PRESIDENCY UNIVERSITY

Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
Approved by AICTE, New Delhi

PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Program Regulations and Curriculum

2025-2027

MASTER OF TECHNOLOGY (M.Tech.) in

COMPUTER SCIENCE AND ENGINEERING

Specialization in

Artificial Intelligence

based on Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

(As amended up to the xx Meeting of the Academic Council held on xx June 2025. This document supersedes all previous guidelines)

Regulations No: PU/AC-xx.x/SOCSE06/AI/2025-2027

Resolution No.xx of the xx Meeting of the Academic Council held on xx June 2025, and ratified by the Board of Management in its x Meeting held on xx June 2025.

JUNE-2025

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PART A – PROGRAM REGULATIONS

1. Vision & Mission of the University and the School / Department

1.1 Vision of the University

To be a Value-driven Global University, excelling beyond peers and creating professionals of integrity and character, having concern and care for society.

1.2 Mission of the University

- Commit to be an innovative and inclusive institution by seeking excellence in teaching, research and knowledge-transfer.
- Pursue Research and Development and its dissemination to the community, at large.
- Create, sustain and apply learning in an interdisciplinary environment with consideration for ethical, ecological and economic aspects of nation building.
- Provide knowledge-based technological support and services to the industry in its growth and development.
- To impart globally-applicable skill-sets to students through flexible course offerings and support industry's requirement and inculcate a spirit of new-venture creation.

1.3 Vision of Presidency School of Computer Science and Engineering

To be a value-based, practice-driven Presidency School of Computer Science and Engineering, committed to developing globally competent engineers, dedicated to developing cutting-edge technology to enhance the quality of life.

1.4 Mission of Presidency School of Computer Science and Engineering

- Cultivate a practice-driven environment with computing-based pedagogy, integrating theory and practice.
- Attract and nurture world-class faculty to excel in teaching and research in the realm of computing sciences.
- Establish state-of-the-art computing facilities for effective teaching and learning experiences.
- Promote interdisciplinary studies to nurture talent for global impact.
- Instill entrepreneurial and leadership skills to address social, environmental and community needs.

2. Preamble to the Program Regulations and Curriculum

This is the subset of Academic Regulations and it is to be followed as a requirement for the award of M.Tech degree.

The Curriculum is designed to take into the factors listed in the Choice Based Credit System (CBCS) with focus on Social Project Based Learning, Industrial Training, and Internship to enable the students to become eligible and fully equipped for employment in industries, choose higher studies or entrepreneurship.

In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes and Academic Regulations of the University, the Academic Council hereby makes the following Regulations.

3. Short Title and Applicability

a. These Regulations shall be called the Master of Technology Degree Program Regulations and Curriculum 2025-2027.
b. These Regulations are subject to, and pursuant to the Academic Regulations.
c. These Regulations shall be applicable to the ongoing Master of Technology Degree Programs of the 2025-2027 batch, and to all other Master of Technology Degree Programs which may be introduced in future.

d. These Regulations shall supersede all the earlier Master of Technology Degree Program Regulations and Curriculum, along with all the amendments thereto.
e. These Regulations shall come into force from the Academic Year 2024-2025.

4. Definitions

In these Regulations, unless the context otherwise requires:

a. "Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;

b. "Academic Council" means the Academic Council of the University;

c. "Academic Regulations" means the Academic Regulations, of the University;

d. "Academic Term" means a Semester or Summer Term;

e. "Act" means the Presidency University Act, 2013;

f. "AICTE" means All India Council for Technical Education;

g. "Basket" means a group of courses bundled together based on the nature/type of the course;

h. "BOE" means the Board of Examinations of the University;

i. "BOG" means the Board of Governors of the University;

j. "BOM" means the Board of Management of the University;

k. "BOS" means the Board of Studies of a particular Department/Program of Study of the University;

l. "CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations;

m. "Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;

n. "COE" means the Controller of Examinations of the University;

o. "Course In Charge" means the teacher/faculty member responsible for developing and organising the delivery of the Course;

p. "Course Instructor" means the teacher/faculty member responsible for teaching and evaluation of a Course;

q. "Course" means a specific subject usually identified by its Course-code and Course-title, with specified credits and syllabus/course-description, a set of references, taught by some teacher(s)/course-instructor(s) to a specific class (group of students) during a specific Academic Term;

r. "Curriculum Structure" means the Curriculum governing a specific Degree Program offered by the University, and, includes the set of Baskets of Courses along with minimum credit requirements to be earned under each basket for a degree/degree with specialization/minor/honours in addition to the relevant details of the Courses and Course catalogues (which describes the Course content and other important information about the Course). Any specific requirements for a particular program may be brought into the Curriculum structure of the specific program and relevant approvals should be taken from the BOS and Academic Council at that time.

s. "DAC" means the Departmental Academic Committee of a concerned Department/Program of Study of the University;

t. "Dean" means the Dean / Director of the concerned School;

u. "Degree Program" includes all Degree Programs;

v. "Department" means the Department offering the degree Program(s) / Course(s) / School offering the concerned Degree Programs / other Administrative Offices;

w. "Discipline" means specialization or branch of M.Tech. Degree Program;

x. "HOD" means the Head of the concerned Department;

y. "L-T-P-C" means Lecture-Tutorial-Practical-Credit – refers to the teaching – learning periods and the credit associated;

z. "MOOC" means Massive Open Online Courses;

aa. *"MOU" means the Memorandum of Understanding;*

ab. *"NPTEL" means National Program on Technology Enhanced Learning;*

ac. *"Parent Department" means the department that offers the Degree Program that a student undergoes;*

ad. *"Program Head" means the administrative head of a particular Degree Program/s;*

ae. *"Program Regulations" means the Master of Technology Degree Program Regulations and Curriculum, 2025-2027;*

af. *"Program" means the Masterr of Technology (M.Tech.) Degree Program;*

ag. *"PSCS" means the Presidency School of of Computer Science and Engineering;*

ah. *"Registrar" means the Registrar of the University;*

ai. *"School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;*

aj. *"Section" means the duly numbered Section, with Clauses included in that Section, of these Regulations;*

ak. *"SGPA" means the Semester Grade Point Average as defined in the Academic Regulations;*

al. *"Statutes" means the Statutes of Presidency University;*

am. *"Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;*

an. *"Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days;*

ao. *"SWAYAM" means Study Webs of Active Learning for Young Aspiring Minds.*

ap. *"UGC" means University Grant Commission;*

aq. *"University" means Presidency University, Bengaluru; and*

ar. *"Vice Chancellor" means the Vice Chancellor of the University.*

5. Program Description

The Master of Technology Degree Program Regulations and Curriculum 2025-2027 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Master of Technology (M.Tech.) Degree Programs of 2025-2027 offered by the Presidency School of Engineering (PSOE):

1. Master of Technology in Computer Science and Engineering Specialization in Artificial Intelligence.M.Tech. (AIE)
2. Master of Technology in Computer Science and Engineering Specialization in Data Science.M.Tech. (DSC)

5.1 These Program Regulations shall be applicable to other similar programs, which may be introduced in future.

5.2 These Regulations may evolve and get amended or modified or changed through appropriate approvals from the Academic Council, from time to time, and shall be binding on all concerned.

5.3 The effect of periodic amendments or changes in the Program Regulations, on the students admitted in earlier years, shall be dealt with appropriately and carefully, so as to ensure that those students are not subjected to any unfair situation whatsoever, although they are required to conform to these revised Program Regulations, without any undue favour or considerations

6. Minimum and Maximum Duration

6.1 Master of Technology Degree Program is a Two-Year, Full-Time Semester based program. The minimum duration of the M.Tech. Program is four (02) years and each year comprises of two academic Semesters (Odd and Even Semesters) and hence the duration of the M.Tech. program is four (04) Semesters.

6.2 A student who for whatever reason is not able to complete the Program within the normal period or the minimum duration (number of years) prescribed for the Program, may be allowed a period of two years beyond the normal period to complete the mandatory minimum credits requirement as prescribed by the concerned Program Regulations and Curriculum. In general, the permissible maximum duration (number of years) for completion of Program is 'N' + 2 years, where 'N' stands for the normal or minimum duration (number of years) for completion of the concerned Program as prescribed by the concerned Program Regulations and Curriculum.

