 15 minutes at least per student.

71. The Internal & the External viva-voce shall evaluate the project based on:-

    (a)   Actual work undertaken by the student

    (b)   Student understands of the organization and business environment

    (c)   Outcome of the project

    (d)   Utility of the project to the organization

    (e)   Basic analytical capabilities

72. Copies of SIP report and records of evaluation shall be maintained by the Department for a period of 3 academic years.

    Dissertation

73. In YearIII &IV the student shall work under the supervision of the Faculty and carry out a minor and major project work / dissertation and Technical Seminar and submit a structured report in TWO hard copies & one soft copy (CD). The student is required to conduct advanced multidisciplinary research on a topic or present a seminar report related to one (or more) of contemporary technical topics. The topic is chosen in consultation with the student's supervisor.

74. The student will prepare and present a detailed research proposal prior to starting the work. It is mandatory for the student to seek advance written approval from the faculty guide and the Dean / HOD of the School about the topic before commencing the dissertation/ Project work. A dissertation outlining the entire problem, including a survey of literature and the various results obtained along with their solutions is expected to be produced. The student must submit the completed dissertation and make an oral / Power point presentation of the same. Through the dissertation, the student is expected to furnish evidence of competence in understanding varied aspects of the theme/topic selected and a deep understanding of the specialty area. The completion of the dissertation / project shall be certified by the Faculty Guide & approved by the Dean of the School.

75. The student can undergo desk research or industrial research and can follow the guidelines mentioned in the SIP for preparation of their final hard copy.

    Assessment & Grade Point Average

76. The performance of a student will be evaluated in terms of two indices, viz. a) Semester Grade Point Average (SGPA) which is the Grade Point Average for a semester b)

Cumulative Grade Point Average (CGPA) which is the Grade Point Average for all the completed semesters at any point in time.

77. **Semester Grade Point Average (SGPA)**. At the end of each semester, SGPA is calculated as the weighted average of GPI of all courses in the current semester in which the student has passed, the weights being the credit values of respective courses.

SGPA = Grade Points divided by the summation of Credits of all Courses.

$$\sum \{C * GPI\} \, SGPA / \sum C \text{ for a semester}$$

Where GPI is the Grade and C is credit for the respective Course.

Cumulative Grade Point Average (CGPA): Cumulative Grade Point Average (CGPA) is the grade point average for all completed semesters. CGPA is calculated as the weighted average of all GPI of all courses in which the student has passed up to the current semester.

Cumulative Grade Point Average (CGPA) for the Entire Course

$$CGPA = \sum \{C * GPI\} / \sum C \text{ for all semesters taken together.}$$

Where GPI is the Grade and C is credit for the respective Course.

Assessment and Grade Point Average

(a) The system of evaluation will be as follows

(i) Each Continuous Evaluation / Assessment and ESE (ETE) will be evaluated in terms of marks. The marks for Continuous Assessment and ESE (ETE) will be added to convert into a grade and later a grade point average. There is no grade independently for CA or ESE (ETE).

(ii) Result of a student will be declared for each semester after the ESE (ETE) only.

(iii) The student will get a Grade Sheet with total grades earned and a Grade Point Average, after earning the minimum number of credits towards the completion of a UG and PG program.

Marks	Grade	Grade Point
80-100	O : Outstanding	10
70-79	A+ : Excellent	9
60-69	A : Very Good	8
55-59	B+ : Good	7
50-54	B : Above Average	6
45-49	C : Average	5
40-44	P : Pass	4
0-39	F : Fail	0
-	Ab : Absent	0

Guidelines for Open Elective

78.   **Open Elective Course:** Open Elective course can be chosen from a pool of courses and are:

- Very specific or specialized or advanced to the discipline / subject of study
- Supportive to the discipline/ subject of study
- Providing an expended scope
- Enabling an exposure to some other discipline/subject/domain
- Nurturing candidate's proficiency/skill.

DETAILS OF TECHNICAL COURSES

79.   School of Engineering & Technology offering the following courses.

S.No.	Course	Year of Starting
1	B.Tech. (Civil Engg.)	2012
3	B.Tech. (Mechanical Engg.)	2012
4	B.Tech. (Electrical Engg.)	2012
5	B.Tech. (Electronics & Communication Engg.)	2012
6	M.Tech. (Computer Engg.)	2012
7	M.Tech. (VLSI Design)	2012
8	M.Tech. (Power System)	2012
9	M.Tech. (Digital Communication)	2012
10	M.Tech. (Structural Engineering)	2012
11	M.Tech. (TrasportationEngg.)	2012
12	M.Tech. (Thermal Engineering)	2012
13	M.Tech. (Industrial Auto. & Control)	2012
14	M.Tech. (Product Design & Manufacturing)	2012
15	M.Tech. (Artificial Intelligence & Data science)	2020
16	Ph.D (in relevant Streams)	2012

ELIGIBILITY CRITERIA

80.   Eligibility criteria for admitting in the following courses is given below.

S. No	Course	Eligibility
		● Pass in 10+2 with minimum 50% (45% for SC/ST/Non Creamy Layer OBC/SBC) ● Marks in aggregate from CBSE/ equivalent board along with 45% (40% for

1.	B. Tech	SC/ ST/OBC/SBC)marks
		● Mathematics and Physics as Compulsory subjects and any one of Chemistry/ Computer Science/ IP/Biology/ Bio-technology. *For Lateral Entry Criteria*
		● 3-Year diploma in relevant branch from state board of technical education/ recognized university/ B.Sc with mathematics as one of the subject/ equivalent qualification with a minimum of 50% marks (45% for SC/ST/OBC/SBC)
2.	M. Tech	● BE/ B.Tech/ equivalent in relevant discipline with 55 % marks or 6.25 CGPA on 10 points Scale (50% or 5.75 CGPA on 10 points scale for ST/SC/OBC/SBC)
		● Candidate with MCA/ M. Sc (IT) will also be considered for M. Tech in computer Engineering.
3.	Ph. D	● A Master's degree in Engineering/Technology/Science of a recognized Indian University, or a degree approved by the Association of Indian Universities, or any other equivalent qualification in the relevant field. Not less than 55 % marks in aggregate or its equivalent grade B in the UGC 7-point scale.
		● Provided that a relaxation of 5 % of marks (from 50% to 45%) shall be allowed for the candidates belonging to SC/ST/OBC (Non-Creamy layers) /Differently-abled category in the entrance examination conducted by the Universities.
		● A relaxation of 5% of marks from 55 % to 50% or an equivalent relaxation of grade shall be allowed for candidates who had obtained their Master's degree prior to 19th September 1991. The eligibility of 55% (or an equivalent grade) and the relaxation shall be permissible on qualifying marks without including grace marks.

COMPONENT WISE MARKS DISTRIBUTION

81. Examination component and their marks distribution.

MARKS DISTRIBUTION				
S.No	Exam Component	Theory (Th)	Practical (Pr)	Discp& TEP DTP/Practical
		Max. Marks	Max. Marks	Max. Marks
A.	Internal Evaluation (IE)	40	60	50
	CIE-I	12	20	NA
	MSE	12	20	NA
	CIE-II	06	10	NA
	Attendance	10	10	NA
B.	End Semester Exam (ESE)	60	40	NA
	Total	100	100	50

IE – Attendance Marks both Theory & Practical Courses :

At the end of the semester, the marks for attendance (both for Theory & Practical) will be finalized by each course teacher/instructor/faculty on the basis of total attendance of his/her course as per the guideline indicated following table :

S. No	Total Attendance (TA in % Range)	Marks (Out of 10)
1	$95\% \leq$ TA	10
2	$90\% \leq$ TA $< 95\%$	09
3	$85\% \leq$ TA $< 90\%$	08
4	$80\% \leq$ TA $< 85\%$	07
5	$70\% \leq$ TA $< 80\%$	06
6	$60\% \leq$ TA $< 70\%$	05
7	$50\% \leq$ TA $< 60\%$	04
8	$40\% \leq$ TA $< 50\%$	03
9	$30\% \leq$ TA $< 40\%$	02
10	$20\% \leq$ TA $< 30\%$	01
11	TA $< 20\%$	00

Minimum Passing Percentage Components

Minimum Passing Percentage				
S. No	Programme	IE	ESE	Total
1	B.Tech	35%	45%	50%
2	M. Tech	30%	40%	40%
3	Ph. D	-----	------	50%

It must be noted that at the end of each semester the marks of IE component stands fixed. They now remain unchanged and can't be improved upon. All the chances of improvement for IE will be given within the semester itself. Moreover the minimum passing percentage in IE component is optional.

If the student attains the minimum percentage in the ESE & Total Components of a particular course then that course will be considered as Clear and will be awarded the "PASS" status, if not the course attains "BACK" status. Additionally a course can be awarded "GPASS" Status if a student passes it by award of Grace marks.

Out of the total courses for which the student has registered in a particular semester, he/she will earn the credits for courses with status "PASS"/"GPASS" in that semester, irrespective of the grade obtained in them.

Moreover Discp& TEP Component credit will not be counted for promotion (neither in total nor in attained as it has no Pass/Back/G Pass Status.

Class Attendance & Debar Policy

Class Attendance and Debar Policy:

Class attendance and Marks for all courses of study will be taken from Department.

Apart from monthly communication for attendance, the tentative short attendance lists and final short attendance lists will be published by Chief Proctor.

The students have to maintain a minimum of 75% attendance, combining all courses / activities in his/her program of study.

If a student is unable to maintain so he/she will not be allowed to sit in the end semester examinations and has to repeat the semester.

For any medical issues / other participation consult department head/ department dean / proctor.

IE Improvement Policy:

As the IE component is fixed and cannot be improved in subsequent attempts, hence a chance will be given to the student who falls below the passing criterion, to improve each of the IE component (CIE/MSE).

After each head CIE/MSE a list will be published by COE office indicating Fail students in the respective component. The students will be asked (by COE office) to apply for improving IE.CIE/MSE – detailing the courses concerned. This includes absent students also.

Once the final list is published (by COE) office, the improvement CIE and MSE will be taken in test/exam mode only. These exams will be kept on Saturdays/off days only.

There will be a minimal fee - Rs 50 per subject per component (as improvement fee).

After improvement IE, the marks for IE are finalized and freeze for subsequent attempts.

Eligibility ESE

Eligibility for ESE (End Semester Examination)

he/she has filled the relevant examination form in stipulated time period.

If student satisfies the minimum attendance

criterionIf student is not guilty of any act of

indiscipline

Repeat Cases (Loss of an academic year)

A student has to repeat the semester if:

His/her attendance falls below the minimum attendance

criterionHe/she is not promoted to next semester

Though the repeat student studies with his junior batch yet his maximum course

durationdoes not changes.

End Semester Examination-Supplementary & Back:

End Semester Examination (ESE) will be held at the end of each semester.

They can befurther categorized as Main ESE, Supplementary ESE and Back

ESE.

Supplementary ESE will be introduced from session 2019-20 to facilitate the

students. Barring the repeat students, all students who have a Back status for some

or more courses oftheir main exam can appear in Supplementary ESE. (The

process of Exam Form, admit cardetc remains same as in Main, Back ESE).

Supp ESE will generally be held on Saturdays, in the month of August/September

during oddsemester and in the month of February/ March during even semester.

If a student still, after supplementary ESE, is unable to clear Backlogs will now

come underBack Cycle, subject to promotion rule and maximum course duration.

Generally ESE Main & Back will be held during 15 Nov – 15 Dec (odd

semester) and 15April 15 May (even semester) (considering no gap/break after odd

semester).

The ESE Theory will be held in two sessions (9-12 and 12:30-3:30).

The student will be given 15-20 days duration to fill the exam form with normal

fee, furtherwith late fee etc., the last date being 10-15 days prior to last teaching

day.

If some student accidently forgot and wishes to fill after last date, he has to

give the application for same, otherwise a undertaking stating that he will

not sit in the exams.

