



AISSMS

COLLEGE OF ENGINEERING

ज्ञानम् सकलजनहिताय

An Autonomous Institute Affiliated with
Savitribai Phule Pune University

Accredited by NAAC with "A+" Grade | NBA - 7 UG Programmes



Savitribai Phule Pune University

All India Shri Shivaji Memorial Society's

COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

Faculty of Science and Technology



National Education Policy (NEP) Compliant Curriculum

**S.Y.B. Tech. Artificial Intelligence and Machine Learning Syllabus
(2025 Pattern)**

(With effect from Academic Year 2026-27)

www.aissmscoe.com

Institute Vision and Mission

Vision

Service to society through quality education

Mission

- Generation of national wealth through education and research
- Imparting quality technical education at the cost affordable to all strata of the society
- Enhancing the quality of life through sustainable development
- Carrying out high-quality intellectual work
- Achieving the distinction of the highest preferred engineering college in the eyes of the stakeholders

Department Vision and Mission

Vision

To emerge as a center of excellence in Artificial Intelligence and Machine Learning to become a leading center in artificial intelligence and machine learning by fostering innovation, ethical research, and societal impact through quality education.

Mission

- To impart quality education in artificial intelligence and machine learning through innovative and hands- on teaching learning processes.
- To encourage interdisciplinary research through creativity, problem solving and entrepreneurship mindset amongst students.
- To nurture collaboration with industries, leading academic and research organizations to enhance sustainable development.
- To inculcate ethical, social and environmental responsibilities amongst students while solving real life problems.

Knowledge and Attitude Profile (WK)

WK Code	Description
WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Program Outcomes (POs)

POs	Description
PO1	Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSOs)

An Artificial Intelligence and Machine Learning graduate will be able to:

- PSO1.** Apply the theoretical concepts and practical knowledge of Artificial Intelligence and Machine Learning in analysis, design, and development in the interdisciplinary domain.
- PSO2.** To formulate software design and testing strategies employing software paradigms and AIML knowledge to solve real-world problems.
- PSO3.** Develop the skills and ethical values necessary to serve as professional in the field of AIML.

Program Educational Objectives (PEOs)

- PEO1.** To produce graduates equipped with cutting-edge skills in artificial intelligence and machine learning enabling them to solve computing problems in interdisciplinary environments.
- PEO2.** To equip graduates with a strong foundation in mathematics, data science and computational techniques to develop scalable AI-driven solutions for real world problems.
- PEO3.** To demonstrate teamwork, communication skills, professional ethics and lifelong learning in a multidisciplinary environment.

B.Tech. Degree Options as per NEP 2020

- A. B.Tech. Artificial Intelligence and Machine Learning Degree with Multidisciplinary Minor (160–176 credits).**
- B. B.Tech. Honours Degree in the chosen major Engineering/Technology discipline with Multidisciplinary Minor (180–194 credits):**
- Enables students to take up **five to six additional courses** in the same Engineering/Technology discipline, amounting to **18 to 20 credits**, distributed over **Semesters III to VIII**.
 - The decision regarding the mechanism of distribution of these **18-20 credits** over semesters III to VIII, which are **over and above the min.160-max.176 Credits** prescribed for Four Year Multidisciplinary Bachelor's Degree in Engg. / Tech., will be taken by Academic Authorities of University/ Autonomous Engineering Colleges.
- C. B.Tech. Honours with Research Degree in the chosen major Engineering/Technology discipline with Multidisciplinary Minor (180–194 credits):**
- The students will work on **a research project or dissertation for 18 credits** in the fourth year in the respective Major Engg. / Tech. Discipline.
 - The decision regarding the distribution of 18 credits for Research Project in **Semesters VII and VIII** of the Fourth Year will be taken by Academic Authorities of University/ Autonomous Engineering Colleges.
 - **These 18 Credits will be over and above the min.160-max.176 Credits** prescribed for Four Year Multidisciplinary Bachelor's Degree in Engg. / Tech. Program.
- D. B.Tech. Degree in the chosen major Engineering/Technology discipline with Double Minor (Multidisciplinary and Specialisation Minor) (180–194 credits):**
- Students would take **up five-six additional courses of 18 to 20 credits** in **another Engg. / Tech.** discipline/ Emerging Areas Specialization.
 - Distributed over **semesters III to VIII**.
 - The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, which are **over and above the min.160-max.176 Credits** prescribed for Four Year Multidisciplinary Bachelor's Degree in Engg. /Tech., will be taken by Academic Authorities of University/ Autonomous Engineering Colleges.

Note:

- The **B.Tech. Degree with Multidisciplinary Minor (Option a)** shall be the **default degree pathway** for all students.
- Students may **opt for any one** of the following additional degree options:
 - (b) **B.Tech. Honours,**
 - (c) **B.Tech. Honours with Research, or**
 - (d) **B.Tech. Degree with Double Minor.**
- The options under (b), (c), and (d) are **mutually exclusive**, and a student shall be allowed to **choose only one option**.
- Students who do not opt for options (b), (c), or (d) shall **continue under the default pathway (Option a)**.

Academic Regulations and Evaluation Scheme

A. Definition of Credit:

Course Component	Weekly Contact Hours	Credits
Lecture (L)	1 Hour / Week	1
Tutorial (T)	1 Hour / Week	1
Practical (Lab)	2 Hours / Week	1

B. Range of credits:

A student must earn a total of **160 to 176 credits** to be eligible for the award of an **Undergraduate Degree in Engineering**, which includes Multidisciplinary Minor(s) comprising **14 credits** within the prescribed credit range.

In addition to the core credit requirements, a student may obtain:

- **Undergraduate Degree with Honors** by earning an additional **18 to 20 credits, Or**
 - **Undergraduate Degree with Honours with Research** by earning research project/dissertation of **18 credits across Semesters VII and VIII.**
- Or**

- **Double Minor** by completing an additional **18 to 20 credits**, and/or

These additional qualifications are awarded only upon successful completion of the specified extra credits beyond the minimum degree requirement.

C. Multiple Entry and Exit

A student shall be eligible to receive a **Diploma in the Artificial Intelligence and Machine Learning** upon successful completion of the **Second Year (S.Y. B.Tech.) in Artificial Intelligence and Machine Learning**, along with completion of an **internship of 8 credits** during the summer term in the relevant discipline.

D. General Guidelines for Examination (CCA)

The examination shall be conducted in THREE parts viz. Continuous Comprehensive Assessment (CCA), In Semester Examination (ISE) and End Semester Examination (ESE).

(i) Continuous Comprehensive Assessment (CCA): 20 Marks (Any TWO)

CCA focuses on continuously assessing a student's performance throughout the semester. Apart from classroom and laboratory learning, CCA activities can be undertaken to accelerate the attainment of the various outcomes in the course: The significance of CCA lies in its ability to provide a more accurate and all-round understanding of a student's abilities, skills, and knowledge. CCA promotes experiential learning, participatory learning, collaborative learning, active learning, self-learning, peer to peer learning, etc. As part of the CCA framework, students are required to undertake ANY TWO ACTIVITIES from the prescribed set Guidelines: To be evaluated based on rubrics.

(ii) In-semester Examination (ISE): 30 Marks

In-semester examination will be of 30 marks based on Unit I and II.

Course Content	Questions	Marks	Total Marks	Duration
Unit I	Q.1 or Q.2	15	30	1 Hour
Unit II	Q.3 or Q.4	15		

(iii) End-semester Examination (ESE)

Examination will be carried out on unit III, IV and V carrying following marks weightage:

Course Content	Questions	Marks	Total Marks	Duration
Unit III	Q.1 or Q.2	16	50	2 Hours
Unit IV	Q.3 or Q.4	17		
Unit V	Q.5 or Q.6	17		

ABBRAVIATIONS

Sr No	Abbreviation	Full Form
1	BSC	Basic Science courses
2	ESC	Engineering Science courses
3	PCC	Programme Core Courses
4	PEC	Programme Elective courses
5	MDM	Multidisciplinary Minor
6	OEC	Open Elective other than particular Programme
7	VSE	Vocational and Skill Enhancement Course
8	AEC	Ability Enhancement Course
9	HSM	Humanities Social Science and Management
10	IKS	Indian Knowledge System
11	VEC	Value Education Course
12	ELC	Experiential Learning Courses
13	CCC	Liberal Learning Courses
14	CCA	Continuous Comprehensive Assessment
15	ISE	In-semester Examination
16	ESE	End-semester Examination