6.3 The time taken by the student to improve Grades/CGPA, and in case of temporary withdrawal/re-joining (Refer to Clause 16.1 of Academic Regulations), shall be counted in the permissible maximum duration for completion of a Program.

6.4 In exceptional circumstances, such as temporary withdrawal for medical exigencies where there is a prolonged hospitalization and/or treatment, as certified through hospital/medical records, women students requiring extended maternity break (certified by registered medical practitioner), and, outstanding sportspersons representing the University/State/India requiring extended time to participate in National/International sports events, a further extension of one (01) year may be granted on the approval of the Academic Council.

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer Section 19.0 of Academic Regulations) in the prescribed maximum duration (Sub-Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

7 Programme Educational Objectives (PEO)

After four years of successful completion of the program, the graduates shall be:

PEO 01: To prepare graduates who will be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms.

PEO 02: To prepare graduates who will contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise.

PEO 03: To prepare graduates who will achieve peer recognition as individuals or in a team through demonstration of good analytical, research, design and implementation skills.

PEO 04: To prepare graduates who will thrive to pursue life-long reflective learning to fulfil their goals.

8 Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

8.1 Programme Outcomes (PO)

On successful completion of the Program, the students shall be able to:

PO1:An ability to analysis, manage and supervise engineering systems and processes with the aid of appropriate advanced tools.

PO2:An ability to design a system and process within constraints of health, safety, security, economics, manufacturability to meet desired needs.

PO3:An ability to carry out research in the respective discipline and publish the findings.

PO4:An ability to effectively communicate and transfer the knowledge/ skill to stakeholders.

PO5:An ability to realize the impact of engineering solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.

8.2 Program Specific Outcomes (PSOs):

On successful completion of the Program, the students shall be able to:

PSO 1:

Apply core and advanced concepts of Artificial Intelligence to design and develop intelligent solutions addressing complex, real-world challenges across interdisciplinary domains.

PSO 2:

Engage in independent research, innovation, and entrepreneurial pursuits in the field of intelligent systems, contributing to academic, industrial, and societal advancement.

PSO 3:

Demonstrate the ability to conceptualize and implement ethical, responsible, and socially beneficial AI applications, ensuring transparency, fairness, and accountability.

9 Admission Criteria (as per the concerned Statutory Body)

The University admissions shall be open to all persons irrespective of caste, class, creed, gender or nation. All admissions shall be made on the basis of merit in the qualifying examinations; provided that forty percent of the admissions in all Programs of the University shall be reserved for the students of Karnataka State and admissions shall be made through a Common Entrance Examination conducted by the State Government or its agency and seats shall be allotted as per the merit and reservation policy of the State Government from time to time**.** The admission criteria to the M.Tech. Program is listed in the following Sub-Clauses:

- Have a Bachelor's degree in engineering (B.E./B.Tech) from a recognized university.
- Have a minimum aggregate of 50% in your Bachelor's degree.
- Have a minimum aggregate of 45% in your Bachelor's degree if you belong to a reserved category.
- Have to submit score card from any state or central entrance exam or the Presidency University admission qualifying exam

10. Specific Regulations regarding Assessment and Evaluation (including the Assessment Details of NTCC Courses, Weightages of Continuous Assessment and End Term Examination for various Course Categories)

10.1 The academic performance evaluation of a student in a Course shall be according to the University Letter Grading System based on the class performance distribution in the Course.

10.2 Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 8.8 of academic regulations) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.

10.3 Format of the End-Term examination shall be specified in the Course Plan.

10.4 Grading is the process of rewarding the students for their overall performance in each Course. The University follows the system of Relative Grading with statistical approach to classify the students

based on the relative performance of the students registered in the concerned Course except in the following cases:

- Non-Teaching Credit Courses (NTCC)

Absolute grading method may be adopted, where necessary with prior approval of concerned DAC.

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades shall be awarded to a student based on her/his overall performance relative to the class performance distribution in the concerned Course. These Letter Grades not only indicate a qualitative assessment of the student's performance but also carry a quantitative (numeric) equivalent called the Grade Point.

10.5 Assessment Components and Weightage

Table 1: Assessment Components and Weightage for different category of Courses

Nature of Course and Structure	Evaluation Component	Weightage
Lecture-based Course L component in the L-T-P Structure is predominant (more than 1) (Examples: 3-0-0; 3-0-2; 2-1-0; 2-0-2, 2-0-4 etc.)	Continuous Assessments	50%
	End Term Examination	50%
Lab/Practice-based Course P component in the L-T-P Structure is predominant (Examples: 0-0-4; 1-0-4; 1-0-2; etc.)	Continuous Assessments	50%
	End Term Examination	50%
Skill based Courses like Industry Internship, Capstone project, Research Dissertation, Integrative Studio, Interdisciplinary Project, Summer / Short Internship, Social Engagement / Field Projects, Portfolio, and such similar Non-Teaching Credit Courses, where the pedagogy does not lend itself to a typical L-T-P structure	Guidelines for the assessment components for the various types of Courses, with recommended weightages, shall be specified in the concerned Program Regulations and Curriculum / Course Plans, as applicable.	

The exact weightages of Evaluation Components shall be clearly specified in the concerned PRC and respective Course Plan.

Normally, for Practice/Skill based Courses, without a defined credit structure (L–P–C) [NTCC], but with assigned Credits (as defined in Clause 5.2 of the Academic Regulations), the method of evaluation shall be based only on Continuous Assessments. The various components of Continuous Assessments, the distribution of weightage among such components, and the method of evaluation/assessment, shall be as decided and indicated in the Course Plan/PRC. The same shall be approved by the respective DAC.

10.6 Minimum Performance Criteria:

10.6.1 Theory only Course and Lab/Practice Embedded Theory Course

A student shall satisfy the following minimum performance criteria to be eligible to earn the credits towards the concerned Course:

a. A student must obtain a minimum of 30% of the total marks/weightage assigned to the End Term Examinations in the concerned Course.

b. The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of the components of Continuous Assessments, Mid Term Examinations and End Term Examinations in the concerned Course.

10.6.2 Lab/Practice only Course and Project Based Courses

The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of all assessment components in the concerned Course.

10.6.3 A student who fails to meet the minimum performance criteria listed above in a Course shall be declared as "Fail" and given "F" Grade in the concerned Course. For theory Courses, the student shall have to re-appear in the "Make-Up Examinations" as scheduled by the University in any subsequent semester, or, re-appear in the End Term Examinations of the same Course when it is scheduled at the end of the following Semester or Summer Term, if offered. The marks obtained in the Continuous Assessments (other than the End Term Examination) shall be carried forward and be included in computing the final grade, if the student secures the minimum requirements (as per sub-clause 8.9.1 and 8.9.2 of academic regulations) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

11 Additional clarifications - Rules and Guidelines for Transfer of Credits from MOOC, etc. – Note: These are covered in Academic Regulations

The University allows students to acquire credits from other Indian or foreign institutions and/or Massive Open Online Course (MOOC) platforms, subject to prior approval. These credits may be transferred and counted toward fulfilling the minimum credit requirements for the award of a degree. The process of transfer of credits is governed by the following rules and guidelines:

11.1 The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer ANNEXURE B of academic regulations) and approved by the Dean - Academics.

11.2 Students may earn credits from other Indian or foreign Universities/Institutions with which the University has an MOU, and that MOU shall have specific provisions, rules and guidelines for transfer of credits. These transferred credits shall be counted towards the minimum credit requirements for the award of the degree.

11.3 Students may earn credits by registering for Online Courses offered by *Study Web of Active Learning by Young and Aspiring Minds* (SWAYAM) and *National Program on Technology Enhanced Learning* (NPTEL), or other such recognized Bodies/ Universities/Institutions as approved by the concerned BOS and Academic Council from time to time. The concerned School/Parent Department shall publish/include the approved list of Courses and the rules and guidelines governing such transfer of credits of the concerned Program from time to time. The Rules and Guidelines for the transfer of credits specifically from the Online Courses conducted by SWAYAM/ NPTEL/ other approved MOOCs are as stated in the following Sub-Clauses:

11.3.1 A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 11.3 (as per academic regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the

concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.