A minimum two day window may open just before the last teaching day to give

chance tosuch students, based on the decisions of a committee.

In no case the exam form will be filled on the day of commencement of theory exam or later.

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M. Tech. COMPUTER ENGINEERING

	POORNIMA UNIVERSITY							
	School of Computer Science and Engineering							
	Name of Program: M. Tech. Artificial Intelligence and Data Science, Batch: 2021-23							
	Teaching Scheme for Year – I, Semester- I _____							
Course Code	Course Name	Teaching Scheme (Hrs per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
A.	University Core Courses							
A.1	Theory							
	-	-	-	-	-	-	-	-
A.2	Practical							
	-	-	-	-	-	-	-	-
B.	Department Core Courses							
B.1	Theory							
MADCAD1101	Artificial Intelligence and Machine Learning	4	-	-	40	60	100	4
MADCAD1102	Advanced Data Structure	4	-	-	40	60	100	4
B.2	Practical							
MADCAD1201	R PROGRAMMING LAB	-	-	2	60	40	100	1
C.	Department Elective: Any Two							
MADEAD1111	Linear Algebra and Optimization	4	-	-	40	60	100	4
MADEAD1112	Parallel and Distributed Computing							
MADEAD1113	Distributed Operating Systems							
MADEAD1121	R Language	4	-	-	40	60	100	4
MADEAD1122	Stochastic Models							
MADEAD1123	Data Mining & Data Warehousing							
MADEAD1124	Embedded Systems							
D.	Open Elective: Anyone							
	Nil	-	-	-	-	-	-	-
E.	Humanities and Social Sciences including Management courses OR Ability Enhancement Compulsory Course (AECC)							
MADCHM1202	Soft Skills-I	-	-	2	60	40	100	1
F.	Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship in Industry or Elsewhere							
MADCAD1401	Seminar-I	-	-	2	60	40	100	1
G.	Social Outreach, Discipline, TEP, VAC& Extra Curricular Activities							
MADCAD1601	Discipline and Talent Enrichment Programme-I	-	-	2	50	-	50	1
	Total	16		8				20
	Total Teaching Hours		24					

Code: MADCAD1101	**Artificial Intelligence & Machine Learning**	**4 Credits [LTP: 4-0-0]**

COURSE OVERVIEW AND OBJECTIVES:

The course provides a sensitization as well as an in-depth explanation on what is Machine Learning and Artificial Intelligence. This section helps you understand answers to questions related to machine learning. Artificial intelligence (AI) is a study field that examines how to achieve intelligent human behaviors on a computer. An ultimate objective of AI is to make a PC that can learn, plan, and take care of issues independently. In spite of the fact that AI has been thought for many years, we can't make a PC that is as clever as a human in all perspectives.

COURSE OUTCOME

The student would be able

CO01101.1 Understand the basics of Soft-computing and Artificial Intelligence.

CO01101.2 To analyze Fuzzy Logic and Fuzzification methods with the help of Inference rules.

CO01101.3 Classify the various types of Learning methods used in Machine Learning.

C001101.4 Understand the Supervised Learning methods used in Machine Learning.

CO01101.5 Understand the concepts of Unsupervised Learning methods in Machine Learning.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Artificial Intelligence	10
2.	Fuzzy Logic	09
3.	Fundamental of Machine Learning	07
4.	Supervised learning	08
5.	Unsupervised learning	08

B. DETAILED SYLLABUS

Unit	Contents
1	**Introduction to Artificial Intelligence (AI):**Overview of Soft Computing, Artificial Intelligence and Expert Systems The concept, characteristics and importance of AI, SC. General Concepts of Expert System
2	**Fuzzy Logic:** Fuzzy Logic: Fuzziness vs probability, Crisp logic vs fuzzy logic, Fuzzy sets and systems, Operations on sets, Fuzzy relations, Membership functions, Fuzzy inference, Fuzzy rule generation, De-fuzzification Methods, Applications of Fuzzy Logic
3	**Fundamental of Machine Learning**: Introduction of ML, Probability Theory, Density Estimation, Fundamental law, The characteristic Function, Tail Bound, Example Estimation , Maximum Likelihood Estimation, Bias Variance and Consistency
4	**Supervised Learning:** Logistic regression. Perceptron. Exponential family. Generative learning algorithms. Gaussian discriminant analysis. Naive Bayes. Support vector machines. Model selection and feature selection. Ensemble methods: Bagging, boosting. Evaluating and debugging learning algorithms. Learning theory: Bias/variance tradeoff. Union and Chernoff/Hoeffding bounds. VC dimension. Worst case (online) learning
5	**Unsupervised Learning:** Clustering. K-means. EM. Mixture of Gaussians. Factor analysis. PCA (Principal components analysis). ICA (Independent components analysis). Reinforcement learning and control: MDPs. Bellman equations.Value iteration and policy iteration.

		Linear quadratic regulation (LQR). LQG. Q-learning. Value function approximation. Policy search. Reinforce. POMDPs.

C. R E

COMMENDED STUDY MATERIAL

S.No	Title of the Book	Author
1.	Neuro-fuzzy and Soft Computing, PHI	J.S.R. Jang, C. – T, Son, E.Mizutani
2.	AI, Tata McGraw Hill	Rich and Knight
3.	Machine Learning, McGraw Hill, 2014	Tom M. Mitchell,
4	S. Machine Learning: An Algorithmic Perspective. CRC Press. 2009	Marsland
Important Web Links		

1- https://www.coursera.org/courses?query=neural networks
2- https://towardsdatascience.com/introduction-to-artificial-neural-networks-ac338f4154e5
3- https://nptel.ac.in/courses/117/105/117105084
4- https://towardsdatascience.com/artificial-neural-networks-ann-21637869b306
5- https://www.edx.org/learn/neural-network

	function, Reproduction, Roulette wheel selection, Boltzmann selection, Tournament selection, Rank selection, Steady state selection. Genetic Modeling: Cross over,

A. RECOMMENDED STUDY MATERIAL

S.No	Title of the Book	Author
1.	Neuro-fuzzy and Soft Computing, PHI	J.S.R. Jang, C. – T, Son, E.Mizutani
2.	AI, Tata McGraw Hill	Rich and Knight
3.	Introduction to Artificial Neural Systems	Jacek M. Zurada
4	Introduction to Neural Networks Using Matlab 6.0	S. N. Sivanandam, S. N Deepa
Important Web Links		

1- https://www.coursera.org/courses?query=neural networks
2- https://towardsdatascience.com/introduction-to-artificial-neural-networks-ac338f4154e5
3- https://nptel.ac.in/courses/117/105/117105084
4- https://towardsdatascience.com/artificial-neural-networks-ann-21637869b306
5- https://www.edx.org/learn/neural-network

Code: MADCAD1102	Advanced Data Structure	4 Credits [LTP: 4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

This course introduces to students with a number of highly efficient algorithms and data structures for fundamental computational problems across a variety of areas. Course provides an understanding for implementation and complexity analysis of fundamental algorithms such as parallel and distributed algorithms, max flow, discrete Fourier transform.

COURSE OUTCOME

The student would be able

CO01102.1 To create various kind of multi-way search tree, AVL tree, Splay tree.

CO01102.2 To understand basic probability theory with random variables.

CO01102.3 To analyze convex hull problems and gift-wrapping algorithms.

C001102.4 To design Ford-Fulkerson Algorithm to obtain the solution of Graph based problems.

CO01102.5 Understanding of Parallel and Distributed algorithms.

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Advanced Data Structures	12
2.	Randomized Algorithms	7
3.	Geometric Algorithms	8
4.	Graph And Approximation Algorithms	8
5.	Parallel And Distributed Algorithms	7

B. DETAILED SYLLABUS

Unit	Contents
1.	**ADVANCED DATA STRUCTURES** Binary Search Tree, AVL Trees, Multi-Way Search Tree, (2-4) Trees, Red-Black Trees, Splay Trees, persistence Trees.
2.	**RANDOMIZED ALGORITHMS** Basic Probability Theory, Independent Events, Random variables and Expectation, Hat Check Problem, Job Hiring Problem using Indicator Random Variable, Birthday Paradox, Las Vegas and Monte Carlo Algorithms.
3.	**GEOMETRIC ALGORITHMS** One Dimensional Range Searching, Quad trees, K-D Trees, Convex Hulls and Gift-Wrapping Algorithm, Graham Scan Algorithm.
4.	**GRAPH AND APPROXIMATION ALGORITHMS** Matching and Flows, Residual Capacity and Augmenting Paths, Ford-Fulkerson Algorithm, Edmonds-Karp Algorithm, Bipartite Matching. Approximation algorithms: Introduction to Approximation Algorithm, Vertex Cover Algorithm, Clustering, TSP Problem, Local Search Heuristics.
5.	**PARALLEL AND DISTRIBUTED ALGORITHMS** Introduction, PRAM Model, ER, CR, EW and CW Models, Parallel Search Algorithm, ER Broadcast Algorithm, Semi group Algorithms and Accelerated Cascading, Recursive Doubling, Parallel Prefix, Sorting Network, Bitonic Sort, Merging and Shearsort.

C. RECOMMENDED STUDY MATERIAL

S. No	Title of the Book	Author
1.	Randomized Algorithms, Cambridge University Press	Motwani and Raghavan
2.	Computational Geometry, Springer Verlag	Preparata and Shamos

3.	Data Structures and Algorithms: 1, Searching and Sorting, Springer Verlag	Mehlhorn
4.	Combinatorial Optimization, Princeton University Press	Papadimitrou and Steiglitz

Important Web Links:

1- https://www.udemy.com/course/introduction-to-data-structures
2- https://www.coursera.org/learn/advanced-data-structures
3- https://www.geeksforgeeks.org/data-structures-and-algorithms-online-courses-free-and-paid/
4- https://www.onlinetraining.in/course/c-data-structures/
5- courses.csail.mit.edu/6.851/spring12/lectures

A. List of Programs

Part A	
	1. Install and configure R, set working directory.
	2. Install Packages and calling installed packages
	3. R studio environment and functionalities of R studio
	4. Implement basic R operations (data input, missing values, importing data into R using different formats : xlsx, CSV, Text files)
	5. Use R as a calculator
	6. Explore various functionalities of dataframes.
	7. Create data set using data frames, list and tables.
	8. Create the contingency table for the given raw data.
	9. Create the interactive user input code line in r using readline ( ) function.
	10. Create the contingency table for the given vector format data.
	11. Convert the contingency table to original format of the given data.
	12. Analyse and give interpretation of summary statistics for the given data.
	13. Calculate mean, median and mode for the grouped data and compare the results for the given data.
	14. Analyse the given data for non-parametric tests and give the interpretations.
	15. Use R for test the given data
	order to compare the effectiveness of two sources of nitrogen, namely ammonium chloride (NH_4Cl) and urea, on grain yield of Coarse cereal, an experiment was conducted. The results on the grain yield of Coarse Cereal (kg/plot) under the two treatments are given below.
	H4Cl : 13.4, 10.9, 11.2, 11.8, 14.0, 15.3, 14.2, 12.6, 17.0, 16.2, 16.5, 15.7.
	rea : 12.0, 11.7, 10.7, 11.2, 14.8, 14.4, 13.9, 13.7, 16.9, 16.0, 15.6, 16.0.
	ssess which source of nitrogen is better for Coarse Cereal.
Part B	
	16. Before an increasing in exercise duty on tea, 800 persons out of a sample of 1000 persons were found to be tea drinkers. After an increasing in duty, 800 people were tea drinkers in a sample of 1200 people. Using SE of a proportion, state whether there is a significant decrease in consumption of tea after the increase in the exercise duty.
	17. Use R for test the given data
	A health status survey in a few villages revealed that the normal serum protein value of children in that locality is 7.0 g/100ml. A group of 16 children who received high protein food for a period of six months had serum protein values shown below. Can we consider that the mean serum protein level of those who were fed on high protein diet is different from that of the general population?