B. Tech. Artificial Intelligence and Machine Learning (2025 Pattern)

Semester-wise Credit Distribution across Programme Domains

Sr. No	Domains	Code	SEM-I	SEM-II	SEM-III	SEM-IV	SEM-V	SEM-VI	SEM-VII	SEM-VIII	Credits
1	BSC/ESC										
	Basic Science courses	BSC	8	8	0	0	0	0	0	0	16
	Engineering Science courses	ESC	9	6	0	0	0	0	0	0	15
2	Program Courses (PC)										
	Programme Core Courses	PCC	0	3	12	12	8	8	8	0	51
	Programme Elective Courses	PEC	0	0	0	0	4	8	4	4	20
3	Multidisciplinary Courses (MDM)										
	Multidisciplinary Minor	MDM	0	0	2	2	4	2	2	2	14
	Open Elective other than particular Programme	OEC	0	0	2	2	2	0	0	0	6
4	Skill Courses										
	Vocational and Skill Enhancement Course	VSE	1	1	1	1	2	2	0	0	8
5	Humanities Social Science and Management (HSSM)										
	Ability Enhancement Course	AEC	2	0	0	2	0	0	0	0	4
	Entrepreneurship/Economics/Management courses	HSM	0	0	2	2	0	0	0	0	4
	Indian Knowledge System	IKS	0	2	0	0	0	0	0	0	2
	Value Education Course	VEC	0	0	2	1	0	0	0	0	3
6	Experiential Learning Courses (ELC)										
	Research Methodology	ELC	0	0	0	0	0	0	4	0	4
	CEP	ELC	0	0	1	0	0	0	0	0	1
	Project	ELC	0	0	0	0	0	2	2	0	4
	Internship	ELC	0	0	0	0	0	0	0	12	12
7	Co-curricular Courses (CC)										
	Liberal Learning Courses	CCC	2	2	0	0	0	0	0	0	4
Total			22	22	22	22	20	22	20	18	168



Multidisciplinary Minor

Semester	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
SEM-III	25RAMDM201	Digital Electronics and Logic Design	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-IV	25RAMDM202	Internet of Things (IoT)	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-V	25RAMDM301	Fundamentals of Robotics and Automation Engineering	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-V	25RAMDM301L	Fundamentals of Robotics and Automation Engineering Lab	-	2	-	-	-	-	-	-	25	25	-	1	-	01
SEM-VI	25RAMDM302	Industrial Robotics and Automation Systems	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-VII	25RAMDM401	Industry 4.0 and Smart Manufacturing	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-VIII	25RAMDM402	Multidisciplinary Mini Project in Robotics and Automation	-	4	-	-	-	-	-	50	50	100	-	2	-	02
			11	6	00	100	150	250	-	50	75	625	11	3	-	14

Open Elective Baskets

BASKE T NO	BASKET	SEM-III	SEM-IV	SEM-V
1	Leadership, Management & Innovation	Principles of Management and Organizational Behaviour	Leadership and Team Dynamics	Supply Chain Management
2	Sustainability and Green Technologies	Circular Economy for Sustainable Development	Green Practices and ESG Frameworks	Sustainable Technologies and Carbon Management
3	Entrepreneurship & Business	Start-up Management and Venture Creation	Innovation and Business Strategy	Digital Marketing
4	Holistic Development & Well-Being	Health and Nutrition for Professionals	Stress Management and Mental Well-Being	Lifestyle Management and Preventive Healthcare
5 (A)	Global Languages	French Language Module – I	French Language Module – II	French Language Module – III
5 (B)		German Language Module – I	German Language Module – II	German Language Module – III
5 (C)		Japanese Language Module -I	Japanese Language Module -II	Japanese Language Module -III

Honor offered by Artificial Intelligence and Machine Learning: Cybersecurity Analytics

Semester	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
SEM-III	25AIHNR201	Fundamentals of Cybersecurity	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-III	25AIHNR201L	Python for Security Analytics Lab	-	-	1	-	-	-	-	-	25	25	-	-	1	01
SEM-IV	25AIHNR202	Cryptography and Secure Communication	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-IV	25AIHNR202L	Cryptography and Network Security Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-V	25AIHNR301	Data Analytics for Cybersecurity	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-V	25AIHNR301L	Security Analytics and SIEM Lab	-	2	-	-	-	-	-	-	25	25	-	1	-	01
SEM-VI	25AIHNR302	Cloud and IoT Security	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-VI	25AIHNR302L	Cloud & IoT Security Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
SEM-VII	25AIHNR401	Mini Project	-	2	1	-	-	-	-	50	50	100	-	1	1	02
	Total		12	8	2	80	120	200	25	75	75	600	12	04	02	18

Double Minor: Blockchain Technology

Semester	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
SEM-III	25AIMNR201	Fundamentals of Blockchain Technology	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-III	25AIMNR201L	Programming for Blockchain Applications	-	-	1	-	-	-	25	-	-	25	-	-	1	01
SEM-IV	25AIMNR202	Smart Contracts and Decentralized Applications	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-IV	25AIMNR202L	Data Analytics and Machine Learning Basics Lab		2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-V	25AIMNR301	Blockchain Security and Cryptography	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-V	25AIMNR301L	Blockchain Security and Cryptography Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
SEM-VI	25AIMNR302	Decentralized AI and Web3 Technologies	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-VI	25AIMNR302L	Decentralized AI and Web3 Technologies Lab	-	2	-	-	-	-	-	-	25	25	-	1	-	01
SEM-VII	25AIMNR401	Blockchain Applications and Emerging Trends	2	-	-	20	30	50	-	-	-	100	2	-	-	02
			14	06	01	100	150	250	50	25	25	600	14	3	1	18

Double Minors offered by Each Department

Offering Department	Double Minor Offered	Sem-III	Sem-IV	Sem-V	Sem-VI	Sem-VII
AI & ML Engineering	Blockchain Technology	Fundamentals of Blockchain Technology	Smart Contracts and Decentralized Applications	Blockchain Security and Cryptography	Decentralized AI and Web3 Technologies	Blockchain Applications and Emerging Trends
Chemical Engineering	Environmental Engineering	Air Pollution Control	Wastewater Treatment	Solid Waste Management	Climate Change and Sustainability	Mini Project
	Energy Engineering	Introduction of Energy	Bio-energy	Electrochemical Energy	Hydrogen Fuel	Mini Project
Civil Engineering	Infrastructure Engineering	Introduction to Infrastructure Engineering	Fundamentals of Infrastructure Engineering	Smart Transportation & Urban Infrastructure	Sustainable & Resilient Infrastructure Systems	Emerging Technologies in Infrastructure Engineering
Computer Engineering	Cybersecurity Engineering	Introduction to Cybersecurity	Cryptography and Network Security	Ethical Hacking	Digital Forensics	Cryptography & Data Protection
Electrical Engineering	Renewable Energy systems	Renewable Energy Sources for Sustainable Development	Solar Photovoltaic Systems	Wind Energy Conversion Systems	Power Electronics and Control for RES	Renewable Energy: Policies, Planning & Audit
E&TC Engineering	Communication Engineering	Analog Communication	Digital Communication	Cellular Networks	Mobile Computing	Optical & Microwave Communication
VLSI D&T Engineering	Semiconductor IC Design	Digital Electronics	System Design using Verilog	Digital CMOS Design	Analog CMOS Design	AI for VLSI
Mechanical Engineering	Mechanical Systems Engineering	Fundamentals of Manufacturing	Fundamentals of Engineering metallurgy	Fundamentals of Thermal Engineering	Fundamentals of Machine Design	Sustainable and Solar Engineering
Mechanical Sandwich Engineering	Mechanical Systems Engineering	Fundamentals of Manufacturing	Fundamentals of Engineering metallurgy	Fundamentals of Thermal Engineering	Fundamentals of Machine Design	Sustainable and Solar Engineering
Robotics and Automation Engineering	Robotics and Automation Engineering	Fundamentals of Robotics and Automation	Programming for Robotics	Sensors and Actuators in Robotic Systems	Introduction to Robot Kinematics	Robot Simulation and Application

S.Y.B. Tech. Artificial Intelligence and Machine Learning (2025 Pattern)

(w.e.f. Academic Year: 2026-2027)

Curriculum Structure: Semester III

Course Category	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
PCC	25AIPCC201	Foundation of Artificial Intelligence	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25AIPCC202	Discrete Mathematics and Graph Theory	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25AIPCC203	Data Structures and Algorithms	3	-	-	20	30	50	-	-	-	100	3	-	-	03
MDM	25RAMDM201	Multidisciplinary Minor-I	2	-	-	20	30	50	-	-	-	100	2	-	-	02
OEC	25OEC201	Open Elective Course-I	2	-	-	20	30	50	-	-	-	100	2	-	-	02
PCC(L)	25AIPCC201L	Foundation of Artificial Intelligence Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
PCC(L)	25AIPCC203L	Data Structures and Algorithms Lab	-	4	-	-	-	-	25	-	25	50	-	2	-	02
VSEC	25AIVSE201	Vocational and Skill Enhancement Course-I	-	2	-	-	-	-	-	25	-	25	-	1	-	01
HSSM	25HSM201	Entrepreneurship/Economics/Management Course-I	-	-	2	-	-	-	-	-	50	50	-	-	2	02
VEC	25VEC201	Universal Human Values	-	-	2	-	-	-	-	-	50	50	-	-	2	02
ELC	25AIELC201	Community Engagement Project	-	2	-	-	-	-	-	-	25	25	-	1	-	01
Total			13	10	04	100	150	250	50	25	150	725	13	05	04	22

L: Lecture, **P:** Practical, **T:** Tutorial

CCA: Comprehensive Continuous Assessment; **ISE:** In-semester Examination; **ESE:** End Semester Examination;