11.3.2 SWAYAM/NPTEL/ other approved MOOCs as mentioned in Clause 11.3 (as per academic regulations) shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.

11.3.3 Parent Departments may release a list of SWAYAM/NPTEL/other approved MOOCs for Pre-Registration as per schedule in the Academic Calendar or through University Notification to this effect.

11.3.4 Students may Pre-Register for the SWAYAM/NPTEL/other approved MOOCs in the respective Departments and register for the same Courses as per the schedule announced by respective Online Course Offering body/institute/ university.

11.3.5 A student shall request for transfer of credits only from such approved Courses as mentioned in Sub-Clause 11.3.2 above.

11.3.6 SWAYAM/NPTEL/other approved MOOCs Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM/NPTEL/other approved MOOCs and obtained a certificate of successful/satisfactory completion.

11.3.7 A student who has successfully completed the approved SWAYAM/NPTEL/ other approved MOOCs and wants to avail the provision of transfer of equivalent credits, must submit the original Certificate of Completion, or such similar authorized documents to the HOD concerned, with a written request for the transfer of the equivalent credits. On verification of the Certificates/Documents and approval by the HOD concerned, the Course(s) and equivalent Credits shall forwarded to the COE for processing of results of the concerned Academic Term.

11.3.8 The credit equivalence of the SWAYAM/NPTEL/other approved MOOCs are based on Course durations and/or as recommended by the Course offering body/institute/university. The Credit Equivalence mapped to SWAYAM/ NPTEL approved Courses based on Course durations for transfer of credits is summarised in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table 8.11 in the academic regulations.

Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL/ other approved MOOC Courses

Sl. No.	Course Duration	Credit Equivalence
1	4 Weeks	1 Credit
2	8 Weeks	2 Credits
3	12 Weeks	3 Credits

11.3.9 The maximum permissible number of credits that a student may request for credit transfer from MOOCs shall not exceed 20% of the mandatory minimum credit requirements

specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree.

11.3.10 The University shall not reimburse any fees/expense; a student may incur for the SWAYAM/NPTEL/other approved MOOCs.

11.4 The maximum number of credits that can be transferred by a student shall be limited to forty percent (40%) of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree. However, the grades obtained in the Courses transferred from other Institutions/MOOCs, as mentioned in this Section (11.0), shall not be included in the calculation of the CGPA.

PART B: PROGRAM STRUCTURE

12. 0 Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements

The M.Tech. CSE Specialization in (Artificial Intelligence) Program Structure (2025-2027) totalling 68credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

Table 3: Summary of mandatory courses and minimum credit contribution from various baskets

S.No	Baskets	Credit Contribution
1	SCHOOL CORE	32
2	PROGRAM CORE	15
3	DISCIPLINE ELECTIVE	15
4	OPEN ELECTIVE	06
	TOTAL CREDITS	**Min. 68**

In the entire Program, the practical and skill based course component contribute to an extent of approximately 61% out of the total credits of 68 for M.Tech. (Product Design and Development) program of twoyears' duration.

13. Minimum Total Credit Requirements of Award of Degree

As per the AICTE guidelines, a minimum of 68 credits is required for the award of a M.Tech. degree.

14. Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies,

14.1 The award of the Degree shall be recommended by the Board of Examinations and approved by the Academic Council and Board of Management of the University**.**

14.2 A student shall be declared to be eligible for the award of the concerned Degree if she/he:

a. Fulfilled the Minimum Credit Requirements and the Minimum Credits requirements under various baskets;

b. Secure a minimum CGPA of 5.0 in the concerned Program at the end of the Semester/Academic Term in which she/he completes all the requirements for the award of the Degree as specified in Sub-clause 19.2.1 a of Academic Regulations**;**

c. No dues to the University, Departments, Hostels, Library, and any other such Centers/ Departments of the University; and

d. No disciplinary action is pending against her/him.

PART C: CURRICULUM STRUCTURE

15. Curriculum Structure – Basket Wise Course List (not Semester Wise)
List of Courses Tabled – aligned to the Program Structure
(Course Code, Course Name, Credit Structure (LTPC), Contact Hours, Course Basket, Type of Skills etc., as applicable).

Type of Skill
F - Foundation
S - Skill Development
EM – Employability
EN – Entrepreneurship

Course Caters to
GS - Gender Sensitization
ES - Environment and sustainability
HP - Human values and Professional Ethics

Table 3.1 : List of School Core Courses (SC)

S.No	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skills	Pre requisite
1	MAT4004	Advanced Engineering Mathematics	3	0	0	3	3	S	-
2	ENG5001	English for Employability	2	1	0	3	3	S	-
3	SEM7000	Seminar	-	-	-	1		S/EM	-
4	PIP7500	Dissertation/ Internship – I	-	-	-	10		S/EM	-
5	PIP7501	Dissertation/ Internship – II	-	-	-	14		S/EM	-
		Total No. of Credits				**31**			

Table 3.2 : List of Programme Core Courses (PC)

S.No	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skills	Pre requisite
1	AIE4000	Knowledge Engineering and Expert Systems	3	0	0	3	3	S	-
2	AIE4001	Artificial Intelligence	2	0	2	3	4	S	-
3	AIE4002	Machine Learning Algorithms	2	0	2	3	4	S	-
4	AIE4003	Deep Learning	2	0	2	3	4	S	-
5	AIE4504	Natural Language Processing Techniques	2	0	2	3	4	S	-
		Total No. of Credits				**15**			

16. Practical / Skill based Courses – Internships / Thesis / Dissertation / Capstone Project Work / Portfolio / Mini project

Practical / Skill based Courses like internship, project work, capstone project, research project / dissertation, and such similar courses, where the pedagogy does not lend itself to a typical L-T-P-C Structure as defined in Clause 5.1 of the Academic Regulations are simply assigned the number of Credits based on the quantum of work / effort required to fulfill the learning objectives and outcomes prescribed for the concerned Courses. Such courses are referred to as Non-Teaching Credit Courses (NTCC). These Courses are designed to provide students with hands-on experience and skills essential for their professional development. These courses aim to equip students with abilities in problem identification, root cause analysis, problem-solving, innovation, and design thinking through industry exposure and project-based learning. The expected outcomes are first level proficiency in problem solving and design thinking skills to better equip M.Tech. graduates for their professional careers. The method of evaluation and grading for the Practical / Skill based Courses shall be prescribed and approved by the concerned Departmental Academic Committee (refer Annexure A of the Academic Regulations). The same shall be prescribed in the Course Handout.

16.1 Internship

A student may undergo an Internship for a period of 12-14 weeks in an industry / company or academic / research institution during 3rd and 4th Semesters, subject to the following conditions:

16.1.1 The Internship shall be in conducted in accordance with the Internship Policy prescribed by the University from time to time.

16.1.2 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Internship to a student;

16.1.3 The number of Internships available for the concerned Academic Term. Further, the available number of internships shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Internship, as stated in Sub-Clause 16.1.2 above.

16.1.4 A student may opt for Internship in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Internship on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Internship confirms to the University that the Internship shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

16.1.5 A student selected for an Internship in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

16.2 Project Work

A student may opt to do a Project Work for a period of 12-15 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Internship during the 3rd and 4th Semester as applicable, subject to the following conditions:

16.2.1 The Project Work shall be approved by the concerned HOD and be carried out under the

guidance of a faculty member.

16.2.2 The student may do the project work in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 16.2.1). Provided further, that the Industry / Company or academic / research institution offering such project work confirms to the University that the project work will be conducted in accordance with the Program Regulations and requirements of the University.

16.3 Capstone Project

A student may undergo a Capstone Project for a period of 12-14 weeks in an industry / company or academic / research institution in the 4th Semester as applicable, subject to the following conditions:

16.3.1 The Capstone Project shall be in conducted in accordance with the Capstone Project Policy prescribed by the University from time to time.

16.3.2 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Capstone Project to a student;

16.3.3 The number of Capstone Project available for the concerned Academic Term. Further, the available number of Capstone Project shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Capstone Project, as stated in Sub-Clause 16.3.2 above.