S.No. (Child No.)	1	2	3	4	5	6	7	8
Protein level (g%)	7.10	7.70	8.20	7.56	7.05	7.08	7.21	7.25

S.No. (Child No.)	9	10	11	12	13	14	15	16
Protein level (g%)	7.36	6.59	6.85	7.90	7.27	6.56	7.93	8.56

18. Students were selected to training. Their performance was noted by giving a test and the marks recorded out of 50. They were given effective 6 months training and again they were given a test and marks were recorded out of 50.

Students	1	2	3	4	5	6	7	8	9	10
Before training	25	20	35	15	42	28	26	44	35	48
After training	26	20	34	13	43	40	29	41	36	46

By applying the t-test can it be concluded that the students have benefited by the training?

19. 100 individuals of a particular race were tested with an intelligence test and classified into two classes. Another group of 120 individuals belong to another race were administered the same intelligence test and classified into the same two classes. The following are the observed frequencies of the two races:

Race	Intelligence		
	Intelligent	Non-intelligent	Total
Race I	42	58	100
Race II	55	65	120
Total	97	123	220

Test whether the intelligence is anything to do with the race.

20. Obtain the correlation coefficient between the heights of father(X) and of the son (Y) from the following data

X	65	66	67	68	69	70	71	72
Y	67	68	65	68	72	72	69	71

And also test its significance. Using R functions.

21. Consider the inbuilt data set cars.
22. Find Correlation between possible variables and pairwise correlation
23. Find regression line between appropriate variables
24. Display the summary statistics and comment on the results

Code:	MADEAD1111	Linear Algebra and Optimization	4 Credit [4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

COURSE OUTCOME

D.   OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Vector Space	12
2.	Linear Transformation	7
3.	Eigen Space	8
4.	Optimization	8
5.	Analysis of Newton's Method	7

E.   DETAILED SYLLABUS

Unit	Contents
1.	Vector Spaces: Vector Spaces, Subspaces- Definition and Examples, Linear independence of vectors, Bases and dimension, Linear Span, Field-Definition, Vector space in Rn: System of linear equations, row space, Column space and null space. Four fundamental spaces, relation between rank and nullity, consistency theorem, basis from a spanning set and independent set.
2.	Linear transformations: General linear transformation, Matrix of transformation, Kernel and range, properties, Isomorphism, change of basis, invariant subspace, Linear functional. Inner Product: Real and complex inner product spaces, properties of inner product, length and distance, Cauchy-Schwarz inequality, Orthogonality, Orthogonal complement, Orthonormal bases, Gram Schmidt orthogonalisation
3.	EigenSpace: Properties of Eigen values and Eigen vectors , Eigen values, Eigen vectors, minimal polynomial, Diagonalization, Orthogonal diagonalization, Jordan canonical form Matrix Factorization: LU decomposition, QR Decomposition and singular value decomposition
4.	Optimization: Conditions for local minimization-One dimensional Search methods:Golden search method, Fibonacci method, Newton's Method, Secant Method, Remarks on Line Search Gradient-based methods-introduction, the method of steepest descent, analysis of Gradient Methods, Convergence, Convergence Rate.
5.	Analysis of Newton's Method, Levenberg-Marquardt Modification, Newton's Method for Nonlinear Least-Squares. Conjugate direction method, Conjugate Direction Algorithm, Conjugate Gradient Algorithm for Non-Quadratic Quasi Newton method.

F.   RECOMMENDED STUDY MATERIAL

S. No	Title of the Book	Author
1.	Linear Algebra and It's Applications, 4th edition, Cengage Learning, 2006.	Gilbert Strang
2.	Introduction to Applied Linear Algebra: Vectors, Matrices, and Least Squares, Cambridge University Press, 2018	Stephen Boyd, Lieven Vandenberghe
3.	Linear Algebra with applications, 4th edition, McGraw-Hill, 2002	W. Keith Nicholson

4.	Topics in Linear Algebra, Wiley Eastern, 1975.	I.N Herstein
5.	Linear Algebra : A Geometric Approach, Prentice-Hall of India, 2000.	S.Kumaresan
6.	Schaum's outline of linear algebra, 3rd Ed., Mc Graw Hill Edn., 2017	Seymour Lipschutz, Marc Lipson

| Code: MADEAD1112 | Parallel & Distributed Computing | 4 Credits [LTP: 4-0-0] |

COURSE OUTCOME

The student would be able

CO01104.1.1 To provide hardware and software issues in modern distributed systems.

CO01104.1.2 Analyze the Communication system provided in the Distributed System.

CO01104.1.3 To distinguish between the concepts of distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security.

CO01104.1.4 Understand client server communication & group communication.

CO01104.1.5 Study a case study of distributed file system (SUN, CODA).

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction To Distributed Operating Systems	10
2.	Communication In Distributed Systems	08
3.	Synchronization In Distributed Systems	06
4.	Processes And Processors In Distributed Systems	09
5.	Distributed File Systems	09

B. DETAILED SYLLABUS

Unit	Contents
1.	**INTRODUCTION TO PARALLEL AND DISTRIBUTED SYSTEMS** Goals, hardware concepts, software concepts, client server model.
2.	**COMMUNICATION & PROCESSES** Communication, layered protocols, remote procedure call, objective invocation, message & stream-oriented communication, processes, threads, clients, servers; naming entities, mobile and unreferenced entities
3.	**CLOCK SYNCHRONIZATION** Algorithms, transaction; consistency and replication, data-centric & client-centric models, protocols.
4.	**FAULT TOLERANCE & SECURITY** Process resilience, reliable client-server & group Communication, commit, recovery, security, channels, access, security control.
5.	**DISTRIBUTED OBJECT-BASED SYSTEMS** explanation and comparison, distributed file systems (SUN, CODA) and comparison; distributed document-based system and coordination-based systems, multimedia systems, Parallel Programming Languages and Algorithms.

C. RECOMMENDED STUDY MATERIAL

S.No	Title of the Book	Author
1.	Distributed Systems Principals and Paradigms, Pearson Edu	Andrew S. Tanenbaum, marten van steen
2.	Distributed Systems Concepts and Design" Pearson Edu.	George Coulouris, Jean Dollimore, Tim Kindber
3.	An Introduction to Distributed & Parallel Computing, PHI.	Joel M. Crichlow
4.	Introduction to parallel Processing, PHI	M. Sasikumar, Dinesh Shikhare P Ravi Prakash
5.	Distributed Operating System, TMH	Andrew S. Tanenbaum

Important Web Links:

1. https://www.geeksforgeeks.org/difference-between-network-os-and-distributed-os/ 2. https://nptel.ac.in/courses/106/106/106106107/
3. https://www.nptel.ac.in/courses/106/106/106106168/
4. https://www.ics.uci.edu/~cs230/lectures/DistributedOSintro.pdf 5. https://link.springer.com/chapter/10.1007/3-540-52609-9_73

C. **RECOMMENDED STUDY MATERIAL**

Code: MADEAD1113	Distributed Operating System	4 Credits [LTP: 4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

This course provides an understanding of hardware and software issues in modern distributed systems. It will enhance the knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems. To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.

COURSE OUTCOME

The student would be able

CO01103.3.1 To understand the concepts of hardware and software in modern distributed systems.

CO01103.3.2 Analyze the Communication system provided in the Distributed System.

CO01103.3.3 To distinguish between the concepts of distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security.

CO01103.3.4 Understand the concept of thread and differentiate between various system models.

CO01103.3.5 Understand and memorize the concepts of Distributed File System.

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction To Distributed Operating Systems	10
2.	Communication In Distributed Systems	08
3.	Synchronization In Distributed Systems	07
4.	Processes And Processors In Distributed Systems	07
5.	Distributed File Systems	10

B. DETAILED SYLLABUS

Unit	Contents
1.	**INTRODUCTION TO DISTRIBUTED OPERATING SYSTEMS** Distributed operating system, Goals, Hardware Concepts: bus-based multiprocessors, switched multiprocessors, bus-based multi computers, switched multi computers, Software Concepts: network operating systems. true distributed systems, multiprocessor time sharing systems, Design, Issues:transparency,flexibility,reliability,performance,scalability.
2.	**COMMUNICATION IN DISTRIBUTED SYSTEMS** Layered Protocols: the physical layer ,the data link layer, the network layer, the transport layer, the session layer, the presentation layer, the application layer, Asynchronous Transfer Mode Networks :definition, ATM physical layer, ATM layer, ATM adaption layer, ATM switching, The Client-Server Model: client and servers, addressing, blocked vs non-blocking primitives, buffered vs unbuffered primitives, reliable vs unreliable primitives, Remote Procedure Call: basic RPC operation, parameter passing, dynamic binding, RPC semantics in the presence of failures, Implementation issues, Group Communication: design issues, group communication in ISIS.
3.	**SYNCHRONIZATION IN DISTRIBUTED SYSTEMS** Clock Synchronization: logical clocks, physical clocks, clock synchronization algorithm, Mutual Exclusion: centralized algorithm, distributed algorithm, token ring algorithm, comparison of three algorithms, Election Algorithms: bully algorithm, ring algorithm, Atomic Transactions: introduction, transaction model, implementation, concurrency control, Deadlocks in Distributed Systems distributed deadlock detection, distributed deadlock prevention.
4.	**PROCESSES AND PROCESSORS IN DISTRIBUTED SYSTEMS** Threads: introduction, thread usage, design issues for thread packages, implementing a thread package, thread and

	RPC, System Models: the workstation model, using idle workstations, processor pool model, hybrid model, Processor Allocation: allocation model, design issue for processor allocation algorithms, Scheduling in Distributed Systems.
5.	**DISTRIBUTED FILE SYSTEMS** Distributed File System Design: file service interface, directory server interface, semantic of file sharing, Distributed File System Implementation: file usage, system structure, caching, replication, sun network file system, Trends in Distributed File Systems: new hardware, scalability, wide area networking, mobile users, fault tolerance, multimedia.

C. RECOMMENDED STUDY MATERIAL

S.No	Title of the Book	Author
1.	Distributed Operating Systems	A.S. Tanenbaum, Pearson Education
2.	Distributed Systems: Concepts and Design	G. Coulouris, J. Dollimore and T. King Berg., Addison Wesley
3.	Advanced Concepts in Operating Systems	M. Singhal and N. G. Shivaratri, TMH
Important Web Links:		

1. https://www.geeksforgeeks.org/difference-between-network-os-and-distributed-os/   2. https://nptel.ac.in/courses/106/106/106106107/
3. https://www.nptel.ac.in/courses/106/106/106106168/
4. https://www.ics.uci.edu/~cs230/lectures/DistributedOSintro.pdf 5. https://link.springer.com/chapter/10.1007/3-540-52609-9_73

| Code: MADEAD1124 | Embedded System | 4 Credits [LTP: 4-0-0] |

COURSE OVERVIEW AND OBJECTIVES

The objective of this course is to introduce the importance & concept of basic functions and structure of embedded systems in order to achieve applications goal. This subject also deals with development software of embedded system. At the end of course work student is expected to present various concepts of Embedded Systems and the methodology to implement these concepts.

COURSE OUTCOME
The student will be able to:

CO02103.3.1 Understand about the basic terminologies of Embedded System.
CO02103.3.2 Differentiate between various types of Processor and Architecture.
CO02103.3.3 Analyze various types of buses and its configurations.
CO02103.3.4 Analyze various design patterns of Embedded System using data flow and control flow graphs.
CO02103.3.5 Study about Embedded System Accelerators.