PR: Practical Examination, **OR:** Oral Examination, **TW:** Term Work

Multidisciplinary Minor-I:

Sr. No.	Course Code	Course Name
1	25RAMDM201	Digital Electronics and Logic Design

Open Elective-I

Basket No.	Course Code	Course Name
1	25OEC201A	Principles of Management and Organizational Behaviour
2	25OEC201B	Circular Economy Sustainable Development
3	25OEC201C	Start-up Management and Venture Creation
4	25OEC201D	Health and Nutrition for Professionals
5 (A)	25OEC201E	French Language Module-I
5 (B)	25OEC201F	German Language Module-I
5 (C)	25OEC201G	Japanese Language Module-I

Vocational and Skill Enhancement Course-I:

Sr. No.	Course Code	Course Name
1	25AIVSE201	Digital Marketing and Social Media

Entrepreneurship/Economics/Management Courses (HSSM)-I:

Sr. No.	Course Code	Course Name
1	25HSM201A	Engineering Economics
2	25HSM201B	Entrepreneurship Development and IPR
3	25HSM201C	Project Management and Business Planning
4	25HSM201D	Financial Management for Engineers



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S.Y.B. Tech. Artificial Intelligence and Machine Learning (2025 Pattern)

(w.e.f. Academic Year: 2026-2027)

Curriculum Structure: Semester IV

Course Category	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
PCC	25AIPCC204	Database Management Systems	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25AIPCC205	Foundation of Machine Learning	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25AIPCC206	Object Oriented Programming and Computer Graphics	3	-	-	20	30	50	-	-	-	100	3	-	-	03
MDM	25RAMDM202	Multidisciplinary Minor-II	2	-	-	20	30	50	-	-	-	100	2	-	-	02
OEC	25OEC202	Open Elective Course-II	2	-	-	20	30	50	-	-	-	100	2	-	-	02
PCC(L)	25AIPCC204L	Database Management Systems Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
PCC(L)	25AIPCC205L	Foundation of Machine Learning Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
PCC(L)	25AIPCC206L	Object Oriented Programming and Computer Graphics Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
VSEC	25AIVSE202	Vocational and Skill Enhancement Course-II	-	2	-	-	-	-	-	-	25	25	-	1	-	01
ACE	25AEC201	Modern Indian Language (MIL)	2	-	-	-	-	-	-	25	25	50	2	-	-	02
HSSM	25HSM202	Entrepreneurship/Economics/Management Course-II	-	-	2	-	-	-	-	-	50	50	-	-	2	02
VEC	25VEC202	Indian Constitution and Governance	-	-	1	-	-	-	-	-	25	25	-	-	1	01
Total			15	08	03	100	150	250	50	50	125	725	15	04	03	22

L: Lecture, **P:** Practical, **T:** Tutorial

CCA: Comprehensive Continuous Assessment; **ISE:** In-semester Examination; **ESE:** End Semester Examination;

PR: Practical Examination, **OR:** Oral Examination, **TW:** Term Work

Multidisciplinary Minor-II:

Sr. No.	Course Code	Course Name
1	25RAMDM202	Internet of Things

Open Elective-II:

Basket No.	Sr. No.	Course Code	Course Name
1	1	25OEC202A	Leadership and Team Dynamics
2	2	25OEC202B	Green Practices and ESG Frameworks
3	3	25OEC202C	Innovation and Business Strategy
4	4	25OEC202D	Stress Management and Mental Well-Being
5 (A)	5	25OEC202E	French Language Module-II
5 (B)	6	25OEC202F	German Language Module-II
5 (C)	7	25OEC202G	Japanese Language Module-II

Vocational and Skill Enhancement Course-II:

Sr. No.	Course Code	Course Name
1	25AIVSE202	Data science and Visualization Techniques

Entrepreneurship/Economics/Management Courses (HSSM)-II:

Sr. No.	Course Code	Course Name
1	25HSM202A	Business Fundamentals for Entrepreneurs
2	25HSM202B	Entrepreneurship and Start-ups
3	25HSM202C	Fundamentals of Accounting and Finance
4	25HSM202D	Business Intelligence and Analytics

Modern Indian Language (MIL)

Sr. No.	Course Code	Course Name
1	25AEC201A	Marathi
2	25AEC201B	Sanskrit



AISSMS

COLLEGE OF ENGINEERING

ज्ञानम् सकलजनहिताय

An Autonomous Institute Affiliated with
Savitribai Phule Pune University

Accredited by NAAC with "A+" Grade | NBA - 7 UG Programmes



S.Y.B. Tech. Artificial Intelligence and Machine Learning (2025 Pattern)

Curriculum Structure: Semester III

(With effect from Academic Year 2026-27)

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (PCC): Foundation of Artificial Intelligence										Course Code: 25AIPCC201			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	20	30	50	-	-	-	100	3	-	-	3
Prerequisite:													
Programming and Problem Solving													
Course Objectives:													
1. Introduce students to the fundamental concepts of Artificial Intelligence, its applications, and ethical considerations. 2. To understand Problem Solving using various peculiar search strategies for AI 3. To introduce students to adversarial search strategies used in game-playing AI and familiarize them with constraint satisfaction techniques essential for solving combinatorial problems in AI 4. To acquaint with the fundamentals of knowledge and reasoning 5. To develop a mind to solve real world problems unconventionally with optimality.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain the fundamentals of AI and its various applications in real-world scenarios. CO2. Build smart system using different informed search / uninformed search or heuristic approaches CO3. Design AI systems using adversarial search algorithms and solve problems using constraint satisfaction techniques for structured environments CO4. Apply knowledge and reasoning algorithms for real-world problem-solving. CO5. Represent complex problems with expressive yet carefully constrained language of representation.													
Course Contents													
Unit I	Fundamentals of Artificial Intelligence										08 Hours		
Introduction: A.I. Representation, Non-AI & AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, Types of production systems, Turing Test. Intelligent Agents: Agent and environment, Rationality, PEAS description (Performance measure, Environment, Actuators, Sensors). Types: Simple Reflex, Model-based, Goal-based, Utility-based problem-solving agents, problem formulation. Formulation of problems: Vacuum world, 8 queens, Route finding, robot navigation. AI in Problem Solving: State Space Representation, AI Ethics and Challenges Case studies: AI Applications with demonstrations like sentiment analysis, Obstacle detection etc.													
Unit II	Problem Solving based on Searching										08 Hours		
Problem Formulation: State space, initial state, goal state, operators, path cost. Uninformed Search Strategies: Breadth-First Search (BFS), Depth-First Search (DFS), Uniform Cost Search, Iterative Deepening DFS.													

Informed (Heuristic) Search: Heuristic functions (admissibility, consistency), Greedy Best-First Search, A* Search Algorithm. Performance Metrics: Completeness, Optimality, Time, and Space complexity Case Studies: A* in GPS Navigation, Airline Crew Scheduling Using Hill Climbing		
Unit III	Adversarial Search and Constraint Satisfaction	08 Hours
Adversarial Search: Game Theory, Optimal Decisions in Games, the minimax algorithm, Optimal decisions in multiplayer games, Alpha-Beta Pruning, Evaluation functions, Cutting off search, Games with an Element of Chance. Logical Agents – Knowledge-Based agents, Heuristic Alpha-Beta Tree Search, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms, Constraint Satisfaction Problems (CSP): Graph Colouring problem, Water Jug Problem, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs. Case Studies: Google DeepMind – AI for Energy Efficiency in Data Centers and Game Playing (e.g., AlphaGo)		
Unit IV	Knowledge and Reasoning	08 Hours
Logical Agents, Knowledge-Based Agents, The Wumpus World problem, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic, First-Order Logic , Representation Revisited, Syntax and Semantics of First Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic, Propositional vs. First-Order Inference, Unification and First-Order Inference, Forward Chaining, Backward Chaining, Resolution, Quantifying Uncertainty- Bayes Rule -Bayesian Belief Network- Approximate Inference in Bayesian networks Case Studies: BBC & Amazon Alexa – AI-Driven Interactive Media with Logic-Based Chatbots		
Unit V	Emerging Trends in AI	08 Hours
Automated and Classical Planning, Hierarchical Planning, Planning under Uncertainty, Analysis of Planning Approaches, Limits of AI, Ethics of AI, Future of AI, AI Components, Introduction of Generative AI (GPT, DALL·E), Explainable AI (XAI), Federated Learning, Edge AI, Large Language Models (LLMs) – GPT, BERT, DALL·E, ChatGPT, Prompt Engineering – Crafting effective prompts for LLMs. Case Studies: OpenAI's GPT-4 & ChatGPT – Impacts of Generative AI and Prompt Engineering		
Total Hours		40
Course Activities for Continuous Comprehensive Assessment (CCA): <i>(Any Two – CCA1 Compulsory).</i>		
CCA1		10 Marks
Application Based Course Activities (Any One) Activity 1: Intelligent Agent Design (10 Marks) Design and implement an intelligent agent for a real-world problem such as Smart Vacuum Cleaner, Route Finding Agent, Chatbot for Student Queries, or Obstacle Detection System. Demonstrate the use of PEAS description, agent architecture, and problem formulation. Activity 2: Search Algorithm Visualization (10 Marks) Implement and compare any two search algorithms such as BFS, DFS, Greedy Best First Search, or A* Search. Apply the algorithms to solve a maze problem, route finding problem, or 8-puzzle problem and analyze their performance. Activity 3: AI-Based Mini Project (10 Marks) Develop a simple AI application using available AI tools/libraries such as Sentiment Analysis, Face Detection, Spam Email Classification, or Recommendation Systems. Demonstrate the working of the developed system.		
CCA2		10 Marks