16.3.4 A student may opt for Capstone Project in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the I Capstone Project on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Capstone Project confirms to the University that the Capstone Project shall be conducted in accordance with the Program Regulations and Capstone project Policy of the University.

16.3.5 A student selected for a Capstone Project in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Capstone Project Policy of the University.

16.4 Research Project / Dissertation

A student may opt to do a Research Project / Dissertation for a period of 12-14 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Capstone Project, subject to the following conditions:

16.4.1 The Research Project / Dissertation shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.4.1). Provided further, that the Industry / Company or academic / research institution offering such Research Project / Dissertation confirms to the University that the Research Project / Dissertation work will be conducted in accordance with the Program Regulations and requirements of the University.

17. List of Discipline Elective Courses:

Table 3.3 DISCIPLINE ELECTIVE - Minimum of 15 Credits to be earned from this basket

Sl. No.	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skill/ Focus	Prerequisites/ Corequisites
1	DSC4011	Data Science with Cloud Computing	3	0	0	3	3	S	-
2	DSC4012	Data Security and Access Control	3	0	0	3	3	S	-
3	DSC4013	Soft Computing Techniques	3	0	0	3	3	S	-
4	DSC4014	Time Series Analysis and Forecasting	3	0	0	3	3	S	-
5	DSC4015	IOT Data Analytics	3	0	0	3	3	S	-
6	DSC4016	Probabilistic Graph Models	3	0	0	3	3	S	-
7	DSC4017	Social Network Analysis	3	0	0	3	3	S	-
8	DSC4018	Application of Probability theory in Computer Science	3	0	0	3	3	S	-
9	DSC4019	Digital Image Processing	2	0	2	3	4	S	-
10	DSC4020	Data Mining and Pattern Recognition	2	0	2	3	4	S	-
11	DSC4021	Graph Analytics and Network Science	2	0	2	3	4	S	-
12	DSC4022	Geospatial Data Science	2	0	2	3	4	S	-
13	DSC4023	Marketing and Consumer Analytics	3	0	0	3	3	S	-
14	DSC4024	Multimodal Learning	2	0	2	3	4	S	-
15	DSC4025	Intelligent Decision Support Systems	2	0	2	3	4	S	-

16	AIE4011	Robotic Process Automation	3	0	0	3	3	S	-
17	AIE4012	Machine Vision	3	0	0	3	3	S	-
18	AIE4013	Cloud Computing	3	0	0	3	3	S	-
19	AIE4014	Ontology Engineering for the Semantic Web	3	0	0	3	3	S	-
20	AIE4015	Intelligent Information Retrieval	3	0	0	3	3	S	-
21	AIE4016	Internet of Things	3	0	0	3	3	S	-
22	AIE4017	Essentials for Machine Learning	3	0	0	3	3	S	-
23	AIE4018	Recommender Systems with Machine Learning and AI	3	0	0	3	3	S	-
24	AIE4019	Green Computing and Sustainable IT	3	0	0	3	3	S	-
25	AIE4020	Reinforcement Learning	2	0	2	3	4	S	-
26	AIE4021	AI Ethics and Responsible AI	2	0	2	3	4	S	-
27	AIE4022	Generative AI and Foundation Models	2	0	2	3	4	S	-
28	AIE4023	Explainable AI	2	0	2	3	4	S	-
29	AIE4024	Digital Twins	2	0	2	3	4	S	-
30	AIE4025	Quantum Computing	2	0	2	3	4	S	-

18. List of Open Electives to be offered by the School / Department (Separately for ODD and EVEN Semesters.

Table 3.4 Open Elective Courses Minimum of 6 Credits to be earned from this basket									
Civil Engineering Basket									
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Contact Hours**	Type of Skills	**Prerequisites**
1	CIV5001	Sustainable Smart Cities	3	0	0	3	3	EM	-
2	CIV5002	Systems Design for Sustainability	3	0	0	3	3	EM	-
3	CIV5003	SelfSustainable Buildings	3	0	0	3	3	EM	

									-
4	CIV5004	Energy and Buildings	3	0	0	3	3	EM	-
Law Basket									
1	LAW5001	International Trade Law	3	0	0	3	3	-	-
2	LAW5002	Law relating to Business Establishment	3	0	0	3	3	-	-
3	LAW5003	Data Protection Law	3	0	0	3	3	-	-
4	LAW5004	Law Relating to Consumer Protection	3	0	0	3	3	-	-
5	LAW5005	Law Relating to Infrastructure Projects	3	0	0	3	3	-	-
Computer Science and Engineering Basket									
1	CSE5001	Programming Methodologies using Java	3	0	0	3	3	-	-
2	CSE5002	Human Computer Interaction	3	0	0	3	3	-	-
3	CSE5003	IOT Applications	3	0	0	3	3	-	-
4	CSE5004	Programming Essentials in Python	3	0	0	3	3	-	-
Electronics and Communication Engineering Basket									
1	ECE5001	Wearable Computing	3	0	0	3	3	-	-
2	ECE5002	MEMS and Nanotechnology	3	0	0	3	3	-	-
3	ECE5003	Advanced Computer Networks	3	0	0	3	3	-	-
4	ECE5004	Pervasive Computing	3	0	0	3	3	-	-
Mechanical Engineering Basket									
1	MEC5001	Optimization Techniques	3	0	0	3	3		

								-	-
2	MEC5002	Industry 4.0	3	0	0	3	3	EM	-
3	MEC5003	Six Sigma for Engineers	3	0	0	3	3	-	-
4	MEC5004	Design for Internet of Things	3	0	0	3	3	-	-
Management Basket									
1	MBA3042	Innovation and Business Incubation	3	0	0	3	3	-	-
2	MBA3037	Personal Wealth Management	3	0	0	3	3	-	-
3	MBA3038	Team Dynamics	3	0	0	3	3	-	-
4	MBA3039	Market Research	3	0	0	3	3	-	-
5	MBA2023	Design Thinking for Business Innovation	3	0	0	3	3	-	-
6	MBA3046	Game Theory in Business	3	0	0	3	3	-	-
7	MBA3047	Data Story Telling	3	0	0	3	3	-	-
8	MBA3048	Environmental Sustainability and Value Creation	3	0	0	3	3	-	-
9	MBA3049	Industry 4.0	3	0	0	3	3	-	-
Media Studies Basket									
1	BAJ5001	Media and Entertainment Business	3	0	0	3	3	EN	-
2	BAJ5002	TV Journalism and News Management	2	0	2	3	4	EM	-
Research Basket									
1	RES5001	Research Methodology	3	0	0	3	3	S	-

2	RES3001	Research Methodology	3	0	0	3	3	S	-
Research Project (Students are required to carry out research work under the guidance of a faculty member/ research scholar and the same shall be evaluated and credit will be granted as per the academic regulations)									
1	URE7001	University Research Experience	-	-	-	3		EM	-
2	URE7002	University Research Experience	-	-	-	0		EM	-
Apart from the above list, the student is free to enroll for any course offered by any school and earn credits for Open elective provided the student has not completed an antirequisite course and the student fulfills the prerequisite if any for the course he wishes to enroll									

Recommended Semester Wise Course Structure / Flow including the Programme / Discipline Elective Paths / Options

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Basket
Semester 1						**22**	**25**	
1	MAT4004	Advanced Engineering Mathematics	4	0	0	4	4	School Core
2	ENG5001	English for Employability	2	1	0	3	3	School Core
3	AIE4000	Knowledge Engineering and Expert Systems	3	0	0	3	3	Program Core
4	AIE4001	Artificial Intelligence	2	0	2	3	4	Program Core
5	AIE4002	Machine Learning Algorithms	2	0	2	3	4	Program Core
6	xxxxxx	Discipline Elective - I	3	0	0	3	3	Discipline Elective
7	xxxxxx	Discipline Elective - II	2	0	2	3	4	Discipline Elective
Semester 2						**22**	**25**	
1	AIE4003	Deep Learning	2	0	2	3	4	Program Core
2	AIE4504	Natural Language Processing Techniques	2	0	2	3	4	Program Core
3	xxxxxx	Discipline Elective - III	2	0	2	3	4	Discipline Elective
4	xxxxxx	Discipline Elective - IV	3	0	0	3	3	Discipline Elective
5	xxxxxx	Discipline Elective - V	3	0	0	3	3	Discipline Elective
6	xxxxxx	Open Elective - I	3	0	0	3	3	Open Elective
7	xxxxxx	Open Elective - II	3	0	0	3	3	Open Elective
8	SEM7000	Seminar	-	-	-	1	1	School Core
Semester 3						**10**	**0**	
1	PIP7500	Dissertation/ Internship - I	-	-	-	10		School Core
Semester 4						**14**	**0**	
1	PIP7501	Dissertation/ Internship - II	-	-	-	14		School Core
						68		

I. Course Catalogues:

Each course shall have a course catalogue with the following details:

i) Pre –Requisites of the course
ii) Course Description
iii) Course Outcome
iv) Course Content
iv) Reference Resources.