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Embedded Computing Requirements	07
2	Embedded Processors	10
3	Embedded Computing Platform	09
4	Embedded Software Analysis and Design	10
5	Embedded System Accelerators	06

B. DETAILED SYLLABUS

Unit	Contents
1.	**Embedded Computing Requirements**: Characteristics and applications of embedded systems; Components of Embedded Systems; challenges in Embedded System Design and design process; Formalism for system design.
2.	**Embedded Processors**: RISC vs. CISC architectures; ARM processor – processor architecture and memory organization, instruction set, data operations and flow control; SHARC processor – memory organization, data operations and flow control, parallelism within instructions; Input and output devices, supervisor mode, exception and traps; Memory system, pipelining and superscalar execution.
3.	**Embedded Computing Platform**: CPU Bus – Bus protocols, DMA, system bus configurations, ARM bus; Timers and counters, A/D and D/A converters, Keyboards, LEDs, displays and touchscreens; Design examples.
4.	**Embedded Software Analysis and Design:** Software design pattern for Embedded Systems; Model programs – data flow graphs and control/data flow graphs; Assembly and linking; Compilation techniques; Analysis and optimization of execution time, energy, power and program size.
5.	**Embedded System Accelerators**: Processor accelerators, accelerated system design

C. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	Computer as Components	Wayne Wolf published by Elsevier Inc
2.	An Introduction to Geographical Information System	Andrew S. Loss published by Elsevier Inc
3.	Embedded System Design	Steve Heath published by Elsevier Inc
4.	Embedded System design: A unified hardware/software Introduction	by Frank Vahid & Tony Givagi published by John Wiley & Sons Inc
Important Web Links:		

1. https://nptel.ac.in/courses/108/102/108102045
2. https://swayam.gov.in/nd1_noc20_cs15/preview
3. https://www.youtube.com/playlist?list=PLrjkTql3jnm-lZMoUb1xMCp0HgxvJ7ocx
4. http://www.nptelvideos.in/2012/11/embedded-systems.html
5. https://www.youtube.com/watch?v=TP1_F3IVjBc

Code: MADEAD1121	R Language	4 Credits [LTP: 4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

COURSE OUTCOME

The student would be able

1. Analyse data and find relative patterns to predict outcomes
2. Analyse continuous data in varying scenarios
3. Perform Confirmatory Data analysis
4. Able to solve Machine learning and Data science problem
5. Able to develop projects to solve real time problems

Demonstrate expert knowledge in outcome predictions

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to R	10
2.	Data with R	08
3.	Data Analysis with R	06
4.	Machine Learning with R	09
5.	Documentation	09

B. DETAILED SYLLABUS

Unit	Contents
1.	Introduction to R: R Installation Guide and Installing R Packages; Basic data types and data structures in R; Reading, writing, manipulating and visualizing data in R
2.	Reading and getting data into R, Vectors and assignment, Logical and Index vectors, Generating regular sequences, Missing values, Ordered and Unordered Factors, The function tapply() and ragged arrays, Ordered factors, Reading data from files.
3.	**Exploring and cleaning data for analysis**, Data organization, Arrays and Matrices, Basics of Arrays in R, Matrix operations, Advanced Matrix operations, Additional Matrix facilities, Lists and Data frames.
4.	**Mapping models to Machine Learning**, Evaluating and Validating models, Probability distributions in R, **Statistical models in R**, Building linear models, Generalized linear models, Nonlinear least squares and maximum likelihood models.
5.	**Documentation**, Graphical analysis, plot() function, Displayingmultivariate data, Using graphics parameters, Matrix plots, Exporting graphs, ggplot package.

C. RECOMMENDED STUDY MATERIAL

S.No	Title of the Book	Author
1.	Mastering Machine Learning with R, Packt Publishing	Cory Lesmeister
2.	Machine Learning with R, Springer	Abhijit Ghatak
3.	Machine Learning, MIT Press	Kevin Murphy
4.	Practical Data Science with R, Manning Publications. 2014	Nina Zumel, John Mount
5.	Practical DataScience Cookbook, Packt Publishing Limited, 2014	Tony Ojeda, Sean Patrick Murphy, Benjarnin Bengfort. Abhijit Dasgupta

Code: MADCHM1202	Soft Skills-I	1 Credit [LTP: 2-0-0]

COURSE OUTCOME

The student would be able to:

CO01206.1 Effectively communicate through verbal/oral communication and improve the listening skills

CO01206.2 To develop and nurture the soft skills of the students through individual and group activities.

CO01206.3 To expose students to right attitudinal and behavioral aspects and to build the same through activities

CO01206.4 To make the engineering students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.

CO01206.5 To encourage the all round development of students by focusing on soft skills.

A. DETAILED SYLLABUS

Unit	Unit Details
1	Personality Enhancement Self-Awareness, Self Esteem & Confidence , Attitude Branding Yourself: Assertiveness and Confidence, The Corporate Fit-Dressing and Grooming, Corporate Dressing – Dress for Success, Etiquette: Social etiquette, business etiquette – civic sense – social norms
2	Effective Management Skills Time & Stress Management: Act in time on commitment Planning & Prioritizing, Emotional Intelligence: Managing Emotions
3	Art of Communication Interview Skills: Fluency & Expression, Group Discussions: Structured & Unstructured, Presentations: Voice, Body Language, Content and Visual Aids, Audience Management
4	Interpersonal Skills The Team Concept& Elements of Teamwork, Stages of Team Formation, & an Effective Team, Essential Building Blocks of Effective Teams Leadership Skills: style andtraits
5	Written & Oral Communication Writing Skills: Picture perception & Story Making, Storytelling, Extempore & Paper Presentations.

| Code: MADCAD1401 | SEMINAR-I | 1 Credits [LTP: 2-0-0] |

A. DETAILED SYLLABUS

Unit	Contents
	Students will be grouped in two to three, will have to decide final thesis area, download research papers from IEEE, ACM, Elsevier, Springer etc. Summarizing paper – Reading abstracts and finding ideas, conclusion, Advantages of Their approach, the drawbacks of the papers. Generalize results from a research paper to related research problems. Comparing the approach - Identify weaknesses and strengths in recent research articles in the subject. Practice sessions on how to read, analyze and summarize research papers. Students in group will have to deliver seminar, prepare a report and a review paper based on analysis.

POORNIMA UNIVERSITY

School of Computer Science and Engineering

Name of Program: M. Tech. Artificial Intelligence and Data Science, Batch: 2021-23

Teaching Scheme for Year – I, Semester- II _____

Course Code	Course Name	Teaching Scheme (Hrs per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
A.	University Core Courses							
A.1	Theory							
	-	-	-	-	-	-	-	-
A.2	Practical							
	-	-	-	-	-	-	-	-
B.	Department Core Courses							
B.1	Theory							
MADCAD2101	Deep Learning & AI	4	-	-	40	60	100	4
MADCAD2102	Natural Language Processing	4	-	-	40	60	100	4
B.2	Practical							
MADCAD2201	Computer Lab-II	-	-	2	60	40	100	1
C.	Department Elective: Any Two							
MADEAD2111	Data Science with Big Data Analytics	4	-	-	40	60	100	4
MADEAD2112	**Genetic Algorithm**							
MADEAD2113	Data Visualization with R							
MADEAD2121	Cloud Computing	4	-	-	40	60	100	4
MADEAD2122	Grid Computing							
MADEAD2123	High Level System Design & Modeling							
D.	Open Elective: Anyone							
	Nil	-	-	-	-	-	-	-
E.	Humanities and Social Sciences including Management courses OR Ability Enhancement Compulsory Course (AECC)							
MADCHM2202	Soft Skills-II	-	-	2	60	40	100	1
F.	Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship in Industry or Elsewhere							
MADCAD2401	Seminar-II	-	-	2	60	40	100	1
G.	Social Outreach, Discipline, TEP, VAC& Extra Curricular Activities							
MADCAD2601	Discipline and Talent Enrichment Programme-II	-	-	2	50	-	50	1
	Total	16		8				20
	Total Teaching Hours		24					

Code: MADCAD2101	Deep Learning & AI	4 Credits [LTP: 4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

COURSE OUTCOME

The student would be able

1. Explain basic Neural Network architectures
2. Apply fundamental principles, theory and approaches for learning with deep neural networks
3. Analyse main variants of deep learning and their typical applications
4. Analyse how deep learning fits within the context of other Machine Learning approaches
5. Demonstrate expert knowledge in outcome predictions

D. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	NeuralNetwork	10
2.	Classification	08
3.	Back propagation	06
4.	Deep Learning	09
5.	Unsupervised Learning	09

E. DETAILED SYLLABUS

Unit	Contents
1.	Neural networks- Perceptrons, sigmoid units; Learning in neural networks - output vs hidden layers; linear vs nonlinear networks; linearmodels (regression) - LMS algorithm.
2.	Perceptrons classification - limitations of linear nets and perceptrons - multi-Layer Perceptrons (MLP)- activation functions - linear, softmax, tanh, ReLU; error functions - feed-forward networks.
3.	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
4.	Introduction to deep reinforcement learning - neural nets forsequences - Recurrent Nets, LSTM Deep neural networks - convolutional nets case studies using Keras/Tensorflow.
5.	Introduction to Deep unsupervised learning autoencoders - PCA to autoencoders - Deep Generative Models - Generative Models and Variational Inference - Autoregressive Models and Invertible Transformations Adversarial Learning - Unifying Variational Autoencoders and Generative Adversarial Networks - Adverserial Autoencoders - Evaluation of Generative Models

F. RECOMMENDED STUDY MATERIAL

S.No	Title of the Book	Author
1.	Deep Learning, Second edition, MIT Press,2016	Ian Goodfellow, Yoshua Bengio, Aaron Courvill
2.	Pattern Classification, Second edition, Wiley – Inter science, 2001	Duda R.O., Hart P.E., Stork D.G.,
3.	Pattern Recognition, Fourth edition, Academic Press,2008	Theodoridis, S., Koutroumbas, K.

Code: MADCAD2102	Natural Language Processing	4 Credits [LTP: 4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

COURSE OUTCOME

The student would be able

1. Discuss about the language modeling techniques.
2. Identify the basic words, parsers and various levels in processing of natural language.
3. Explain the various semantics discourse and pragmatic levels of NLP.
4. Analyze Natural language Generation and apply machine translation.
5. Implement levels of NLP system using lexical resources to demonstrate Morphology of a language.

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction	10
2.	Word sense Disambiguation	08
3.	Vector Semantics	06
4.	Speech	09
5.	Overview	09

B. DETAILED SYLLABUS

Unit	Contents
1.	Introduction to NLP: Definition, History, Applications, Goals.Regular expressions and Automata, Morphology and Finite State Transducers. N-grams: Introduction, Simple (Unsmoothed) N-Grams, Smoothing: Add-one smoothing,Witten-Bell Discounting, Good-Turing Discounting, Back off, Deleted Interpolation. Entropy HMM: Overview, Viterbi Algorithm Syntax: Word Classes and Part-of Speech Tagging, Context Free Grammars for English,Parsing with Context-Free Grammars.
2.	Word Sense Disambiguation: Selection Restriction Based Disambiguation, Robust WSD: Machine Learning, Supervised Learning Approaches, Bootstrapping Approaches, Unsupervised Methods, Dictionary Based Approaches. Machine Translation: Introduction, Language Similarities and Differences, Approaches, Steps involved in machine translation system design.
3.	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 ofembeddings, Bias and Embeddings, Evaluating Vector Models.
4.	Speech: Phonetics Speech Sounds and Phonetic Transcription. Articulator Phonetics Phonological categories and Pronunciation Variation Acoustic phonetics and signals. Automatic Speech Recognition Architecture
5.	Overview and Language Modeling: Origins and challenges of NLP-Language and Grammar- Processing Indian Languages-NLP Applications-Information Retrieval.