Case Study / Survey • Case Study on OpenAI GPT-4 and ChatGPT • Case Study on Google DeepMind AlphaGo • Case Study on AI-Based Sentiment Analysis Systems • Case Study on Amazon Alexa and Intelligent Voice Assistants • Case Study on AI Applications in Healthcare • Survey of Emerging Trends in Artificial Intelligence • Survey of AI in Smart Cities • Survey of AI in Autonomous Vehicles • Survey of Explainable AI (XAI) and Responsible AI • Survey of Generative AI Applications in Education and Industry • Survey of AI-Powered Recommendation Systems and Personalization Techniques	
CCA3	10 Marks
Seminar Any Topic from Unit I to V	
Text Books	
1. Artificial Intelligence: A Modern Approach, 4th US ed.by Stuart Russell and Peter Norvig. 2. A First Course in Artificial Intelligence:1st Edition By Deepak Khemani McGrawHill 3. Kothari C.R., “Research Methodology. New Age International, 2004, 2nd Ed; ISBN:13: 978-81-224-1522-3 4. Deepak Khemani: “A First Course in Artificial Intelligence”, Mc Graw Hill 5. Saroj Kaushik: “Artificial Intelligence” Cengage Publication	
Reference Books	
1. Artificial Intelligence with Python, Prateek Joshi, Packt Publication, ISBN:9781786464392 2. Artificial Intelligence: Structures and Strategies by George Luger. 3. J. Gabriel, Artificial Intelligence: Artificial Intelligence for Humans (Artificial Intelligence, Machine Learning), Create Space Independent Publishing Platform, First edition, 2016 4. Ivan Bratko: "Prolog Programming for Artificial Intelligence", 2nd Edition Addison Wesley, 1990. 5. Eugene, Charniak, Drew McDermott: "Introduction to Artificial Intelligence.", Addison Wesley 6. Patterson: “Introduction to AI and Expert Systems”, PHI 7. Nilsson: “Principles of Artificial Intelligence”, Morgan Kaufmann	
Online References	
MOOC / NPTEL Courses: 1. Fundamentals of Artificial intelligence by Prof. Shyamanta M. Hazarika (IIT Guwahati) (NPTEL) (This course covers AI and Problem Solving by Search, Problem Solving by Search, Knowledge Representation and Reasoning) https://nptel.ac.in/courses/112103280 2. An Introduction to Artificial Intelligence by Prof. Mausam (IIIT Delhi) (NPTEL) (This course covers the philosophy of AI, and how to model a new problem as an AI problem. It describes a variety of models such as search, logic, Bayes nets, and MDPs, which can be used to model a new problem) https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_cs56	

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (PCC): Discrete Mathematics and Graph Theory										Course Code: 25AIPCC202			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	20	30	50	-	-	-	100	3	-	-	3
Prerequisite:													
Basic knowledge of mathematics, problem-solving skills.													
Course Objectives:													
1. To understand the concepts of propositional and predicate logic and proof techniques used in problem solving. 2. To analyze and apply sets, relations, and functions for mathematical modeling of problems. 3. To apply counting techniques, permutations, combinations, and recurrence relations in solving combinatorial problems. 4. To understand the fundamental concepts of graphs, graph representations, paths, cycles, and connectivity. 5. To apply trees, spanning trees, and graph traversal techniques in solving computational and network problems.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Apply propositional and predicate logic to construct and evaluate valid mathematical arguments. CO2. Analyze problems using sets, relations, and functions for mathematical modeling. CO3. Solve combinatorial problems using counting techniques, permutations, combinations, and recurrence relations. CO4. Represent and analyze problems using graph theory concepts such as paths, cycles, and connectivity. CO5. Apply trees, spanning trees, and graph traversal algorithms to solve problems in computing and networks.													
Course Contents													
Unit I	Set Theory and Logic										08 Hours		
Foundations and Importance of Discrete Mathematics, Sets – Basic Set Theory (Cantor’s Set Theory), Axiomatic Set Theory, Set Operations, Size of Sets (Cardinality), Inclusion–Exclusion Principle. Types of Sets – Bounded and Unbounded Sets, Diagonalization Method, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, Power Sets. Propositional Logic – Introduction to Logic, Logical Equivalences, Applications of Propositional Logic – Converting English Statements into Logical Statements, Mathematical Induction, and Strong Mathematical Induction.													

Unit II	Relations and Functions	08 Hours
Study of Relations and Their Properties, n-ary Relations and Practical Applications, Methods of Representing Relations, Relation Closures, Equivalence Classes and Relations, Partial Ordering Relations, Partitions of Sets, Hasse Diagram Representation, Introduction to Lattices, Chains and Antichains in Ordered Sets, Transitive Closure of Relations, and Warshall's Algorithm for Computing Closures. Introduction to Functions, Injective, Surjective, and Bijective Mappings, Identity Mapping, Partial Functions, Invertible Functions, Constant Functions, and Finding Inverse Functions and Compositions of functions, The Pigeonhole Principle.		
Unit III	Counting Principles	08 Hours
Introduction to Counting Methods, Sum Rule and Product Rule, Arrangements and Selections (Permutations and Combinations), Binomial Coefficients and Related Identities, Advanced Counting Techniques, and Algorithms for Constructing Permutations and Combinations.		
Unit IV	Graph Theory	08 Hours
Fundamentals of Graph Theory, Types of Graph Structures, Methods for Representing Graphs, Graph Equivalence (Isomorphism), Connected Graphs, Eulerian and Hamiltonian Traversals, Degree-Sum Principle (Handshaking Lemma), Shortest Path Computation using Dijkstra's Algorithm, Planarity of Graphs, Vertex Coloring, and Graph Search Algorithms: BFS and DFS.		
Unit V	Trees	08 Hours
Introduction to Trees and their Properties, Binary Search Trees, Tree Traversal Techniques, Decision Trees, Prefix Codes and Huffman Coding, Cut Sets in Graphs, Spanning Trees and Minimum Spanning Trees (MSTs), Kruskal's and Prim's Algorithms for MST Construction, and Maximum Flow–Minimum Cut Theorem in Transportation Networks.		
Total Hours		40
Course Activities for Continuous Comprehensive Assessment (CCA): (Any Two – CCA1 Compulsory)		
CCA1		10 Marks
List of Course Activity Application Based Course Activities (any one) Activity 1: Logic Puzzle and Mathematical Induction Challenge (10 Marks) Unit I – Set Theory and Logic Task: Solve a real-life logic puzzle using propositional logic. 1. Convert 5 English statements into logical expressions. Activity 2: Social Network Analysis Using Graph Theory (10 Marks) Unit IV – Graph Theory Task: Create a graph representing friendships among at least 10 students. 1. Draw the graph using adjacency matrix and adjacency list. 2. Identify: - Degree of each vertex - Connected components - Euler/Hamilton path (if exists) 3. Perform BFS and DFS traversal from a selected vertex. Activity 3: Minimum Spanning Tree for Campus Network Design (10 Marks) Related Unit: Unit V – Trees Task: Consider 6–8 campus buildings as nodes. 1. Assign distances (weights) between buildings. 2. Draw the weighted graph. 3. Find the Minimum Spanning Tree using: - Kruskal's Algorithm, Prim's Algorithm 4. Compare the total network cost before and after MST implementation.		