The Course Catalogues for the Courses offered in each basket are attached below:

Course Code: PIP6001	**Course Title: Dissertation-I** **Type of Course:**	**L- T-P- C**	0	0	0	10
Version No.	**1.0**					
Course Pre- requisites	--					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify problems based on societal /research needs. (Understand) 2. Apply Knowledge and skill to solve societal problems in a group. (Apply) 3. Develop interpersonal skills to work as member of a group or leader. (Apply) 4. Analyze the inferences from available results through theoretical / Experimental / Simulations. (Analyze) 5. Analyze the impact of solutions in societal and environmental context for					

	sustainable development. (Analyze) 6. Improve in written and oral communication. (Create) 7. Demonstrate capabilities of self-learning in a group, which leads to lifelong learning. (Understand)

Course Code: PIP6002	**Course Title: Dissertation-II** **Type of Course:**	**L- T-P- C**	0	0	0	14
Version No.	**1.0**					
Course Pre- requisites	--					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 1. Identify problems based on societal /research needs. (Understand) 2. Apply Knowledge and skill to solve societal problems in a group. (Apply) 3. Develop interpersonal skills to work as member of a group or leader. (Apply) 4. Analyze the inferences from available results through theoretical / Experimental / Simulations. (Analyze) 5. Analyze the impact of solutions in societal and environmental context for sustainable development. (Analyze) 6. Improve in written and oral communication. (Create) 7. Demonstrate capabilities of self-learning in a group, which leads to lifelong					

	learning. (Understand)

Course Code: SEM7000
Course Title: Seminar
Type of Course: L–T–P–C: 0–0–0–1
Version No.: 1.0
Course Pre-requisites: Nil
Anti-requisites: Nil

Course Description
This course is designed to enhance the research aptitude, presentation skills, and domain knowledge of postgraduate students. Students are required to select a recent topic related to their specialization, perform an extensive literature survey, and prepare a seminar report. The seminar is to be presented before a committee comprising faculty members and peers. This process fosters critical thinking, self-directed learning, and effective communication skills, while also promoting collaborative learning and peer feedback.

Course Objectives
- To develop the ability to conduct independent literature reviews and identify key issues in a chosen domain.
- To improve students' oral and written communication skills for technical and academic settings.
- To encourage active participation in academic discussions and constructive feedback.

Course Outcomes
Upon successful completion of this course, students will be able to:
1. **(Understand)** Identify and comprehend emerging research areas relevant to their field.
2. **(Apply)** Apply analytical skills to review and synthesize information from multiple sources.
3. **(Analyze)** Organize and structure academic content logically for presentation.
4. **(Create)** Prepare technical documents (seminar report) adhering to standard formats.
5. **(Apply)** Deliver an effective oral presentation using appropriate tools and techniques.
6. **(Evaluate)** Critically respond to questions and feedback from peers and faculty.
7. **(Understand)** Recognize the importance of continuous learning and staying updated in their field of study.

Course Code: AIE4000	**Course Title: KNOWLEDGE ENGINEERING AND EXPERT SYSTEM** **Type of Course: Program Core** **Theory Only**	**L- T- P- C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	--					
Anti-requisites	**NIL**					
Course Description	Knowledge engineering is a field within artificial intelligence that develops knowledge-based systems. Such systems are computer programs that contain large amounts of knowledge, rules and reasoning mechanisms to provide solutions to real-world problems. A major form of knowledge-based system is an expert system, one designed to emulate the reasoning processes of an expert practitioner. Topics includes: Introduction to Knowledge Engineering, Knowledge based Systems, Types of Knowledge-based systems, Knowledge acquisition, Knowledge					

		representation and reasoning: Logic rules and representations, Semantic Networks, frames, Life cycle Methodologies, Uncertain Reasoning with confidence factor, Basic Structure and Architecture of Expert System. Tools used in Expert System.
Course Objective		The objective of the course is to familiarize the learners with the concepts of Knowledge Engineering and Expert Systems and attain **Skill Development** through **Participative Learning** techniques.
Course Outcomes		On successful completion of the course the students shall be able to: CO1.Explain the basic concepts in Knowledge Engineering and types of Knowledge based system. CO2.Discuss the process of acquiring the Knowledge from the human expert. CO3.Apply the logical rules, Semantic Networks and Frames for representing the knowledge. CO4.Life Cycle and Methodologies applied to support the development of Knowledge based Systems. CO5.Explain how expert system deal with uncertainty and describes architecture and tools used.
Course Content:		

Module 1	Introduction to Knowledge Engineering and Knowledge Base	Assignment	Analysis		**10 Sessions**
	Topics: Data, Information and Knowledge Skills of a Knowledge Engineering, Engineering, software engineering and knowledge engineering, Knowledge Engineering around the world. Introduction to Knowledge-Based Systems.				
Module 2	Knowledge Acquisition	Assignment	Analysis, Data Collection		**5 Sessions**
	Topics: Knowledge Engineering life cycle, , Knowledge acquisition - knowledge acquired from a human expert - purpose and types of Interviews in obtaining knowledge.				
Module 3	Knowledge Representation and Reasoning	Problem-Solving	Data analysis task		**9 Sessions**
	Topics: Using knowledge - Logic, rules and representation- Developing rule-based systems, Conceptual Networks.				
Module 4	Life Cycle and Methodologies	Assignment	Analysis		**9 Sessions**
	Topics: Need for methodologies- Blackboard architectures- Problem Solving Methods (PSMs)- GEMINI, POLITE, - The Hybrid Methodology (HyM)- Building a well-structured application using Aion BRE.				

Module 5	Uncertain Reasoning and Expert System	Assignment	Analysis		**10 Sessions**

Topics: Uncertainty – Confidence factor- Expert System – Basic Structure, Architecture – Tools used Constructing Expert System, Rule-based system.

Targeted Applications & Tools that can be used:

After Completion of the course, student may get an opportunity to be a Knowledge engineer to design and develop Knowledge base with reference to Acquisition and to represent it.
Expert System can be developed on real time application (To highlight a few)
Medical Knowledge Automation, Chemical and Biological Synthesis, Mineral and Oil explorations, Planning and Scheduling. Space Defense, VLSI Design, Air traffic control, Equipment fault Diagnosis. Circuit Diagnosis and So on.

Tools: Programming tools for building Expert System.

- OPS 5
- EMYCIN
- KAS
- TEIRESIAS

Project work/Assignment:

Case Study Analysis: To Study, analyze and develop expert system on applications.

Term Assignments:

- **Comparative analysis on methods in Knowledge representations.**
- **A short survey on techniques used to build Knowledge base.**
- **Recent trends used in developing Expert System.**

Text Book

T1. "An introduction to knowledge engineering", Simon Kendal, Malcolm creen, Springer, 2007.(with Recent version copyright)
T2. "An Overview of Expert System " William B. Gevarter,Dept. of Commerce,U.S , NBS, Washignton,D.C.

References

R1. "An introduction to knowledge engineering", Peter Smith, Thomson computer press, 1996.
R2. "A guide to an Expert System ", Donald Waterman, Pearson India.

Weblinks

W1.https://presiuniv.knimbus.com/user#/home
W2.https://www.javatpoint.com/ai-knowledge-engineering.

Topics relevant to "SKILL DEVELOPMENT": Converting from English to Predicate Logic, and logically prove statements using inference rules like first-order resolution, Uncertain Reasoning and Expert Systems for skill development through participative learning techniques. This is attained through the assessment components mentioned in the course handout.