C. RECOMMENDED STUDY MATERIAL

S.No	Title of the Book	Author
1.	Speech and Language Processing	Dan Jurafsky and James H. Martin.
2.	Foundations of Statistical Natural Language Processing, MIT Press	Manning C, Schuetze H.
3.	Natural Language Understanding, 2/E, Addison-Wesley, 1994	James Allen

Code: MADEAD2111	Data Science with Big Data Analytics	4 Credits [LTP: 4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

COURSE OUTCOME

The student would be able

1. Understands various phases of the data analytics life cycle.
2. Apply statistical methods to data for inferences.
3. Analyze data using Classification, Graphical and computational methods.
4. Understand Big Data technologies and NOSQL.

5. Analyze various types of data using Data Analytics Techniques

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Data analytics life cycle	10
2.	Overview of supervised learning	08
3.	Time series analysis	06
4.	Introduction to big data	09
5.	NoSql Data Management	09

B. DETAILED SYLLABUS

Unit	Contents
1.	**Data Analytics Life Cycle:** Data Analytics Life cycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalise, Exploratory Data Analysis, Statistical Methods for Evaluation, ANOVA.
2.	**Overview of Supervised Learning:** Variable Types and Terminology, Two Simple Approaches to Prediction: Least Squares and Nearest Neighbors, Model Selection and Bias–Variance Tradeoff. **Association Analysis:** Association rules, Apriori algorithm, FP-Growth Technique
3.	**Time Series Analysis:** Overview of Time Series Analysis, ARIMA Model; **Text Analysis:** Text Analysis Steps, Stop Word Removal, Tokenization, Stemming and Lemmatization, Representing Text: Term-Document Matrix, Term Frequency
4.	**Introduction to Big Data:** Defining big data, 4 V's of big data, Big data types, Analytics, Examples of big data, Big data and Data Risk, Big data technologies, benefits of big data, Crowd sourcing analytics; **Hadoop Distributed File Systems:** Architecture of Apache Hadoop HDFS and other File Systems, HDFS File Blocks, HDFS File Commands
5.	**NoSQL Data Management:** Types of NOSQL data bases, Benefits of NO SQL, **Map Reduce:** Introduction, Map reduce example, Job Tracker, Map Operations. **Data Stream Mining:** The stream data model, streaming applications, continuous query processing and optimization, Distributed query processing.

C. RECOMMENDED STUDY MATERIAL

S.No	Title of the Book	Author
1.	Data Science and Big Data Analytics Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publishers, 2012.	EMC Education Services
2.	The elements of statistical learning: Data Mining, Inference, and Prediction", Vol. 2. No. 1. New York: Springer, 2009	Hastie, Trevor, et al.,
3.	Big Data & Hadoop", Khanna Publishing House, 2017.	V.K. Jain

Code: MADEAD2112	Genetic Algorithm	4 Credits [LTP: 4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

This course will give an introduction to the **Genetic Algorithms**. This course will cover the most fundamental concepts in the area of **Artificial Intelligence** techniques. The main focus will be on the applications and techniques of Genetic Algorithm as the most well-regarded **optimization algorithm** in history. The Genetic Algorithm is a search method that can be easily applied to different applications including **Machine Learning, Data Science, Neural Networks, and Deep Learning.**

COURSE OUTCOME

The student would be able

CO01103.4.1 Understand the mathematical theorems implemented in Genetic Algorithms.

CO01103.4.2 Understand the data structure, mutation concepts used in Genetic Algorithm.

CO01103.4.3 Analyze the applications of genetic algorithm in various fields.

CO01103.4.4 Understand the various macro operator to implement in knowledge based techniques.

CO01103.4.5 Analyze the applications of genetic algorithm in the fields of industry.

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Mathematical Foundations	10
2.	Computer Implementation Of Genetic Algorithms	09
3.	Applications Of Genetic Algorithms	07
4.	Advanced Operators And Techniques In Genetic Algorithm Search	10
5.	Industrial Application Of Genetic Algorithms	06

B. DETAILED SYLLABUS

Unit	Contents
1.	**MATHEMATICAL FOUNDATIONS** Definition Robustness of traditional optimization and search techniques Goals of optimization A Simple Genetic Algorithm Similarity Templates, Fundamental theorem Schema Processing Problem solving-2 armed and K armed bandit problem Building block hypothesis Minimal deceptive problem Similarity templates as hyper planes.
2.	**COMPUTER Implementation of Genetic Algorithms:** Data structure, reproduction, crossover and mutation Mapping objective functions to fitness form Fitness scaling, discretization and constraints.
3.	**APPLICATIONS OF GENETIC ALGORITHMS** DeJong and Function optimization structural optimization via genetic algorithm Medical image registration with genetic algorithms Iterated prisoner's dilemma problem.
4.	**ADVANCED OPERATORS AND TECHNIQUES IN GENETIC ALGORITHM SEARCH** Dominance, Diploidy and abeyance Inversion and other re-ordering operators Macro operators, niche and special speciation Multi objective optimization Knowledge based techniques Genetic Algorithms and Parallel processors Genetic Based machine learning Classifier systems.
5.	**INDUSTRIAL APPLICATION OF GENETIC ALGORITHMS** Data mining using genetic Algorithms, Search in data mining Genetic algorithms for game playing e.g. TIC TAC TOE

C. RECOMMENDED STUDY MATERIAL

S.No	Title of the Book	Author

1.	Genetic Algorithms in search, optimization machine leaning	David Goldberg 6th edition	
2.	Industrial applications of Genetic Algorithms	Charles L Karr and L.Michael Freeman, CRC Press	
3.	Handbook of Genetic Algorithms	Davis, Lawrence	

Important Web Links:

1- https://www.udemy.com/course/geneticalgorithm/
2- https://www.pluralsight.com/courses/genetic-algorithms-genetic-programming
3- https://www.cs.rit.edu/~jmg/courses/ga/20091/intro.html
4- https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html
5- https://www.udemy.com/course/genetic-algorithms-in-python-and-matlab/

Code: MADEAD2113	Data Visualization with R	4 Credits [LTP: 4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

COURSE OUTCOME

The student would be able

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

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction	10
2.	Visual Analytics	08
3.	Presenting	06
4.	Dashboard development	09
5.	Animation	09

D. DETAILED SYLLABUS

Unit	Contents
1.	**Introduction to visualization** - the visualization pipeline, The Value ofVisualization, Data - Why Do Data Semantics and Types Matter, Data Types, Dataset Types, Attribute Types, Semantics **Plotting in R** - plot() function, Displaying multivariate data, Using graphics parameters, Matrix plots, Exporting graphs.
2.	**Visual Analytics** - Optimal visualization types, Binning values,Calculated fields, Table calculations, Level of Detail calculations. **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.
3.	**Presenting results to stakeholders**, ggplot library in R - layers, geoms, stats, positioning, annotations, scales, axes and legends, facetting, autoplot and fortify
4.	**Dashboard development** - Dashboard design principles, Dashboard interactivity, Connected "drill-down" dashboards. Visualization case studies - Textual data, Temporal data.
5.	Creating HTML5 CANVAS Charts (HTML5 Canvas basics, Linear interpolations, A Simple Column Chart, Animations), Starting with Google charts (Google Charts API Basics, A Basic bar chart, A basic Pie chart, Working with Chart Animations).

E. RECOMMENDED STUDY MATERIAL

S.No	Title of the Book	Author
1	Visualization Analysis and Design (VAD), CRC press	Tamara Munzner,
2	Practical Data Science with R, Manning Publications. 2014	Nina Zumel, John Mount "

Code: MADEAD2121	Cloud Computing	4 Credits [LTP: 4-0-0]

COURSE OVERVIEW AND OBJECTIVES

This course is the delivery of computing services over the Internet. Cloud services allow individuals and businesses to use software and hardware that are managed by third parties at remote locations. Cloud computing provides a shared pool of resources, including data storage space, networks, computer processing power, and specialized corporate and user applications

COURSE OUTCOME

The student will be able to:

CO02104.1.1: To have a deep understanding of the concepts of virtualization along with VMWare Server, citrix Xen Server.

CO02104.1.2: To discuss about the architecture of cloud computing with IaaS, Paas, SaaS

CO02104.1.3: To understand about how application can be deploy on Azure.

CO02104.1.4: To understand the concepts of security in cloud computing with cloud security reference model, internal security breaches and identity management.

CO02104.1.5: To learn about the applications of cloud computing..

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Introduction of Virtualization	07
2	Cloud Computing Architecture	10
3	Windows Azure Platform Architecture	09
4	Analyzing the Windows Azure Operating System	10
5	Cloud Applications and advanced topics in Cloud Computing	06

B. DETAILED SYLLABUS

Unit	Contents
1.	**Introduction of Virtualization** Traditional Server Concept, advantages and disadvantages of traditional server concept, Virtual server concept, Cloud Computing and Virtualization, Pros and Cons of Virtualization
2.	**Cloud Computing Architecture** Introduction, Cloud Reference Model, Architecture, Infrastructure as a service, Platform as a service, Software as a service, Files [storage] as a Service, Communication as a Service, Monitoring as a Service, Everything as a Service, Cloud Computing Ontologies, Cloud Computing Concerns
3.	An Introduction to the Idea of Data Security, The Current State of Data Security in the Cloud, CryptDb: Onion Encryption layers-DET, RND, OPE,JOIN,SEARCH, HOM, and Homomorphic Encryption, FPE. Trust, Reputation and Security Management.
4.	**Virtual Machines and Virtualization of Clusters and Data Centers:** Levels of Virtualization, Virtualization Structures//Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization Data-Center Automation. Case studies: Xen Virtual machine monitors- Xen API. VMware - VMware products-Vmware Features. Microsoft Virtual Server - Features of Microsoft Virtual Server.
5.	**Cloud Applications and advanced topics in Cloud Computing** Scientific Applications: ECG analysis, Protein structure Prediction, Satellite Image Processing (Geoscience), Media Applications, Drop Box and iCloud, Social Networking

	Energy Efficient and Green Cloud Computing Architecture, Market Oriented Cloud Computing (MOCC), Reference model for MOCC, Market Oriented Architecture for Datacenters

C. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	Cloud Computing with the Windows Azure Platform	Roger Jennings, Wiley
2.	Mastering Cloud Computing	Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, McGraw Hill
3.	Cloud Computing	Michael Miller, Pearson Education

Important Web Links:

1- http://www.tutorialspoint.com/cloud_computing/
2- http://www.thecloudtutorial.com/
3- https://www.youtube.com/playlist?list=PLV8vIYTIdSnaKSiSGvJf2QquSN4lEzGob
4- https://www.nptel.ac.in/courses/106/105/106105223/
5- https://swayam.gov.in/nd1_noc20_cs65
6- https://swayam.gov.in/nd1_noc19_cs64

Code: MADEAD2122	Grid Computing	4 Credits [LTP: 4-0-0]

COURSE OVERVIEW AND OBJECTIVES.

COURSE OUTCOME
The student will be able to:

1. Learn the foundations of Grid Computing
2. Understand basic of CORBA
3. Learn different measurement techniques
4. Implement principles of grid computing for solving real world problems

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Soft Computing	07
2	History	8
3	Grid Computing	09
4	CORBA	8
5	Computing Model	06

B. DETAILED SYLLABUS

Unit	Contents
1.	Soft Computing Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.
2.	Cluster computing models, Grid models, Mobile grid models, Applications. Parset: System independent parallel programming on distributed systems: Motivation and introduction, Semantics of the parset construct, Expressing parallelism through parsets, Implementing parsets on a loosely coupled distributed system. Anonymous remote computing model: Introduction, Issues in parallel computing on interconnected workstations, Existing distributed programming approaches, The arc model of computation, The two tired arc language constructs, Implementation
3.	Introduction and motivation, A model for integrating task parallelism into data parallel programming platforms, Integration of the model into ARC, Design and implementation applications, performance analysis, guidelines for composing user programs, related work Anonymous remote computing and communication model: Introduction, Location in dependent inter task communication with DP, DP model of iterative grid computations, Design and implementation of distributed pipes, Case study, and Performance analysis.
4.	Parallel programming model on CORBA Introduction, Existing works, notion of concurrency, system support implementation performance, sitability of CORBA: introspection.
5.	Grid computing model: Introduction, a parallel computing model over grids, Design and implementation of the model, Performance studies, Related work.

C. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1.	Grid Computing a Research Monograph" by Tata McGraw hill publications, 2005	D. Janakiram,
2.	Grid Computing: A Practical Guide to technology and Applications" by River media – 2003	Ahmar Abbas, Charles

COURSE OVERVIEW AND OBJECTIVES

This course covers the architecture that would be used for developing a software product. HLD uses possibly nontechnical to mildly technical terms that should be understandable to the administrators of the system. In contrast, low-level design further exposes the logical detailed design of each of these elements for programmers.

COURSE OUTCOME
The student will be able to:

CO02104.3.1 Discuss about various types of flow-graph and charts to design high level design.
CO02104.3.2 Understand about various type of Controller architecture, parallel processors, Embedded systems
CO02104.3.3 Build an understanding for VHDL, Verilog and other language specific features.
CO02104.3.4 Understand the application specific implementation of High Level Systems.
CO02104.3.5 Understand to differentiate between various type of Partitioning issues of structural and functional.

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Introduction	07
2	Architectural Taxonomy	10
3	Specification Requirements Languages	09
4	A Specification example of Telephone answering machine	10
5	System Partitioning	06

D. DETAILED SYLLABUS

Unit	Contents
1.	**Introduction** Introduction to Design Representation of Digital Systems, levels of abstraction, design Methodologies, System level methodologies, System specification and design. Model Taxonomy: State-Oriented models -finite-state machine, Petri net, Hierarchical concurrent finite state machine; Activity-oriented models - Dataflow graph, flow charts; Heterogeneous model control/data flowgraph, Object oriented model, Program-state machine;
2.	**Architectural Taxonomy** : Application specific architectures -Controller Architecture, Data path architecture, Finite-state machine with data path; Processors -Complex instruction set Computer, Reduced instruction set Computer; Vector machine -Very long instruction word Computer; Parallel processors. Embedded Systems
3.	**Specification Requirements Languages** : Characteristics of Conceptual models Concurrency, State Transitions, Hierarchy, Programming Constructors, Behavioral Completion, Communication, Synchronization, Exception handling, Timing; Comparative features of Specification languages -VHDL, Verilog, HardwareC, State-charts, Esterel; Embedded system specification in spec-charts.
4.	**A Specification example of Telephone answering machine** : Specification capture with speccharts, Sample test bench, Advantage of executable specifications; Strengths of the PSM model -Hierarchy, State transitions, Programming Constructors, Concurrency, Exception handling, Completion.
5.	**System Partitioning:** Structural versus functional Partitioning. Partitioning issues -Specification extraction level, Granularity, System Component allocation, Metrics and Estimations, Objective functions and closeness functions, Partitioning Algorithm, Output. Basic Partitioning algorithms -Random mapping, Hierarchical clustering, Multistage Clustering, Group Migration, Radio cut and Simulated Annealing

C. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
3.	Specification and Design of Embedded Systems	Daniel D. Gajski, PTR Prentice Hall Englewood New Jersey
4.	High Level System Modeling : Specification and Design Methodologies	Ronald Waxman, Kluwer Academic Publishers
Important Web Links		

1- https://www.youtube.com/watch?v=gTuWkoOq1k0
2- https://swayam.gov.in/nc_details/NPTEL
3- https://www.fhwa.dot.gov/cadiv/segb/files/i15/i15hld.htm
4- https://www.coursera.org/lecture/software-design-development-life-cycle/the-role-of-architecture-in-design-n72Qe
5- https://coderanch.com/t/99762/engineering/Diffrence-High-Level-Desgin-Level

Code: MADCHM2202	Soft Skills-II	1 Credit [LTP: 2-0-0]

A. DETAILED SYLLABUS

Unit	Unit Details
1.	**Interpersonal Skills/ Understanding Others** Developing interpersonal relationship-Team building-group dynamics-Net working Improved work relationship
2.	**Corporate Skills / Working with Others** Developing body language-Practicing etiquette and mannerism-Time management Stress management
3.	**Attitude** Planning & Prioritizing, Emotional Intelligence: Managing Emotions
4.	**Motivation** Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators.
5.	**Selling Self / Job Hunting** Writing resume/cv-interview skills- Group discussion- Mock interview- / Mock GD – Goal setting - Career planning

B. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Developing the leader within you	John c Maxwell
2.	Good to Great	Arthur Jim Collins
3.	The seven habits of highly effective people	Stephen Covey
4.	Emotional Intelligence	Daniel Goleman
5.	You can win	Shive Khera
6.	Principle centered leadership	Stephen Covey
Important Web Links:		

1. https://en.wikipedia.org/wiki/Soft_skills
2. https://www.wikijob.co.uk/content/interview-advice/competencies/soft-skills/
3. https://www.thebalancecareers.com/what-are-soft-skills-2060852
4. https://searchcio.techtarget.com/definition/soft-skills
5. https://www.omniagroup.com/the-7-soft-skills-you-need-to-be-successful/

| **Code:** MADCAD2401 | **SEMINAR-II** | **1 Credit [LTP: 2-0-0]** |

A. DETAILED SYLLABUS

Unit	Contents
	Students grouped in two to three during Semester I, will now continue to download further the research papers in the area, analyze, allocate individually, the set of papers, **Literature survey** Overview – What is literature survey, Functions of literature survey, maintaining a notebook, developing a Bibliography Methods of data collection – Observation, survey, contact methods, experimental, determining sample design Searching for publications – Publication databases, search engines and patent databases, Find some/all of the references for a given paper, including those that are not on the web Online tools – Google, Cite Seer, ACM Digital Library, IEEE, The on-line Computer Science bibliography, Survey papers, Finding material not on the web, Searching patents **Publishing a paper** How to write scientific paper Structure of a conference and journal paper, how (and How Not) to write a Good Systems Paper: Abstract writing, chapter writing, discussion, conclusion, references, bibliography, and In-class discussion of technical writing examples, Poster papers, review papers, how to organize thesis Project report, How to write a research proposal? How research is funded? Research ethics – Legal issues, copyright, and plagiarism General advice about writing technical papers in English Tips for writing correct English Practice sessions on above will be conducted. Students will have to deliver seminar, prepare a report and a review paper based on analysis individually.

Course Code	Course Name	Teaching Scheme (Hrs. per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
POORNIMA UNIVERSITY								
School of Engineering & Technology								
M. Tech. (Artificial Intelligence & Data Science), Batch: 2021-23								
Teaching Scheme for Second Year (Third Semester)								
A.	**Core Courses**							
MADCAD3101	Python for Data Analysis	4	-	-	40	60	100	4
MADCHM3102	Research Methodology	4	-	-	40	60	100	4
MADCAD3201	Computer Lab-III	0	0	2	60	40	100	1
B.	**Department Elective**							
	NIL							
C.	**Open Elective**							
	As per annexure attached		-	-	40	60	100	4
D.	**Humanities and Social Sciences including Management courses (HSSM) OR Ability Enhancement Compulsory Course (AECC)**							
MADCAD3202	Review/Research Paper	0	0	2	60	40	100	1
E.	**Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship**							
MADCAD3301	Dissertation Part-I	0	0	12	60	40	100	6
F.	**Social Outreach, Discipline & Extra Curricular Activities**							
MADCAD3601	Discipline and Talent Enrichment Programme	-	-	2	50	-	50	1
	Total	12	0	18				21
	Total Teaching Hours		30					

MADCAD3101	Python for Data Analysis	4 Credits [LTP: 4-0-0]

A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Python Basic	07
2	Data Aggregation	10
3	Cross Tabulation	09
4	Modelling library in Python	10
5	Plotting and visualization	06

B. DETAILED SYLLABUS

Unit	Contents
1	Introduction to Data Analysis, Kinds of Data, Essential Python Libraries: NumPy, Pandas, Matplotlib, IPython, Jupyter, SciPy, Scikit-learn, Statsmodels Introduction to IPython, and Jupyter Notebooks: The Python Interpreter NumPy Basics: Arrays and Vectorized Computation, The NumPy ndarray: A Multidimensional Array Object, Universal Functions: Fast Element-Wise Array Functions,Array-Oriented Programming with Arrays. Advanced NumPy: ndarray Object Internals, Advanced Array Manipulation, Broadcasting, Advanced ufunc Usage, Structures and Record Arrays, More About Sorting, Writing Fast NumPy Functions with Numba, Advanced Array Input and Output Introduction to pandas Data Structures Essential Functionality: Reindexing, Dropping Entries from an Axis, Indexing, Selection, Filtering, Integer Indexes, Arithmetic and Data Alignment, Function Application and Mapping, Sorting and Ranking, Axis Indexes with Duplicate Labels Summarizing and Computing Descriptive Statistics: Data Loading, Storage, and File Formats, Reading and Writing Data in Text Format: Binary Data Formats Data Cleaning and Preparation: Handling Missing Data, Data Transformation, String Manipulation, Data Wrangling, Join, Combine, and Reshape, Hierarchical Indexing, Combining and Merging Datasets, Reshaping and Pivoting
2	Data Aggregation and Group Operations: GroupBy Mechanics, Data Aggregation General split-apply-combine: Suppressing the Group Keys, Quantile and Bucket Analysis, Example: Filling Missing Values with Group-Specific Values, Example: Random Sampling and Permutation, Example: Group Weighted Average and Correlation, Example: Group-Wise Linear Regression
3	Pivot Tables and Cross-Tabulation: Time Series: Date and Time Data Types and Tools, Time Series Basics, Date Ranges, Frequencies, and Shifting, Time Zone Handling, Periods and Period Arithmetic, Resampling and Frequency Conversion, Moving Window Functions
4	Introduction to Modeling Libraries in Python: Interfacing Between pandas and ModelCode, Creating Model Descriptions with Patsy Introduction to statsmodels: Estimating Linear Models, Estimating Time Series Processes scikit-learn
5	Plotting and Visualization: A Brief matplotlib API Primer, Plotting with pandas and seaborn,Other Python Visualization Tools Case Studies: USA.gov Data from Bitly, MovieLens 1M Dataset, US Baby Names 1880-2010,USDA Food Database, 2012 Federal Election Commission Database

C. RECOMMENDED STUDY MATERIAL:

S.No	Title of the Book	Author
1	Python for Data Analysis, Shroff Publications and Distributors	Wes McKinney

Code: MULEEE3111	Digital India Implementation	4 Credit [LTP:4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

The Digital India programme aims to provide broadband highways, universal access to mobile connectivity, public internet access programme, e-governance: Reforming government through technology, eKranti - Electronic delivery of services, Information for all, Electronics manufacturing: Target net zero imports, IT for jobs and early harvest programmes.