CCA2	10 Marks
Presentation Topics - Applications of Set Theory in Computer Science - Role of sets in databases, programming, and information retrieval. - Graph Traversal Algorithms: BFS and DFS - Working principles, comparison, and applications in networking and web crawling. - Dijkstra's Algorithm and Shortest Path Problems - Concept, implementation, and real-world applications such as GPS navigation. - Graph Coloring and Its Applications - Timetable scheduling, register allocation, and frequency assignment. - Huffman Coding for Data Compression - Prefix codes, Huffman trees, and applications in multimedia compression.	
CCA3	10 Marks
Case Study / Survey - Case Study of Social Network Analysis Using Graph Theory - Representation of users and relationships as graphs and network analysis. - Survey of Transportation Networks Using Graph Theory - Analysis of road, railway, and airline networks using shortest path algorithms. - Case Study of Decision Trees in Machine Learning - Structure, construction, and applications in classification problems. - Survey of Network Design Using Minimum Spanning Trees - Applications of Prim's and Kruskal's algorithms in communication networks. - Case Study on Data Compression Techniques Using Huffman Coding - Comparison of compression methods and their effectiveness in real-world systems.	
Text Books	
C. L. Liu, "Elements of Discrete Mathematics" II, TMH, ISBN 10:0 -07-066913-9. N. Biggs, "Discrete Mathematics", 3rd Ed, Oxford University Press, ISBN 0 -19-850717-8.	
Reference Books	
- Kenneth H. Rosen, "Discrete Mathematics and its Applications" Tata McGraw-Hill, ISBN 978-0-07-288008-3. - Bernard Kolman, Robert C. Busby and Sharon Ross, "Discrete Mathematical Structures" Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450. - Narsingh Deo, "Graph with application to Engineering and Computer Science", Prentice Hall of India, 1990, 0 - 87692 - 145 - 4. - Eric Gossett, "Discrete Mathematical Structures with Proofs", Wiley India Ltd. - Sriram P. and Steven S., "Computational Discrete Mathematics", Cambridge University Press, a. ISBN 13: 978-0-521-73311-3.	
Online References	
MOOC / NPTEL Courses: - Discrete Mathematics, Prof. Sudarshan Iyengar, Prof. Neeldhara, IIT Ropar, IIT Gandhinagar (Covers Recurrence relations, Principle of Inclusion-Exclusion, Advanced Topics) https://onlinecourses.nptel.ac.in/noc20_cs82/preview - Discrete Mathematics, Prof. Sudarshan Iyengar, IIT Ropar, (Covers Counting, Set Theory, Logic, Relations, Graph Theory , Mathematical Induction and Pigionhole Principle) https://nptel.ac.in/courses/106106183	

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (PCC): Data Structures and Algorithm										Course Code: 25AIPCC203			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	20	30	50	-	-	-	100	3	-	-	3
Prerequisite:													
1. Programming and Problem Solving, Discrete Mathematics													
Course Objectives:													
The course aims to													
1. To understand various data structure and their memory requirements.													
2. To understand nonlinear data structures to solve complex problems in various domains.													
3. To build the logic to use appropriate data structure in logical and computational solutions.													
4. To understand various algorithmic strategies to approach the problem solution													
5. To suggest appropriate data structure and algorithm for graphical solutions of the problems.													
Course Outcomes:													
At the end of the course, students will be able to:													
CO1. Discriminate the usage of various structures in approaching the problem solution.													
CO2. Design the algorithms to solve the programming problems.													
CO3. Apply appropriate data structure and efficient algorithms to approach the problems of various domain.													
CO4. Use effective and efficient data structures in solving various AIML domain problems.													
CO5. Analyze the algorithmic solutions for resource requirements and optimization.													
Course Contents													
Unit I	Introduction to Linear and Non Linear Data Structures										07 Hours		
Introduction to Data Structures: Definition of data structure, Need for data structures in programming, Basic concepts of data organization, Relationship between data, information, and data structures, Real-life examples of data structures													
Classification of Data Structures: Types of Data Structures, primitive data types, their role in building complex structures, non-primitive Data Structures, Overview and characteristics, its types (linear and non-linear), Basic Operations on Data Structures, Comparison Between Linear and Non-Linear Data Structures.													
Linear Data Structures: Basic introduction of Array, Linked List, Stack, Queue, Sequential organization, Memory representation, Basic operation (insert, delete, traverse, search).													
Unit II	Linked List										07 Hours		
Introduction to Linked List: Concept, Comparison of sequential and linked organizations, Primitive operations, Realization of Linked Lists, Realization of linked list using arrays, Dynamic Memory Management, Linked list using dynamic memory management, Linked List Abstract Data Type, Linked list operations, Head pointer and header node,													

Types of linked list: Linear and circular linked lists, Doubly Linked List and operations, Circular Linked List, Singly circular linked list, Doubly circular linked list.		
Unit III	Stack and Queue	09 Hours
Stack: Basic concept, stack Abstract Data Type, Representation of Stacks Using Sequential Organization, Stack Operations, Applications of Stack- Expression Evaluation and Conversion, Polish notation and expression conversion, Postfix expression evaluation Queue: Queue as Abstract Data Type, Representation of Queue using Sequential organization, Queue Operations, Circular Queue and its advantages, Deque and its operations Stack and Queue as Linked List: Linked stack and its operations, Queue as LL and its operations.		
Unit IV	Tree	09 Hours
Tree- basic terminology, General tree and its representation, representation using sequential and linked organization, Binary tree- properties, converting tree to binary tree, binary tree traversals(recursive and non-recursive)- inorder, preorder, post order, depth first and breadth first, Operations on binary tree. Huffman Tree (Concept and Use), Binary Search Tree (BST), BST operations, Threaded binary search tree- concepts, threading, insertion and deletion of nodes in in-order threaded binary search tree, in order traversal of in-order threaded binary search tree.		
Unit V	Graph	08 Hours
Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals-depth first and breadth first, Minimum spanning Tree, Greedy algorithms for computing minimum spanning tree- Prims and Kruskal Algorithms, Dijkstra's Single source shortest path, All pairs shortest paths- Topological ordering.		
Total Hours		40
Course Activities for Continuous Comprehensive Assessment (CCA): (Any Two – CCA1 Compulsory).		
CCA1		10 Marks
Title: Application of Data Structures in AI and Machine Learning Suggested Topics (Choose Any One) Dataset Management using Linked List Store and manipulate training data records. Prediction History Management using Stack Implement undo/rollback operations for model predictions. Task Scheduling in ML Pipeline using Queue Simulate preprocessing, training, and testing tasks. Decision Tree Representation using Binary Tree Create and traverse a simple decision tree. Social Network Analysis using Graph Represent users as nodes and connections as edges. Perform BFS/DFS traversal. Shortest Path for Autonomous Agent using Graph Implement Dijkstra's Algorithm on a sample graph.		
CCA2		10 Marks
Title: Comparative Study of Data Structures for AI Applications (choose Any two) Students compare: • Array vs Linked List • Stack vs Queue • Tree vs Graph and discuss their use in: • Machine Learning • Knowledge Representation		

• Search Algorithms • Recommendation Systems	
CCA3	10 Marks
Title: Problem-solving and implementation skills Design and Implement a Decision Tree or Graph-Based AI Problem Using Appropriate Data Structures.	
Text Books	
1. Horowitz, Sahani, Dinesh Mehata, “Fundamentals of Data Structures in C++”ll, Galgotia Publisher, ISBN: 8175152788, 9788175152786. 2. Brassard & Bratley, —Fundamentals of Algorithmicsll, Prentice Hall India/Pearson Education, ISBN 13 - 9788120311312. 3. Goodrich, Tamassia, Goldwasser, —Data Structures and Algorithms in C++ll, Wiley publication, ISBN - 978-81-265-1260-7	
Reference Books	
1. Sartaj Sahani, “Data Structures, Algorithms and Applications in C++”ll, Second Edition, University Press, ISBN:81-7371522 X. 2. A. Aho, J. Hopcroft, J. Ulman, “Data Structures and Algorithms”, Pearson Education, 1998, ISBN -0-201-43578-0. 3. R. Gillberg, B. Forouzn, —Data Structures: A Pseudo code approach with C, Cenage Learning, ISBN 9788131503140	
Online References	
MOOC / NPTEL Courses: 1. Data Structures and Algorithms by Prof. Naveen Garg (IIT Delhi) (NPTEL) (Covers fundamental data structures such as arrays, linked lists, stacks, queues, trees, heaps, hashing, graphs, sorting, searching, and algorithm design techniques.) https://nptel.ac.in/courses/106102064 2. Programming and Data Structures by Dr. P. P. Chakraborty (IIT Kharagpur) (NPTEL) (Introduces programming concepts, recursion, arrays, linked lists, stacks, queues, trees, graphs, sorting, searching, and implementation of data structures.) https://nptel.ac.in/courses/106105085 3. Programming, Data Structures and Algorithms Using C by Prof. Hema A. Murthy, Prof. Shankar Balachandran, Prof. N. S. Narayanaswamy & Prof. Sudarshan Iyengar (IIT Madras) (NPTEL) (Provides a comprehensive understanding of C programming, data structures, algorithm design, recursion, sorting, searching, trees, graphs, and problem-solving techniques.) https://nptel.ac.in/courses/106106127	

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (Multidisciplinary Minor-I): Digital Electronics and Logic Design										Course Code: 25RAMDM201			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
Basic gates, Number Systems and their conversations													
Course Objectives:													
To make students understand													
1. K-map and its use to design the various applications of combinational digital circuits.													
2. Sequential logic using flip flops and their applications viz. counters, shift registers.													
3. The concepts of sequential circuits and apply them in state machines.													
4. The digital logic families.													
5. Memory systems and data converters.													
Course Outcomes:													
At the end of the course, students will be able to:													
CO1. Design combinational logic circuits.													
CO2. Explain different sequential circuits.													
CO3. Develop finite state machine models.													
CO4. Illustrate performance parameters of digital ICs.													
CO5. Describe memory systems and data converters.													
Course Contents													
Unit I	Combinational Logic Design										06 Hours		
Definition of combinational logic, Standard representations for logic functions, k-map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don't care conditions, Design Examples: Full adder, Full Subtractor, 1-bit comparator. Multiplexers, Multiplexer trees, Demultiplexer, Demultiplexer trees.													
Unit II	Sequential Logic Design										06 Hours		
1-Bit Memory Cell/latch, Difference between combinational and sequential circuits. Flip-Flops: SR Flip-Flop, JK Flip-Flop, D Flip-Flop, T Flip-Flop. Characteristic table and Excitation Table for flip flops. Introduction to Registers, Shift registers & Counters: Asynchronous (ripple) counters, Synchronous counters , up/down counters, concept of Mod-N counter.													
Unit III	State Machines										06 Hours		
Moore and Mealy machines, State diagram, State table, State reduction, State assignment, finite state machine implementation.													
Unit IV	Digital Logic Family										06 Hours		
Digital Logic Family: Performance parameters of digital ICs- fan in, fan out, noise margin, propagation delay, power dissipation. Comparison of different TTL logic families, Comparison of CMOS and TTL.													