Course Code: AIE4001
Course Title: Artificial Intelligence
Type of Course: Program Core (Integrated Theory and Laboratory)
L-T-P-C: 2-0-2-3
Total Hours: 30 Hours Theory + 30 Hours Lab = 60 Hours
Version No.: 1.0
Course Prerequisites: Nil

Course Description:
This course introduces students to the fundamental principles and techniques of Artificial Intelligence (AI). It covers problem-solving, knowledge representation, reasoning, and learning. Students will implement AI algorithms and apply them to various domains through practical lab experiments.

Course Objectives:
- Understand the core concepts of Artificial Intelligence and intelligent agents.
- Analyze and implement search strategies for problem-solving.
- Learn knowledge representation schemes and reasoning techniques.
- Apply AI techniques in practical, real-world applications.

Course Outcomes (COs):
- **CO1:** Analyze the foundational principles and scope of Artificial Intelligence.
- **CO2:** Analyze and compare search algorithms for AI-based problem-solving.
- **CO3:** Apply knowledge representation and inference techniques.
- **CO4:** Apply AI algorithms to real-world scenarios using programming.

Course Content (Total: 60 Hours)
Module 1: Introduction to AI and Intelligent Agents (CO1 – Analyze) – 8 Theory Hours
Topics: History and evolution of AI, foundations and applications, AI techniques, Types of AI, Intelligent agents, environments, and agent structures.
Module 2: Problem Solving and Search (CO2 – Analyze) – 10 Theory Hours
Topics: Problem formulation, uninformed search (BFS, DFS, DLS, IDS), informed search (Greedy, A*), heuristic functions, constraint satisfaction problems.
Module 3: Knowledge Representation and Reasoning (CO3 – Apply) – 6 Theory Hours
Topics: Propositional and predicate logic, inference rules, semantic networks, frames, production rules, forward and backward chaining.
Module 4: AI Applications and Learning (CO4 – Apply) – 6 Theory Hours
Topics: Machine learning overview, rule-based systems, AI in NLP, robotics, computer vision, and expert systems.

Laboratory Experiments (15 Weeks / 30 Hours)
1. Implement intelligent agent simulation using Python.
2. Write a program to solve a problem using BFS and DFS.
3. Implement A* algorithm for a route-finding problem.
4. Solve a constraint satisfaction problem (e.g., Sudoku).
5. Develop a knowledge base using propositional logic.
6. Implement forward chaining inference.
7. Implement backward chaining inference.
8. Simulate a rule-based expert system.
9. Create a semantic network for a given domain.
10. Build a chatbot using basic NLP libraries.
11. Image recognition using pre-trained models.

12. Build a simple AI game (e.g., Tic-Tac-Toe).
13. Implement decision tree classification.
14. Develop a face detection system using OpenCV.
15. Final integration of an AI-based mini project.

Textbooks:

- **T1:** Stuart Russell & Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson Education.
- **T2:** Elaine Rich, Kevin Knight, Shivashankar B Nair, *Artificial Intelligence*, McGraw Hill Education.

Reference Books:

- **R1:** George F. Luger, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, Pearson Education.
- **R2:** Nils J. Nilsson, *The Quest for Artificial Intelligence*, Cambridge University Press.

Web Resources:

- [W1] https://www.csail.mit.edu/research/artificial-intelligence
- [W2] https://www.geeksforgeeks.org/artificial-intelligence/
- [W3] https://www.coursera.org/specializations/artificial-intelligence

Course Code: AIE4002	**Course Title: Machine Learning Algorithms** **Type of Course: Program Core** **Theory and Laboratory Integrated**	**L-T-P-C**	2	0	2	3
Version No.	2.0					
Course Pre-requisites	--					
Anti-requisites	NIL					
Course Description	This course provides a broad introduction to machine learning and statistical pattern recognition. Topics include: supervised learning (generative/discriminative learning, parametric/non-parametric learning, neural networks, support vector machines); unsupervised learning (clustering, dimensionality reduction, kernel methods); learning theory (bias/variance tradeoffs, practical advice); reinforcement learning and adaptive control.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Machine Learning Algorithms and attain **Skill Development** through **Experiential Learning** techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Identify the characteristics of datasets and compare the trivial data for various applications. CO2: Understand and apply scaling up machine learning techniques. CO3: To design and implement various machine learning algorithms in a range of real-world applications.					
Course Content:						
Module 1	Machine Learning Model	Assignment	Programming		**10 Sessions**	

	Fundamentals				
	Topics: Data-generating process, Understanding the structure and properties of good datasets, Scaling datasets, including scalar and robust scaling, Selecting training, validation and test sets, including cross-validation, Features of a machine learning model, Learnability, Capacity, including Vapnik-Chervonenkis theory, Bias including underfitting, Variance including overfitting, Regularization with types, cross validation, Defining loss and cost functions.				
Module 2	Clustering and Unsupervised Models	Assignment	Programming		**10 Sessions**
	Topics: K-Nearest Neighbors(KNN), based on k-dimensional(k-d) trees and ball tress, K-means and K-means++, Clustering Fundamentals, Evaluation of clustering models on the ground truth, Hierarchical clustering algorithms, Spectral clustering, DBSCAN, Clustering as a Mixture of Gaussians.				
Module 3	Semi- Supervised Learning Algorithms	Assignment	Programming		**15 Sessions**
	Topics: Introduction to Semi- Supervised Learning, Semi-supervised scenario, The different approaches to semi-supervised learning, Generative Gaussian Mixture, contrastive pessimistic likelihood estimation approach, Self-Training, Co-Training, Advanced Semi-Supervised Classification, Contrastive Pessimistic Likelihood Estimation(CPLE), Semi-supervised Support Vector Machines(S3VM). Transductive Learning via regularized least squares				
Module 4	Graph-Based Semi-Supervised Learning	Assignment	Programming		**12 Sessions**
	Topics: Graph-Based Semi-Supervised Learning, Label propagation, Example of label propagation, Label spreading, Label propagation based on Markov random walks, Manifold Learning. Quadratic cost criterio. Regularization with graph.				
	List of Laboratory Tasks: **Experiment N0 1:** Programming assignment for data cleaning.. **Level 1:** Programming scenarios which handles missing features, data normalization, data scaling. **Level 2:** Programming assignment which helps in feature filtering, selection. **Experiment No. 2:** Programming assignment for unsupervised learning **Level 1:** Implementation of covariance rule. Implementationof rubner_tavan_network **Level 2:** Implementation of sanger_network. **Experiment No. 3:** Programming assignment for advanced unsupervised learning **Level 1:** Implementation of kNN, K-means. Implementation of fuzzy cmeans. **Level 2:** Implementation of spectral clustering. **Experiment No. 4:** Programming assignment for supervised learning. **Level 1**: Programming assignment on label_propogation, spreading				

	Experiment No. 5: Programming assignment for supervised learning. **Level 1**: Implementing SVM **Level 2:** Implementing TSVM **Experiment No. 6:** Programming assignment for Graph-Based Supervised learning. **Level 1:** Estimating Gaussian mixture in ICA **Level 2:** Estimating parameter using PCA.
	Targeted Application & Tools that can be used: • Data Mining • Text Mining • Web Mining • Medical Industry **Tools**: Anaconda for Python or Google Colab for Python.
	Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
	After completion of each module a programming-based Assignment/Assessment will be conducted. **A dataset will be given to the student to practice the learned algorithms** **On completion of Module 4, student will be asked to develop a Project for analyzing the given dataset.**
	Text Book **T1. Giuseppe Bonaccorso, *"Mastering Machine Learing Algorithms"*,Packt.** **T2. Giuseppe Bonaccorso, *"Machine Learning Algorithms"*,Packt.**
	References **R1. Imran Ahmed, *"40 Algorithms Every Programmer Should Know"*, Packt** **Weblinks** W1.https://presiuniv.knimbus.com/user#/home W2.https://www.javatpoint.com/machine-learning-algorithms
	Topics relevant to "SKILL DEVELOPMENT: Machine Learning, Clustering and Unsupervised, Graph-Based Semi-Supervised Learning for developing Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout

Course Code: AIE 4003	**Course Title: Deep Learning** **Type of Course: Program Core Theory and Laboratory Integrated**	**L-T-P-C**	2	0	2	3

Version No.		2.0
Course Pre-requisites	•	--
Anti-requisites		NIL
Course Description		The course introduces the core intuitions behind Deep Learning, an advanced branch of Machine Learning involved in the development and application of Artificial Neural Networks that function by simulating the working principle of human brain. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. The course includes theory and lab components which emphasizes on understanding the implementation and application of deep neural networks in various prominent problem domains like speech recognition, sentiment analysis, recommendations, and computer vision etc. The course facilitates the students to interpret and appreciate the successful application of deep neural nets in various prediction and classification tasks of ML.
Course Objective		The objective of the course is to familiarize the learners with the concepts of **Deep Learning** and attain **SKILL DEVELOPMENT** through **Experiential Learning techniques**
Course Out Comes		On successful completion of the course the students shall be able to: CO1: Apply basic concepts of Deep Learning to develop feed forward models CO2: Apply Supervised and Unsupervised Deep Learning techniques to build effective models for prediction or classification tasks CO3: Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains of Machine Learning and Machine vision. CO4: Analyze performance of implemented Deep Neural models
Course Content:		

Module 1	Introduction to Deep Learning	Assignment	Programming		**10 Sessions**
	Topics: Machine Learning in a nutshell, Fundamentals of deep learning and neural networks, Deep Neural Network, Feedforward Neural Network, Perceptron, Activation Functions, Loss Functions, Gradient Descent, Back-propagation, Training Neural Networks Building your Deep Neural Network: Step by Step, Introduction to CNN				
Module 2	Improving Deep Neural Networks	Assignment	Programming		**09 Sessions**
	Topics: Hyperparameter tuning, Initialization, Overfitting and Underfitting, Regularization and Optimization, Dropout, Batch Normalization				
Module 3	Deep Supervised	Assignment	Programming		**10 Sessions**

	Learning Models				
	Topics: Convolutional neural network with pooling flattening, Prediction of image using Convolutional Neural Networks, Deep learning in Sequential Data, RNN & LSTM, GRU,				
Module 4	Deep Unsupervised Learning	Assignment	Programming		**10 Sessions**
	Topics: Basics of Deep unsupervised learning, Auto encoders, Recommender systems, computer vision				

List of Laboratory Tasks:

Experiment No. 1: Programming assignment to implement a single layer feed forward neural network from scratch (Application: A basic neural network).

Level 1: Programming scenario to implement a basic single layer feed-forward neural network perceptron.

Level 2: Programming scenario to implement a basic single layer feed-forward neural network with a single hidden layer having ReLU activation function and sigmoid in the output layer.

Experiment No. 2: Programming assignment to build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

Level 1: Programming scenario to use the Backpropagation algorithm to build an ANN and run it on a dataset for few epochs.

Level 2: Programming scenario to use the Backpropagation algorithm to build an ANN and run it on a dataset for few epochs and interpret the accuracy, loss and other evaluation parameters.

Experiment No. 3: Programming assignment to build a multiple layer neural network with specific model parameters and hyperparameters on a given real life dataset.

Level 1: Programming assignment to implement a MLP with

- possibility to use 2-4 layers
- ReLU for the hidden layer
- Sigmoid in the output layer
- optimization via gradient descent (GD)

Level 2: Programming assignment to implement the neural network and add some more hyperparameters in the perceptron model

- softmax output layer
- optimization via stochastic gradient descent (SGD)
- Gradient checking code (!!!)

Generate the confusion matrix

Experiment No. 4: Programming assignment to implement classification of linearly separable Data with a Deep neural network (Application: Binary classification).

Level 1: Programming scenarios to build a binary classifier with a deep ANN.

Level 2: Programming scenarios to build a binary classifier with a deep ANN

- Weight initialization with random noise (!!!) (use normal distribution with changing std. deviation for now)
- implement dropout, *l2* regularization
- implement a different optimization scheme (RPROP, RMSPROP, ADAGRAD)
- employ batch normalization

Experiment No. 5: Programming assignment to implement a basic Convolution Neural Network.

Level 1: Programming scenarios which use the concept of convolution and pooling to implement a CNN.

Level 2: Programming scenarios which use the concept of convolution and pooling to implement a CNN and also specify some parameters like number of filters, length of feature detector, stride etc.

Experiment No. 6: Programming assignment to perform image segmentation and object detection using CNNs.

Level 1: Programming assignment to instantiate a CNN (that uses FullyConnectedLayers) and train the neural network using the training data from MNIST data set.

Level 2: Programming assignment to instantiate a CNN (that uses FullyConnectedLayers) and train the neural network using the training data from MNIST data set. Choose appropriate hyper parameters for the training of the neural network. Plot the cost versus training iterations using different mini-batch sizes: 16; 64; 256; 1024. Record the test accuracy in percentage and total training time you spent in seconds. Implement Adam Optimizer. To obtain full marks, the network should be able to achieve a test accuracy of 90% or more across many different random seeds.

Experiment No. 7: Programming assignment to employ CNN in image classification from given dataset.

Level 1: Programming scenario to instantiate a CNN (with at least one convolutional layer) and train the neural network using the training data from CIFAR10 data. Choose appropriate hyperparameters for the training of the neural network. The network should be able to achieve a test accuracy of at least 50% within 10 training epochs.

Level 2: Programming scenario to build a CNN (with more than one convolutional layer) and train the neural network using the training data from CIFAR10 data. Choose appropriate hyperparameters for the training of the neural network. The network should be able to achieve a test accuracy of at least 50% within 10 training epochs. Continue to train further and examine training and testing performance. Report hyperparameters (learning rate, number of hidden layers, number of nodes in each hidden layer, batch size and number of epochs) of the Deep Neural Network. Also, explain the observations.

Experiment No. 8: Programming assignment to perform Sentence (text) Classification using Convolutional Neural Networks.

Level 1: Programming Scenarios to utilize CNN to categorize text data in given datasets like SST movie reviews.

Level 2: Programming Scenarios to utilize CNN to categorize text data in given datasets like SST and MR movie reviews.

Experiment No. 9: Programming assignment to apply Recurrent Neural Networks for sentiment

	analysis of text data. **Level 1:** Programming scenario to build a model to perform sentiment analysis of IMDB movie reviews using. Reviews are categorized into two polarities: positive and negative. **Level 2:** Programming scenario to build a model to perform sentiment analysis of IMDB movie reviews. Reviews are categorized into three polarities: positive, negative and neutral. **Experiment No. 10:** Programming assignment to create a generative model for text, character-by-character using Recurrent neural networks. **Level 1:** Programming scenario to implement a multi-layer Recurrent Neural Network like LSTM for training/sampling from character-level language models, which takes one text file as input and trains an RNN that learns to predict the next character in a sequence. The RNN can then be used to generate text character by character that will look like the original training data. **Level 2:** Programming scenario to implement a multi-layer Recurrent Neural Network utilizing both LSTM and GRU in turns for training/sampling from character-level language models, which takes one text file as input and trains an RNN that learns to predict the next character in a sequence. The RNN can then be used to generate text character by character that will look like the original training data. Train the model and use it to generate new text. **Experiment No. 11:** Programming assignment to implement RNN models for multivariate time series forecasting. **Level 1:** Programming scenario to implement a many-to-one Recurrent Neural Network for Stock Price forecasting, i.e. trained with a certain number of day's data, the model should predict the stock price of the next day. **Level 2:** Programming scenario to implement a many-to-one Recurrent Neural Network for Stock Price forecasting, i.e. trained with a certain number of day's data, the model should predict the stock price of the next day. Students are free to use RNN, GRU, or LSTM (or compare between) and any number of layers and architecture. In the testing, plot the ground truth and your predicted values for 100 days. **Experiment No. 12:** Programming assignment to implement Autoencoders and deep Boltzmann's machines. **Level 1:** Programming scenario to implement a basic recommender system using deep Boltzmann's machines. **Level 2:** Programming scenario to build a recommender system with Collaborative filtering algorithm using deep Boltzmann's machines,
	Targeted Application & Tools that can be used: Targeted employment sector is not restricted to any single domain. Today, ML and Dl have been employed for data analysis and improved business intelligence in every sector. Targeted job profiles include Data Analyst, Data Scientist, Data Engineer, Neuroinformatician, Bioinformatician, Image Recognition, Research Analyst, Full Stack Developer for Deep Learning, Natural Language Process Engineer, Business Analyst etc. Few of the top recruiters are Amazon, NVIDIA. Microsoft, IBM, Accenture, Facebook, Intel, Samsung, Lenovo, Adobe etc., among numerous others. **Tools**: Neural Designer, AutoML, AutoDL, Keras, TensorFlow, Torch, Google Colaboratory, Spider,