COURSE OUTCOME:

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

1. Understand concepts and objectives digital India and digital infrastructure.
2. Understand the pillars of the digital India.
3. Understand the concept of new digital services and platforms for implementations purpose.
4. Understand the various digital facilities to empower citizen.
5. Apply the digital India initiative for training objective.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Digital India Initiative	8
2.	Focus Area	8
3.	Implementation	9
4.	Facilities To Digitally Empower Citizen	7
5.	Training	8

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Digital India Initiative** Concept, aims and objectives, opportunities, inclusive growth in areas of electronic services, products, manufacturing and job opportunities, centered on three keyareas – Digital Infrastructure as a Utility to Every Citizen, Governance & Services on Demand and Digital Empowerment of Citizens.
2	**Focus Area** The Government of India specifically targets nine 'Pillars of the Digital India' as follows: Broadband Highway, Universal Access to Mobile connectivity, Public Internet Access Programme, E-Governance, reforming Government through Technology, E- Kranti, electronic delivery of services, Information for All, Electronics Manufacturing, IT for Jobs
3	**Implementation** New digital services, MyGov.in is a platform to share inputs and ideas on matters of policy and governance, UMANG (Unified Mobile Application for New-age Governance) ,AADHAR,Digi-Locker,Bharat Bill Payment System, PAN, EPFO services, PMKVY services, Indian railway tickets bookings, birth certificates, e-District, e-Panchayat, e-Sign framework, Swachh Bharat Mission(SBM)

	Mobile app, e-Hospital application, Digital attendance.
4	**Facilities To Digitally Empower Citizen** Digital locker facility, eliminating the use of physical documents and enables the sharing of verified electronic documents across government agencies, three key stakeholders of citizen, issuer and requester. BPO and job growth, government is planning to create 28,000 seats of bpos in various states and set up at least one common service centre in each of the gram panchayats in the state. Easy access to a common services center (CSC), Shareable private space on a public cloud, Safe and secure cyberspace, Universally accessible digital resources, Collaborative digital platforms for intergovernmental operations. E- Samparkvernacular email service: connect rural India with the digital India, the government of India impelled email services provider giants including Gmail, office and rediff to provide the email address in regional languages, anIndian-based company, data Xgen technologies pvt.ltd, has launched world‟s first free linguistic email address under the name „Data mail‟ which allows creating email ids in 8 Indian languages, English; and 3 foreign languages – Arabic, Russian and Chinese. Overthe period of time the email service in 22 languages will be offered by Data Xgen technologies.
5	**Training** PradhanMantriGramin, Digital SakshartaAbhiyan, PMG Disha, Ongoing awareness campaign, reception within country and the outside world, criticism and impact.

C. RECOMMENDED STUDY MATERIAL:

S.No	Tittle of Book	Author
1.	Digital India: Understanding Information,Communication and Social Change	PradipNinan Thomas
2.	Book on Digital India (Special Edition) by National e-governance mission, Government of India	
Important Web Links:		

1. https://economictimes.indiatimes.com/tech/internet/digital-india-15-salient-things-to-know-about-pm-narendra-modis-project/articleshow/47893380.cms
2. https://en.wikipedia.org/wiki/Digital_India
3. https://www.researchgate.net/publication/303643369_Digital_India_Objectives_Initiatives_and_Inherent_Challenges
4. https://digitalindia.gov.in/content/programme-pillars
5. https://www.civilserviceindia.com/subject/Essay/digital-india-or-green-india-discuss3.html

Code: MULECV3112	SMART CITY DESIGN	4 Credits [LTP:4-0-0]

COURSE OVERVIEW AND OBJECTIVES: The objective of the Smart Cities **Mission** is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and **application** of 'Smart' Solutions.

COURSE OUTCOME:

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

CO03112.1 Understand the concept of smart city and smart energy business concepts.

CO03112.2 Apply governance of smart city by various techniques like Augmented Reality for City Planning.

CO03112.3 Understand the concept and characteristics of Smart City Intelligent Buildings and Urban Spaces.

CO03112.4 Understand the environmental and economic impacts on buildings by Multi-objective optimization.

CO03112.5 Apply the energy management and Smart City Distributed Energy.

A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Smart City Introduction And Concept	7
2.	Smart City Governance	8
3.	Smart City Intelligent Buildings And Urban Spaces	7
4.	Multi Objective Optimization- Smart City	7
5.	Smart City Distributed Energy	8

B. DETAILED SYLLABUS

Unit	Unit Details
1	**Smart City Introduction And Concept** Smart City: local but networked, distributed but integrated Smart City, City monitoringandoperationssystemsVisionofanopensmartcityinteroperability environment Road maps for research and innovation policy Smart energybusiness concepts for Energy Hub districts Identifying development trends in smart city technologies – VTT Trend generator Public procurement of innovation for smart city solutions.
2	**Smart City Governance** Real-time decision support systems for city management, Boosting collaborative planning with visualisation technology, Virtual Model Facilitating Citizen Interaction, Mobile Augmented Reality for City Planning, Co-creating future smart cities - Visual and participative urban planning services Citizen-driven co- design for a smarter city Social media for citizen participation Gamification as an enabler of mutual learning in complex health care systems, Decision-making support: A smart city perspective
3	**Smart City Intelligent Buildings And Urban Spaces** Intelligent buildings and urban spaces in smart cities Intelligent urban spaces– automatic real-time responses to people behavior Occupancy in smart buildings of smart cities – case hospital smart lighting Mobile

	augmented reality for building maintenance Autonomous management system for buildings and districts
4	**Multi Objective Optimization- Smart City** Multi-objective optimization for the minimization of environmental and economic impacts on buildings at district level Intelligent Street lights adapt to conditions City mills leading the positive change in recycling.
5	**Multi Objective Optimization- Smart City** Distributed renewable energy and energy management Highlights from the Smart Grids and Energy Systems programme. Active distribution networks with full integration of demand and distributed resources Integration of variable power generation into urban energy systems Future district heating solutions for residential districts Smart metering cyber security ICT for neighborhoods" energy management Energy-Hub for residential and commercial districts and transport ICT-supported business in energy positive neighborhood's Renewable energy and energy efficiency in new districts – how to accelerate systemic change towards smart cities Internet of Energy: Electric Mobility with Smart Grids.

C. RECOMMENDED STUDY MATERIAL:

S.No	Title of Book	Author
1.	Building smart cities-Analytics, design building and thinking	Carol l. Stimmel
2.	Smart City- Foundation, principles and application	Houbing Song
3.	Smart city and urban development of India	N. Mani
Important Web Links:		
1.	https://nptel.ac.in/courses/105/105/105105160/	
2.	https://nptel.ac.in/courses/124/107/124107007/	
3.	https://swayam.gov.in/nd1_noc20_ce43/preview	
4.	https://www.youtube.com/watch?v=8G8ewFxE_V8	
5.	http://www.digimat.in/nptel/courses/video/105105160/L41.html	

| Code: MULEEE3113 | Renewable Energy | 4 Credits [LTP:4-0-0] |

COURSE OVERVIEW AND OBJECTIVES The course should enable the students to : 1. Understand the various forms of conventional energy resources. 2. Learn the present energy scenario and the need for energy conservation 3. Explain the concept of various forms of renewable energy 4. Outline division aspects and utilization of renewable energy sources for both domestics and industrial application 5. Analyse the environmental aspects of renewable energy resources.

COURSE OUTCOME

The student would be able to

CO03113.1 Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations

CO03113.2 Know the need of renewable energy resources, historical and latest developments.

CO03113.3 Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc

CO03113.4 Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.

CO03113.5 Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Classification Of Energy	9
2.	Applications Of Solar Energy	10
3.	Bio Energy Sources	8
4.	Wind Energy & Small Hydro Power Systems	10
5.	Ocean & Geothermal Energy	7

B. DETAILEDSYLLABUS

1	**CLASSIFICATION OF ENERGY** Energy chain and common forms of usable energy- Present energy scenario-World energy status-Energy scenario in India - Introduction to renewable energy resources Introduction to Solar Energy-Energy from sun-Spectral distribution of Solar radiation- Instruments for measurement of solar radiation-Solar radiation data analysis

2	**APPLICATIONS OF SOLAR ENERGY** Thermal applications -Introduction to Solar thermal collectors- Types - Principle of operation of different collectors - Flat plate- Evacuated tube collectors-Compound parabolic collectors- Solar air heaters - Solar dryers-solar cookers- solar stills - Solar ponds - concentrating collectors- line type - point type - Methods of Solar power generation - Power towers. Physics of solar cells - Cell and module Characteristics of cells and module - Performance parameters -BoS- PV System applications - Stand- alone- Grid connected systems
3	**BIO ENERGY SOURCES** Energy through various processes - Energy through fermentation - Gasification - various types of gasifiers -Pyrolysis - Fixed bed and fast Pyrolysis - Bio energy through digestion - Types of Digesters- Factors affecting the yield of products
4	**WIND ENERGY & SMALL HYDRO POWER SYSTEMS** Resource assessment - types of wind turbines - selection of components - blade materials - power regulation - various methods of control - wind farms - site selection - off shore wind farms - Solar Wind Hybrid energy systems.Introduction - types - system components, discharge curve and estimation of power potential- Turbines for SHP
5	**OCEAN & GEOTHERMAL ENERGY** Power generation through OTEC systems - various types - Energy through waves and tides - Energy generation through geothermal systems - types

C. RECOMMENDED STUDYMATERIAL:

S. No	Title of the Book	Author
1.	Energy Science: Principles, technologies and impacts	Oxford Universities press.
2.	Renewable Energy, power for a sustainable future	CRC Press
3.	Renewable Energy Systems, Advanced conversion technologies and applications	CRC Press
4.	Wind Turbine technology	CRC Press
5.	Solar Photovoltaics, fundamentals, technologies and applications	Prentice Hall India.
Important Website Link		

1. https://www.act.edu.om/media/2091/renewable-energy.pdf

2. https://www.nrdc.org/stories/renewable-energy-clean-facts

3. https://www.journals.elsevier.com/renewable-energy

4. https://www.eia.gov/energyexplained/renewable-sources/

5. https://www.google.co.in/search?q=renewable+energy+examples&sa=X&ved=2ahUKEwiW58_qy

| Code: MULECV3108 | Water and Environmental Pollution | 4 Credits [LTP:4-0-0] |

COURSE OVERVIEW AND OBJECTIVES

The aim of this course is to teach students about current environmental problems. From an environmental perspective, the student will learn how to develop an activity using various strategies to control, reduce and monitor all environmental problems that might arise as a result.

COURSE OUTCOME

The student would be able to

CO03114.1 To be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.

CO03114.2 To be able to analyse an industrial activity and identify the environmental problems.

CO03114.3 TO be able to plan strategies to control, reduce and monitor pollution.

CO03114.4 To be able to select the most appropriate technique to purify and/or control the emission of pollutants.

CO03114.5 To be able to apply the basis of an Environmental Management System (EMS) to an industrial activity.

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Water And Water Analysis	9
2.	Wastewater And Their Treatment	8
3.	Global Atmospheric Change	9
4.	Air Pollution & Meteorology	9
5.	Solid Waste Management	9

B. DETAILED SYLLABUS

1	**WATER AND WATER ANALYSIS** Water resources, Sources of water, characteristics of water, water pollutants, oxygen demanding wastes, surface water quality, ground water quality. Municipal water supply: Requisites of drinking water, Steps involved in treatment of water
2	**WASTEWATER AND THEIR TREATMENT** Wastewater Characteristics: Quality parameters: BOD, COD, TOC, Solids, DO, Nitrogen, Phosphorus, Standards of disposal into natural watercourses and on land, Indian standards. wastewater treatment systems, disposal scope
3	**GLOBAL ATMOSPHERIC CHANGE** The atmosphere of earth, greenhouse effect, radiative forcing of climate change, global warming potential, carbon cycle, carbon emissions from fossil fuels, regional impacts of temperature change, global initiatives.

4	**AIR POLLUTION & METEOROLOGY** Atmospheric motion, Lapse rate, atmospheric stability, inversion, atmospheric dispersion, maximum mixing depth, Air quality standards, plume rise, emission controls. Air pollution control methods in industries. **NOISE POLLUTION:** Effect of noise on people, rating systems, community noise sources and criteria, traffic noise prediction, noise control
5	**SOLID WASTE MANAGEMENT** Integrated solid waste management, hazardous waste management, biomedical waste treatment technologies and disposal options, e-waste management, waste minimization for sustainability, waste management – Indian scenario.

C. **RECOMMENDED STUDYMATERIAL:**

S.No	Title of the Book	Author
1.	Environmental Engineering	Howard S Peavy, Donald RRowe, George Tchobanoglous
2.	Engineering: Treatment, and Reuse, 4th edition, Tata McGraw Hill, 2007.	Metcalf and Eddy Inc
3.	Manual for Water Treatment.	Ministry of Urban development, Govt of India
4.	Manual for Sewage Treatment	Ministry of Urban development, Govt of India
5.	Air Pollution	M N Rao
6.	Air Pollution Control Engineering	De Nevers
7	Solid Wastes: Engineering principles and Management issues	Tchobanoglous G.