Unit V	Memory Systems and Data Converters	06 Hours
Introduction to memory systems: RAM and ROM concepts. Types of RAM: SRAM and DRAM. Types of ROM: PROM, EPROM, EEPROM. Data Converters: Need for data conversion, Digital-to-Analog Converter (DAC) basics, Analog-to-Digital Converter (ADC) basics.		
Total Hours		30
Course Activities for Continuous Comprehensive Assessment (CCA): <i>(Any Two)</i>		
CCA1		10 Marks
Quiz based on GATE questions.		
CCA2		10 Marks
Design and simulate different digital circuits. (Some of the examples are given below) NOTE: Free Online Simulators like Circuit Verse can be used. 1. Design and Simulate Full Adder. 2. Design and Simulate Full Subtractor. 3. Design and Simulate 3 bit Binary to Gray Code Converter. 4. Design and Simulate 3 bit Gray to Binary Code Converter. 5. Design and Simulate digital comparator. 6. Design and Simulate 4:1 MUX using 2:1 MUX. 7. Design and Simulate 1:4 DEMUX using 1:2 DEMUX. 8. Minimize the given 4 variable function using K-map and simulate the same.		
CCA3		10 Marks
List of Case Study: 1. Digital Clock System. 2. Digital Code Lock System. 3. Electronic Voting Machine. 4. Digital Traffic Light Controller System. 5. ATM Security System. 6. Smart Parking System. 7. Error Detection Using Parity bits.		
CCA4		10 Marks
List of Surveys: 1. Combinational Logic Design Techniques. 2. Counters and Their Applications. 3. Analog vs Digital Systems Comparison. 4. Digital Electronics in Medical Devices. 5. Digital Electronics in Communication Systems.		
Text Books		
1. R. P. Jain, "Modern Digital Electronics", Tata Mc Graw Hill Publication. 2. Thomas Floyd, "Digital Fundamentals", Pearson Publication, India. 3. Anil K. Maini, "Digital Electronics Principles, Devices and Applications", Wiley Publication.		
Reference Books		
1. John. F. Wakerly, "Digital Design-Principles and Practices", Pearson Publication. 2. M. M. Mano, "Digital Design," Prentice Hall India.		

3. Stephen Brown, "Fundamentals of digital logic design with VHDL "Tata Mc Graw Hill Publication.

Online References

e-Books:

<https://www.mheducation.co.in/modern-digital-electronics-9789355321770-india>

NPTEL Courses

Digital Circuits by Prof. Santanu Chattopadhyay (IIT Kharagpur) (SWAYAM)

(This proposed course on digital circuits will cover all the fundamental concepts in digital design)

https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ee125

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (OE-1) (Basket No 1): Principles of Management and Organizational Behaviour										Course Code: 25OEC201A			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
1. Basic knowledge of Engineering Mathematics 2. Fundamentals of Economics and Accounting 3. Analytical and quantitative reasoning skills													
Course Objectives:													
1. To introduce the fundamental concepts, functions, and theories of management. 2. To develop an understanding of organizational behavior and individual dynamics at the workplace. 3. Evaluate leadership styles, communication processes, and team dynamics. 4. Apply decision-making, planning, organizing, and controlling techniques in practical scenarios. 5. Assess organizational culture, change management processes, and conflict resolution strategies.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain core management functions and classical as well as modern management theories. CO2. Analyze individual behavior, personality, perception, and motivation in organizational settings. CO3. Apply capital budgeting methods for evaluating engineering investment decisions. CO4. Evaluate cost of capital and capital structure decisions. CO5. Apply working capital and financial planning concepts for engineering projects..													
Course Contents													
Unit I	Introduction to Management										06 Hours		
Definition and nature of management; functions of management (planning, organizing, staffing, directing, controlling); levels of management; managerial roles and skills; evolution of management thought (classical, behavioral, modern approaches); principles of management.													
Unit II	Planning and Organizing										06 Hours		
Planning process; types of plans; decision-making process and techniques; organizing principles; organizational structure (line, functional, matrix); delegation, authority, and responsibility; centralization and decentralization.													
Unit III	Individual Behavior in Organizations										06 Hours		
Foundations of organizational behavior; personality and attitudes; perception and attribution; learning theories; motivation theories (Maslow, Herzberg, McGregor, etc.); job satisfaction and employee engagement.													
Unit IV	Group Behavior and Leadership										06 Hours		

Group dynamics; team development; communication process and barriers; leadership theories and styles; power and politics; conflict management; negotiation techniques; organizational culture.		
Unit V	Organizational Change and Development	06 Hours
Organizational change and resistance to change; change management models; organizational development; stress management; ethics and corporate social responsibility; contemporary issues in management; digital transformation and innovation in organizations.		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
1. Case Study Analysis Students analyze a real organizational problem related to planning, leadership, motivation, or change management and present solutions. 2. Group Discussion & Presentation Teams discuss management topics such as leadership styles, organizational culture, or conflict management and deliver presentations. 3. Role Play / Management Simulation Students perform role plays on manager–employee communication, negotiation, decision-making, or team management scenarios. 4. Mini Project on Organizational Study Students visit or study an organization/startup and prepare a report on management practices, hierarchy, communication, and work culture. 5. Hands-on Activity using Planning & Decision Tools Students prepare organizational charts, decision trees, SWOT analysis, project planning schedules, or management process flowcharts using practical examples.		
Text Books		
1. Robbins, S. P. & Coulter, M., Management, Pearson Education. 2. L. M. Prasad, Principles and Practice of Management, Sultan Chand & Sons.		
Reference Books		
1. Robbins, S. P. & Judge, T. A., Organizational Behavior, Pearson Education. 2. Koontz, H. & Weihrich, H., Essentials of Management, McGraw Hill. 3. K. Aswathappa, Organizational Behavior, Himalaya Publishing House. 4. Harold Koontz & Cyril O'Donnell, Principles of Management, McGraw Hill. 5. P. Subba Rao, Management and Organizational Behavior, Himalaya Publishing House.		
NPTEL/MOOCs		
1. NPTEL course on Principles of Management by Prof. Susmita Mukhopadhyay, Prof. S. Srinivasan, IIT Kharagpur. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg88 2. NPTEL course on Organizational Behaviour by Prof. M. P. Ganesh, IIT Hyderabad. https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_mg51		

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (OE-1) (Basket No 2): Circular Economy for Sustainable Development										Course Code: 25OEC201B			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
Entrepreneurship, market survey, innovation.													
Course Objectives:													
1. Understand the fundamentals principles of circular economy, sustainability, environmental systems, and resource cycles. 2. Apply sustainable development goals (SDGs), life-cycle thinking, and circular economy models in real-world contexts. 3. Develop the ability to assess materials, energy, and waste flows in businesses and communities to optimize resource use and reduce environmental impact. 4. Examine environmental governance, global sustainability policies, and circular strategies for industry and society. 5. Foster creative and practical solutions for sustainable consumption, production, and cleaner technologies.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain the fundamental principles of circular economy and sustainable development, and differentiate between linear and circular economic systems. CO2. Analyse global environmental challenges and evaluate the role of Sustainable Development Goals (SDGs) in addressing sustainability issues. CO3. Apply life cycle thinking, material flow analysis, and resource efficiency tools to assess environmental impacts of products and processes. CO4. Design and evaluate circular business models incorporating strategies such as reuse, recycling, remanufacturing, and extended producer responsibility. CO5. Assess sustainability policies, governance mechanisms, and technological interventions to propose practical solutions for sustainable development.													
Course Contents													
Unit I	Fundamentals of Circular Economy and Sustainable Development										06 Hours		
Concept of sustainable development; evolution of sustainability; environmental, social and economic dimensions (Triple Bottom Line); limitations of the linear economy (take–make–dispose model); principles of circular economy; relationship between circular economy and sustainability; planetary boundaries; ecological footprint; overview of global sustainability challenges; introduction to Sustainable Development Goals (SDGs) and their relevance to industry and society.													
Unit II	Resource Efficiency and Life Cycle Approaches										06 Hours		