	Jupiter Notebook
	Project work/Assignment:
	Throughout the progression in each module, students will have to submit scenario based programming Assignments/Experiments as listed in "List of Lab Tasks". On completion of each module, students will be asked to develop a Mini Project, similar to the following: • **Music genre classification system** This is one of the interesting deep learning project ideas. This is an excellent project to nurture and improve one's deep learning skills. The aim is to create a deep learning model that uses neural networks to classify the genre of music automatically. For this project, students will use an FMA (Free Music Archive) dataset. FMA is an interactive library comprising high-quality and legal audio downloads. It is an open-source and easily accessible dataset. However, it is noteworthy that before one can use the model to classify audio files by genre, he/she will have to extract the relevant information from the audio samples (like spectrograms, MFCC, etc.) • **Image Caption generator** This is one of the trending deep learning project ideas. This is a Python-based deep learning project that leverages Convolutional Neural Networks and LTSM (a type of Recurrent Neural Network) to build a deep learning model that can generate captions for an image. An Image caption generator combines both computer vision and natural language processing techniques to analyze and identify the context of an image and describe them accordingly in natural human languages (for example, English, Spanish, Danish, etc.). This project will strengthen one's knowledge of CNN and LSTM, and one will learn how to implement them in real-world applications as this. • **Visual tracking system** A visual tracking system is designed to track and locate moving object(s) in a given time frame via a camera. It is a handy tool that has numerous applications such as security and surveillance, medical imaging, augmented reality, traffic control, video editing and communication, and human-computer interaction. This system uses a deep learning algorithm to analyze sequential video frames, after which it tracks the movement of target objects between the frames. The two core components of this visual tracking system are Target representation and localization • **Traffic Signal Classification** The traffic sign classification project is useful for all autonomous vehicles. Machines are able to identify traffic signs from the image. Students can use the GTSRB dataset that contains 43 different traffic sign classes. This is a good project to understand image classification. • **Driver Drowsiness Detection** The driver drowsiness detection is a project which can detect whether a person is sleeping or not while driving. We can implement a model for drivers and it can also prevent accidents from happening. • **Autocolouring old Black and white images** The idea of this project is to make a model that is capable of colorizing old black and

	white images to colorful images. Digital artists take a few hours to color the image but now with Deep Learning, it is possible to color an image within seconds.
	Text Book T1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017
	References R1. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classification. Wiley-Inderscience, 2nd Edition. 2013 R2. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4, Academic Press, 2015 R3. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence, 2013 R4. Bishop, C. M. Neural Networks for Pattern Recognition, Oxford University Press, 2008. **Weblinks** W1.https://presiuniv.knimbus.com/user#/home W2.https://www.ibm.com/in-en/topics/deep-learning#:~:text=Deep%20learning%20is%20a%20subset,from%20large%20amounts%20of%20data.
	Topics relevant to development of "SKILL DEVELOPMENT": Real time Data Analysis using Deep learning. for developing **SKILL DEVELOPMENT** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout

Course Code: AIE5404	**Course Title:** **Natural Language Processing** **Type of Course:** **Program Core** **Theory and Laboratory Integrated Course**	**L-T-P-C**	2	0	2	3
Version No.	2.0					
Course Pre-requisites	--					
Anti-requisites	**NIL**					
Course Description	This course introduces a basics of Natural Language Processing methods with specific emphasis on modern applications. The course will cover pre-processing techniques of textual data like stemming, lemmatization, tokenization etc. Different word Vectorization Techniques like Bag of Words, TF-iDF etc. followed by basics of Probability for building language models. Basics of Neural Network, LSTM Recurrent Neural Network, Applications of NLP like Information Extraction, Emotion Extraction from text, sentiment analysis etc.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Natural Language Processing** and attain **SKILL DEVELOPMENT** through **Experiential Learning** techniques					

Course Outcomes		**On successful completion of this course the students shall be able to:** CO1: Understanding the fundamentals of NLP techniques. CO2: Apply Language modelling techniques for predictions. CO3: Apply Deep learning Techniques to build NLP Model CO4: Outline the application of NLP Techniques.			
Course Content:					
Module 1	**pre-processing techniques**	Assignment		**Apply all the pre-processing techniques to the corpus of your choice.**	**14 Sessions**
	Topics: Introduction to Natural Language Processing, terminologies, empirical rules, why NLP is hard, why NLP is useful, Natural Language generation, NLP Processing pipeline, Corpus Cleaning techniques – word tokenization, sentence tokenization, word frequency distribution, stemming, lemmatization, dictionary, Part of Speech Tagging, optical character recognition, Textual Pre-Processing techniques – Stop words removal, regular expression, lower case, text standardization. Punctuation Mark Removal.				
Module 2	**Language Model**	**Assignment**		**Build n-gram language model for future word predictions.**	**11 Sessions**
	Topics: Word Embeddings techniques- bag of words, Tf-iDF, Word2Vec and optimization. Hidden Markov Models Simple N-gram models. Estimating parameters and smoothing. Negative Sampling Evaluating language models. (Forward and Viterbi algorithms and EM training), Maximum Entropy Models, N-gram and unigram.				
Module 3	**Deep Learning techniques for NLP models**	**Assignment**		**Build model for spam detection using mail subject as Corpus**	**11 Sessions**
	Topics: **Introduction to Neural Network, Perceptron, back Propa**gation, Recurrent Neural network, LSTM, Attention Models, BERT (Bidirectional **E**ncoder **R**epresentation from **T**ransformer), Reformer, speech recognition. Document summarization				
Module 4	**Application of NLP**	**Assignment**		**Paper Review of State-of-the-ArtNLP Technique**	**11 Sessions**
	Topics: Application of NLP- Lexical semantics and word-sense disambiguation. Named entity recognition and relation extraction. IE using sequence labeling, Emotion Extraction. tExt Summarization**.**				
	Targeted Application & Tools that can be used: 1. **Application Area Sentiment Analysis , Text Classification , Chatbots & Virtual Assistants , Text Extraction , Machine Translation , Text Summarization , Market Intelligence , Auto-Correct , Intent Classification , Urgency Detection ,**				

	Speech Recognition **Professionally Used Software: Anaconda Navigator, Python Packages, NLP toolkit** **List of Laboratory Task** 1. **Experiment No. 1: Apply all preprocessing technique to corpus of choice and plot word frequency.** 2. **Experiment No. 2: Word Embedding using Bag of words** 3. **Experiment No. 3: Word Embedding using TF-iDF** 4. **Experiment No. 4: Word Embedding using Word2Vec Continuous Bag of words** 5. **Experiment No. 5: Word Embedding using Word2Vec Skip gram Model** 6. **Experiment No. 6: Build language Model using n- gram.** 7. **Experiment No. 7: Build NLP model using LSTM** 8. **Experiment No. 8: Build NLP model using BERT** 9. **Experiment No. 9: Build NLP model using Reformer to show optimization.**
	Project work/Assignment:
	Project Assignment: NIL **Assignment 1: Paper Review of the state of the art NLP Technique**
	Text Books T1. Daniel Jurafsky, James H. MartinSpeech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014. T2. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Pythonll, First Edition, OReilly Media, 2009.
	References **R1. Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.** **R2. Richard M Reese, Natural Language Processing with Javall, OReilly Media, 2015.** **R3. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.** **R4. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.** **Weblinks** W1.https://presiuniv.knimbus.com/user#/home W2.https://www.ibm.com/in-en/topics/natural-language-processing
	Topics relevant to development of "SKILL DEVELOPMENT": Information retrieval of Search Engines Information Retrieval. for developing **SKILL DEVELOPMENT** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.