Important Web Links:

1. https://www.google.co.in/search?biw=1366&bih=608&ei=Y4HLXvytHffYz7sPn9eB4AY&q=water+and+enviroment+polluation+nptel&oq=water+and+enviroment+polluation+nptel&gs_lcp=CgZwc3ktYWIQAzIKCCEQFhAKEB0QHjIKCCEQFhAKEB0QHjIKCCEQFhAKEB0QHjoECAAAQRzoGCAAQFhAeOgcIIRAKEKABUIsYWP4mYMItaABwAXgAgAG8AogBuw2SAQcwLjEuNS4xmAEAoAEBqgEHZ3dzLXdpeg&sclient=psy-ab&ved=0ahUKEwi868D4y87pAhV37HMBHZ9rAGwQ4dUDCAw&uact=5\

2. https://www.nrdc.org/stories/water-pollution-everything-you-need-know

3. https://www.environmentalpollutioncenters.org/water/

4. https://www.explainthatstuff.com/waterpollution.html

5. https://wwf.panda.org/knowledge_hub/teacher_resources/webfieldtrips/water_pollution/

| Code: MULEEE3107 | E- Commerce & Knowledge Management | 4 Credits [LTP:4-0-0] |

COURSE OVERVIEW AND OBJECTIVES

This course provides an introduction to information systems for business and management. It is designed to familiarize students with organizational and managerial foundations of systems, the technical foundation for understanding information systems.

COURSE OUTCOME

The student would be able to

CO03115.1 Understand the basic concepts and technologies used in the field of management information systems.

CO03115.2To impart the knowledge of the different types of management information systems.

CO03115.3 To Understand the processes of developing and implementing information systems.

CO03115.4 To aware of the ethical, social, and security issues of information systems.

CO03115.5 To familiarize students with organizational and managerial foundations of systems.

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Introduction To Electronic Commerce	9
2.	Building Own Website	8
3.	Internet And Extranet	9
4.	Electronic Data Interchange	9
5.	Planning For Electronic Commerce	9

B. DETAILED SYLLABUS

Unit	Unit Details
1	**INTRODUCTION TO ELECTRONIC COMMERCE** Introduction of Unit, what is E-Commerce (Introduction and Definition), Main activities E- Commerce, Goals of E-Commerce, Technical Components of E-commerce, Functions of E- commerce, Advantages and Disadvantages of E-commerce, Scope of E-commerce, Electronic commerce Applications, Electronic commerce and Electronic Business, Conclusion of Unit.
2	**BUILDING OWN WEBSITE** Introduction of Unit, Reasons for building own website, Benefits of website, Bandwidth requirements, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Banner Exchange, Shopping Bots, Conclusion of Unit

3	**INTERNET AND EXTRANET** Introduction of Unit, Definition of Internet, Advantages and Disadvantages of the Internet, Component of an Intranet Information technology structure, Development of a Intranet, Extranet and Intranet Difference, Role of Intranet in B2B Application, Conclusion of Unit.	
4	**ELECTRONIC DATA INTERCHANGE** Introduction of Unit, Concepts of EDI and Limitation, Application of EDI, Disadvantages of EDI, EDI model, Conclusion of Unit.	
5	**PLANNING FOR ELECTRONIC COMMERCE** Introduction of Unit, planning electronic commerce initiatives, linking objectives to business strategies, measuring cost objectives, comparing benefits to costs, strategies for developing electronic commerce web sites, Conclusion of Unit.	

C. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	E-Commerce	Greenstein & Feinman, Tata McGrew Hill
2.	Frontiers of Electronic Commerce	Kalakota Winston ,Pearson Education
Important Web Links:		
1. https://www.kmslh.com/3-reasons-why-ecommerce-must-have-knowledge-management/ 2. https://link.springer.com/chapter/10.1007/978-3-642-23993-9_31 3. https://ieeexplore.ieee.org/document/5279962 4. https://www.sciencedirect.com/science/article/pii/S0268401207001120 5. https://www.slideshare.net/monoaziz/knowledge-management-1852596		

Code: MULEME3109	IR& Patents	4 Credits [LTP:4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work. Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's

COURSE OUTCOME:

CO03116.1 To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.

CO03116.2 To disseminate knowledge on patents, patent regime in India and abroad and registration aspects

CO03116.3 To acquire knowledge on copyrights and its related rights and registration aspects

CO03116.4 To understand knowledge on trademarks and registration• aspects

CO03116.5 To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects

A. OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Introduction To Ipr	9
2.	Types Of Ipr And Wipo	8
3.	Legal And Commercial Aspects Of Ipr	9
4.	Introductions To Patents	9
5.	Patent Procedures	9

B. DETAILED SYLLABUS

Unit	Unit details
1	**INTRODUCTION TO IPR** General Regime of Intellectual Property Rights, Concept of Property vis-à-vis Intellectual Property, Concept of Property and Theories of Property - An Overview. Theories of Intellectual Property Rights, Intellectual Property as an Instrument of Development, Need for Protecting. Intellectual Property- Policy Consideration- National Perspectives and International demands.
2	**TYPES OF IPR AND WIPO** Types of Intellectual Property- Origin and Development- An Overview, Intellectual Property Rights as Human Right, Role of International Institutions, World Intellectual Property Organization (WIPO), Function of WIPO, Membership of WIPO, Agreement between the WIPO and the WTO.

3	**LEGAL AND COMMERCIAL ASPECTS OF IPR** Dispute Settlement- New Treaties, Commercialization of Intellectual Property Rights by Licensing, Determining Financial Value of Intellectual Property Rights, Negotiating Payments Terms in Intellectual Property Transaction, Intellectual Property Rights in the Cyber World.
4	**INTRODUCTIONS TO PATENTS** Introduction to Patent Law, Paris Convention, Patent Cooperation Treaty, WTO- TRIPS, Harmonization of CBD and TRIPs, Indian Patent Law, The Patents Act, 1970, Amendments to the Patents Act, Patentable Subject Matter, Patentability Criteria.
5	**PATENT PROCEDURES** Procedure for Filing Patent Applications, Patent Granting Procedure, Revocation, Patent Infringement and Remedies, Relevant Provisions of the Biological Diversity Act, 2002, Access and Benefit SharingIssues.

C. RECOMMENDED STUDY MATERIAL:

S. No	Title of the Book	Author
1.	Intellectual Property Rights in India	VK Ahuja (Lexis Nexis butter worths Publications)

Important Web Link:
1. https://www.cencenelec.eu/ipr/Pages/default.aspx 2. http://www.ipindia.nic.in/ 3. https://en.wikipedia.org/wiki/Intellectual_property 4. https://en.wikipedia.org/wiki/Intellectual_propert 5. https://www.itu.int/en/ITU-T/ipr/Pages/default.aspx

Code: MULEEE3110	Robotics	4 Credits [LTP:4-0-0]

COURSE OVERVIEW AND OBJECTIVES:

To understand the basic concepts associated with the design and Functioning and applications of Robots

To study about the drives and sensors used in Robots To learn about analyzing robot kinematics and robot programming.

COURSE OUTCOME:

The student would be able to**:**

CO03117.1 To be able to introduce basics of robotics.

CO03117.2 To understand robot kinematics and robot programming

CO03117.3 To understand the application of Robots

CO03117.4 To learn about force and torque sensing

CO03117.5 To acquire knowledge of robotics programming.

A.   OUTLINE OF COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Fundamentals	9
2.	Robot Kinematics	9
3.	Robot Dynamic Analysis And Forces	8
4.	Actuators And Sensors	9
5.	Robot Programming, Systems And Applications	9

B. DETAILED SYLLABUS

Unit	Unit details
1	**FUNDAMENTALS** Historical information, robot components, Robot characteristics, Robot anatomy, Basic structure of robots, Resolution, Accuracy and repeatability, Position Analysis forward and inverse kinematics of robots, Including frame representations.
2	**ROBOT KINEMATICS** Transformations, position and orientation analysis and the Denavit-Hartenberg representation of robot kinematics, The manipulators, The wrist motion and grippers. Differential motions, Inverse Manipulator Kinematics: Differential motions and velocity analysis of robots and frames.
3	**ROBOT DYNAMIC ANALYSIS AND FORCES** Analysis of robot dynamics and forces, Lagrangian mechanics is used as the primary method of analysis and development. Trajectory Planning: Methods of path and trajectory planning, Both in joint-space and in Cartesian-space.

4	**ACTUATORS AND SENSORS** Actuators, including hydraulic devices, Electric motors such as DC servomotorsand stepper motors, Pneumatic devices, as well as many other novel actuators, It also covers microprocessor control of these actuators, Mechatronics, Tactile sensors, Proximity and range sensors, Force and torque sensors, Uses of sensors in robotics.	
5	**ROBOT PROGRAMMING, SYSTEMS AND APPLICATIONS** Robot languages, Method of robots programming, Lead through programming methods, A robot programs as a path in space, Motion interpolation, WAIT, SIGNAL and DELAY commands, Branching capabilities and limitation of lead through methods and robotic applications. Basic principles of fuzzy logic and its applications in microprocessor control and robotics.	

C. RECOMMENDED STUDYMATERIAL:

S.No	Title of the Book	Author
1.	Robotics Control Sensing, Vision and Intelligence	McGraw Hill Gonzalez, R. C., Fu, K. S. and Lee, C.S.G.
2.	Robotics for Engineers	McGraw Hill Koren,Y
3.	Introduction to Robotics, Analysis, Systems, Applications,	Dorling Kingsley, Dorling Kingsley Niku, S.B
4.	Programming robot controllers	McGraw Hill Predko, M

Important Web Links:

1. https://nptel.ac.in/courses/112/105/112105249/

2. https://nptel.ac.in/courses/112/101/112101099/

3. https://nptel.ac.in/courses/112/101/112101098/

4. https://swayam.gov.in/nd1_noc20_me03

5. https://www.youtube.com/watch?v=DaWMvEY3Qgc

Code: MADCAD3301   DISSERTATION PART-I   3 Credits [LTP:0-0-6]

Unit	Content
	• Dissertation Part I consist of Finalization of thesis title based on literature review carried out during Semester I andII • Objective finalization &presentation • Design & experimentationdetails • Experimentation work (partial) • Part I thesis preparation • Presentation and submission of research prepare based on experimentation carried out.

POORNIMA UNIVERSITY

School of Computer Science and Engineering
Name of Program: M. Tech. Artificial Intelligence and Data Science, Batch: 2021-23
Teaching Scheme for Year – II, Semester- IV _____

Course Code	Course Name	Teaching Scheme (Hrs per Week)			Marks Distribution			Credits
		Lecture (L)	Tutorials (T)	Practical (P)	IE	ESE	Total	
A.	University Core Courses							
A.1	Theory							
	-	-	-	-	-	-	-	-
A.2	Practical							
	-	-	-	-	-	-	-	-
B.	Department Core Courses							
B.1	Theory							
	-	-	-	-	-	-	-	-
B.2	Practical							
	-	-	-	-	-	-	-	-
C.	Department Elective: At least Two							
	-	-	-	-	-	-	-	-
D.	Open Elective: Anyone							
	-	-	-	-	-	-	-	-
E.	Humanities and Social Sciences including Management courses OR Ability Enhancement Compulsory Course (AECC)							
	-	-	-	-	-	-	-	-
F.	Skill Enhancement Courses (SEC) OR Project work, Seminar and Internship in Industry or Elsewhere							
MADCAD4301	Dissertation Part-II	-	-	-	250	250	500	20
G.	Social Outreach, Discipline, TEP, VAC& Extra Curricular Activities							
MADCAD4601	Discipline and Talent Enrichment Programme-IV	-	-	-	50	-	50	1
	Total	-	-	-				21
	Total Teaching Hours							