Resource scarcity and resource efficiency; material flow analysis (MFA); life cycle thinking; Life Cycle Assessment (LCA) methodology and stages (goal and scope definition, inventory analysis, impact assessment, interpretation); carbon footprint and water footprint; eco-efficiency and resource productivity indicators; waste hierarchy (reduce, reuse, recycle, recover); strategies for decoupling economic growth from resource consumption		
Unit III	Circular Business Models and Industrial Applications	06 Hours
Circular business model innovation; product life extension strategies; reuse, repair, refurbishment and remanufacturing; recycling technologies; product-as-a-service (PaaS); sharing economy; eco-design and design for environment (DfE); reverse logistics and closed-loop supply chains; Extended Producer Responsibility (EPR); industrial symbiosis; sustainable manufacturing practices.		
Unit IV	Policy, Governance and Sustainable Development Frameworks	06 Hours
Environmental governance and regulatory frameworks; national and international sustainability policies; climate change mitigation and adaptation strategies; green finance and sustainable investment; Environmental, Social and Governance (ESG) reporting; corporate social responsibility (CSR); sustainable procurement practices; role of government, private sector and civil society in promoting circular economy; global environmental agreements and initiatives.		
Unit V	Tools, Technologies and Case Studies in Circular Economy	06 Hours
Emerging technologies enabling circular economy (IoT, Artificial Intelligence, blockchain for traceability); digitalization and smart resource management; sustainable supply chain management; urban circular systems and smart sustainable cities; waste-to-energy and waste-to-resource technologies; sectoral applications (manufacturing, agriculture, construction, energy); case studies of successful circular economy initiatives; challenges and future prospects of sustainable development.		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
1. Waste Audit & Recycling Survey Students conduct a survey of waste generation in campus/home and suggest recycling or reuse strategies based on circular economy principles. 2. Life Cycle Assessment (LCA) Mini Study Analyze the life cycle of a product (plastic bottle, mobile phone, paper bag, etc.) and identify environmental impacts and sustainability improvements. 3. Case Study Presentation on Circular Economy Models Teams study companies practicing circular economy, green manufacturing, or sustainable business models and present findings. 4. Hands-on Eco-Design / Upcycling Activity Students create useful products from waste or redesign an existing product using eco-design and sustainability concepts. 5. Sustainability Policy & SDG Mapping Project Students map business/industrial activities with Sustainable Development Goals (SDGs) and prepare reports on sustainable practices.		
Text Books		
1. Kirchherr, J., Reike, D., & Hekkert, M. – Conceptualizing the Circular Economy: An overview (Journal/Book compendium) 2. Ellen MacArthur Foundation – Towards the Circular Economy (Vol. 1–3) 3. (Open-access foundation reports widely used in curricula) 4. Pearce, D. & Turner, R. K. – Economics of Natural Resources and the Environment 5. Bruntland Commission Report – Our Common Future (UN document foundational to sustainability thought)		

Reference Books
1. Bocken, N. M. P., et al. – Product Design and Business Model Strategies for a Circular Economy 2. Geissdoerfer, M., et al. – The Circular Economy: A Critical Literature Review 3. McDonough, W. & Braungart, M. – Cradle to Cradle: Remaking the Way We Make Things 4. UNEP / UN Documents – Global Environmental Outlook Reports (for SDG policy context) 5. Geyer, R., et al. – Industrial Ecology and Circularity
MOOC / NPTEL Courses
1. Coursera: Sustainability and Circular Economy, Michael J. Readey, University of Colorado Boulder https://www.coursera.org/learn/sustainability-and-the-circular-economy 2. NPTEL, Environment and Development, Prof. By Prof. Ngamjahao Kipgen, IIT Guwahati https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_hs83 3. NPTEL, Education for Sustainable Development, By Prof. Atasi Mohanty, IIT Kharagpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_hs61 4. NPTEL, Environmental Planning and Management, By Prof. Sonal K. Thengane, IIT Roorkee https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ge08 5. NPTEL5 Corporate social responsibility By Prof. Aradhna Malik, IIT Kharagpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg54

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (OE-1) (Basket No 3): Start-up Management &Venture Creation										Course Code: 25OEC201C			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
Entrepreneurship, market survey, innovation													
Course Objectives:													
1. Understand the fundamentals of startup management and venture creation. 2. Develop the ability to identify, evaluate, and validate startup ideas. 3. Gain knowledge of business models, funding mechanisms, and startup operations. 4. Understand legal, ethical, and IPR aspects related to startups. 5. Build entrepreneurial skills, teamwork, leadership, and lifelong learning orientation.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain concepts, types, and lifecycle stages of start-ups and new ventures. CO2. Identify and analyze start up opportunities using market and customer discovery tools. CO3. Develop suitable business models and assess technical and financial feasibility of ventures. CO4. Apply knowledge of funding, legal, IPR, and government policies for startup creation. CO5. Prepare and present a startup business plan demonstrating teamwork, communication, ethics, and lifelong learning.													
Course Contents													
Unit I	Introduction to Startups & Venture Creation										06 Hours		
Startup: Definition, characteristics, and types, Startup vs MSME vs traditional business, Startup lifecycle and growth stages,Role of startups in innovation and economic development Case studies of successful startups (Indian & global).													
Unit II	Idea Generation, Opportunity & Market Validation										06 Hours		
Entrepreneurial mindset and ideation techniques, Problem identification and solution fit, Design Thinking and Lean Startup approach, Customer discovery and validation, Market analysis and value proposition development.													
Unit III	Business Models & Feasibility Analysis										06 Hours		
Business Model Canvas and Lean Canvas, Technical, market, and financial feasibility, Cost structures, revenue models, and break-even analysis, Risk analysis and mitigation strategies, Sustainability and ethical considerations in startups													
Unit IV	Startup Ecosystem, Funding & Legal Aspects										06 Hours		
Startup ecosystem in India and globally, Government initiatives: Startup India, MSME, SIDBI, DPIIT, Sources of funding: bootstrapping, angel investors, venture capital, crowdfunding, Legal aspects:													

company registration, compliance, Intellectual Property Rights (IPR): patents, trademarks, copyrights.

Unit V	Startup Operations, Scaling & Business Plan	06 Hours
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Team formation, leadership, and culture, Operations and scaling strategies, Marketing, branding, and customer acquisition Business plan preparation and pitch deck, Future trends, failure analysis, and lifelong learning for entrepreneurs.

Total Hours	30
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List of Course Activities for Continuous Comprehensive Assessment (Any Two):

- 1. Startup Idea Pitching Activity**
Students develop and present innovative startup ideas addressing real-world problems using value proposition concepts.
- 2. Business Model Canvas Workshop**
Hands-on preparation of Business Model Canvas (BMC) for a startup including customer segments, revenue streams, and value proposition.
- 3. Market Survey & Customer Validation**
Students conduct field/online surveys to identify customer needs, validate startup ideas, and analyze market opportunities.
- 4. Prototype / Product Demonstration**
Teams create a basic prototype, mock-up, or digital model of a product/service and demonstrate its functionality and usefulness.
- 5. Startup Business Plan Preparation**
Students prepare a practical business plan including funding requirements, marketing strategy, operational plan, and financial feasibility analysis.

Text Books

1. S. S. Khanka – Entrepreneurial Development, S. Chand & Company.
2. Vasant Desai – Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House.

Reference Books

1. Steve Blank & Bob Dorf – The Startup Owner’s Manual, Wiley.
2. Alexander Osterwalder & Yves Pigneur – Business Model Generation, Wiley.
3. Barringer & Ireland – Entrepreneurship: Successfully Launching New Ventures, Pearson.
4. Peter F. Drucker – Innovation and Entrepreneurship, Harper Business.
5. Steve Blank & Bob Dorf – The Startup Owner’s Manual, Wiley.

MOOC / NPTEL Courses

1. NPTEL1, Entrepreneurship, By Prof. C Bhaktavatsala Rao, IIT Madras
https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg70
2. NPTEL2, Entrepreneurship Essentials By Prof. Manoj Kumar Mondal, IIT Kharagpur
https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_ge08
3. NPTEL3, Innovation, Business Models and Entrepreneurship, By Prof. Vinay Sharma, Prof. Rajat Agrawal, IIT Roorkee:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_mg95
4. NPTEL4, Entrepreneurship Essentials, By Prof. Manoj Kumar Mondal, IIT Kharagpur:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ge03
5. Coursera: Technology & Entrepreneurship Specialization, Brent Sebold, Arizona State University
<https://www.coursera.org/specializations/technology-and-entrepreneurship>

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (OE-1) (Basket No 4): Health and Nutrition for Professionals										Course Code: 25OEC201D			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Course Objectives:													
1. To understand the importance of nutrition and healthy lifestyle for professionals. 2. To create awareness about balanced diet and nutritional requirements. 3. To understand lifestyle diseases and their prevention. 4. To develop healthy habits for stress management and productivity.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain the basic concepts of health and nutrition. CO2. Understand nutritional requirements and balanced diet. CO3. Identify lifestyle diseases and preventive measures. CO4. Apply principles of healthy living and stress management. CO5. Analyze the role of nutrition in improving professional productivity.													
Course Contents													
Unit I	Introduction to Health and Nutrition										06 Hours		
Concept of health and wellness Dimensions of health (physical, mental, social) Importance of nutrition for professionals Nutrients and their functions Macronutrients and micronutrients													
Unit II	Balanced Diet and Nutritional Requirements										06 Hours		
Concept of balanced diet Dietary guidelines Recommended dietary allowance (RDA) Nutritional needs during childhood, adolescence, adulthood and old age Special Nutritional needs for working professionals Vegetarian vs non-vegetarian diets Food pyramid and healthy eating habits													
Unit III	Lifestyle Diseases										06 Hours		
Causes of lifestyle diseases Obesity, diabetes, hypertension, heart disease Role of diet in prevention of diseases Importance of physical activity Nutritional management of common diseases Prevention through healthy diets and lifestyle													
Unit IV	Health Management for Professionals										06 Hours		

Work-life balance Stress and its management Role of exercise and yoga Sleep and mental health Ergonomics and workplace health		
Unit V	Food Safety and Healthy Lifestyle	06 Hours
Food hygiene and sanitation Food adulteration Safe food handling practices Sustainable and healthy eating habits Nutrition for long-term health and productivity Importance of hydration Healthy snacking options at work		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
Balanced Diet Planning Activity Students prepare a daily/weekly balanced diet chart for different age groups or working professionals based on nutritional requirements. Nutritional Analysis Survey Conduct a survey on eating habits, junk food consumption, hydration, or lifestyle diseases and analyze the collected data. Healthy Recipe Preparation / Demonstration Students prepare and present nutritious, low-cost, and healthy food recipes promoting balanced nutrition and food safety. Fitness, Yoga & Stress Management Activity Practical sessions on yoga, exercise routines, meditation, posture correction, and stress management techniques for healthy living. Food Safety & Awareness Campaign Students create posters, presentations, or awareness drives on food hygiene, adulteration detection, healthy snacking, and lifestyle disease prevention.		
Text Books		
- Srilakshmi, B., Human Nutrition, New Age International (P) Ltd., Publishers, New Delhi. - Joshi, Shubhangini A., Nutrition and Dietetics: With Indian Case Studies, 5th Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2021.		
Reference Books		
- Swaminathan, M., Food and Nutrition, Bangalore Printing & Publishing Co. Ltd., Bangalore. (You may verify the exact edition/year available in your library before finalizing.) - Swaminathan, M., Essentials of Food and Nutrition, Vol. I & II, Ganesh & Co., Madras, 1974.		
MOOC / NPTEL Courses /Online Resources:		
- Adolescent Health and Well-Being: A Holistic Approach by By Prof. Sumana Samanta, Prof. Parmeshwar Satpathy, IIT Kharagpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ge102 - Diet Management in Health and Disease by By Dr. Vipparti Vijaya Lakshmi, The English and Foreign Languages University: https://onlinecourses.swayam2.ac.in/e-learning/preview/cec25_hc01 - Food and Nutrition by By Dr. Asna Urooj, University of Mysore: https://onlinecourses.swayam2.ac.in/e-learning/preview/cec19_ag02		

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (OE-1) (Basket No 5 (A)): French Language Module-I										Course Code: 25OEC201E			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Course Objectives:													
1. To identify basic French vocabulary and pronunciation.													
2. To develop elementary listening and speaking skills in French.													
3. To construct simple French sentences using basic grammar.													
4. To apply French language skills in everyday communication.													
5. To build a foundation for further learning of the French language.													
Course Outcomes:													
At the end of the course, students will be able to:													
CO1. Identify basic French vocabulary and pronunciation.													
CO2. Use simple French expressions for self-introduction and basic interactions.													
CO3. Read and write simple French sentences.													
CO4. Communicate in familiar everyday situations using basic French.													
CO5. Demonstrate awareness of French culture and etiquette.													
Course Contents													
Unit I	Introduction au français (Introduction to French)										06 Hours		
French alphabet and pronunciation Greetings and introductions Numbers (1-100), days and months Classroom expressions													
Unit II	Parler de ses loisirs et de sa famille (Talking about his hobbies and his family)										06 Hours		
Talking about a hobby (Vocab: Activities, expressions + Aimer) Family and friends (Grammar: Subject pronouns, ER ending verbs, Family relations)													
Unit III	La France (France)										06 Hours		
Reading about French city Asking simple questions about France Writing a post card (Vocab: Information on France and it's cities, interrogative words.)													
Unit IV	Au café! (At the cafe!)										06 Hours		
Ordering in French Fruits and vegetables Quantities													

Expressions of politeness		
Unit V	Faire une invitation (Make an invitation)	06 Hours
Letter writing Organising a party Accepting / refusing an invitation Role play activities		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
1. Self-introduction in French: Students introduce themselves using simple French sentences. 2. Greetings and Classroom Conversation: Students practice basic greetings and classroom expressions in French. 3. Listening Comprehension Exercise: Students listen to short French audio clips and answer simple questions. 4. Picture Description in French: Students describe a given picture using basic French vocabulary. 5. French Culture Presentation: Students give a short presentation on French culture, food, or festivals.		
Text Books		
1. Alter Ego A1 – Hachette (Goyal Publishers) 2. Latitude 1 – Didier (Goyal Publishers)		
Reference Books		
1. Myrna Bell Rochester, “Easy French Step-By-Step: Master High-Frequency Grammar for French Proficiency—Fast”, McGraw Hill, ISBN-13 : 978-0071453875 2. Eugene Jackson, Antonio Rubio, Julien J. Lafontant, Pamela Haze, “French Made Simple”, Crown Publication, ISBN-13 : 978-0767918596 3. Claire Miquel, “Communication Progressive du Français A1”, Cle International, Atlantic Publishers and Distributors (P) Ltd., 7/22, Ansari Road, Darya Ganj, New Delhi – 110002 4. Ranjit, Mahita & Singh, Monica, Apprenons le français', Part 1, Saraswati House Pvt. Ltd., New Delhi. Second Revised Edition, 2007 5. Ranjit, Mahita & Singh, Monica, Cahier d'exercices', (Apprenons le français) 1., Saraswati House Pvt. Ltd., New Delhi. Second Revised Edition, 2007		
Online Resources		
1. https://www.elearningfrench.com/ 2. https://www.laits.utexas.edu/fi/index.html 3. https://blog.rosettastone.com/french-accent-marks/ 4. https://www.frenchcircles.ca/online-free-french-resources/ 5. Proficiency course in French By Prof. Nirupama Rastogi (Retd): https://onlinecourses.swayam2.ac.in/e-learning/preview/cec19_lg04 6. Foundations of French by Ramya Jagannathan: https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg73 7. The Complete French Course : Learn French – Beginners : https://www.udemy.com/course/french-for-beginners-a1/?couponCode=PMNVD2025 8. Complete French Course: Learn French for Beginners: https://www.udemy.com/course/complete-french-course/?couponCode=PMNVD2025		

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (OE-1) (Basket No 5 (B)): German Language Module-I										Course Code: 25OEC201F			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Course Objectives:													
1. To identify basic German vocabulary and pronunciation. 2. To develop elementary communication skills in German. 3. To construct simple German sentences using basic grammar. 4. To apply German language skills in everyday communication. 5. To develop awareness of German culture and traditions.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Identify basic German vocabulary and pronunciation. CO2. Use simple German expressions for basic communication. CO3. Read and write elementary German sentences. CO4. Apply common German phrases in everyday situations. CO5. Demonstrate awareness of German culture and traditions.													
Course Contents													
Unit I	Willkommen! (Welcome!)										06 Hours		
Topics and Vocabulary - Greetings - Introductions - Numbers - Countries & languages Grammar - Alphabet - Pronunciation - Personal pronouns Skills - Speaking: self-introduction - Listening: simple conversations - Reading: name cards, dialogues - Writing: short introduction paragraph													
Unit II	Familie, Freunde und ich (Family, Friends and I)										06 Hours		
Topics and Vocabulary - Family members - Hobby and work Grammar - Nominative case - Articles- der, die, das •Regular verb conjugation Skills													

• Speaking: describe family, ask about profession, introduce others • Reading: small paragraphs about nuclear and joint families Activity • Family tree presentation		
Unit III	Orte und Dinge (Places and things)	06 Hours
Topics and Vocabulary • Household objects • Classroom objects • Office equipment • Nature vocabulary • Public places Grammar • Sentence structure • Definite articles- der, die, das • Indefinite articles- ein, eine, ein • Negative markers- kein, keine, kein, nicht Skills • Speaking: describing surroundings and objects • Reading: simple descriptive passages and labels • Writing: short descriptions using simple sentences Activities • Vocabulary Hunt • Mystery Object Game • Picture Description		
Unit IV	Studentenleben & Alltag (Student life & everyday life)	06 Hours
Topics and Vocabulary • Daily routine • University life • Subjects • Time expressions Grammar • Time • Nominative case- personal pronouns • Nominative case- possessive Pronouns Skills • Speaking and Writing: daily routine discussion Listening: Schedules at university and at the work place		
Unit V	Revision & Mini Project	06 Hours
Integrated Skills Students prepare: • Self-introduction • Poster • Dialogue • Simple presentation Suggested Project My dream study trip to Germany/ Cultural connectivity between Germany and India/ Any other topic related to German language and culture. Assessment • Speaking viva • Listening test		

• Vocabulary quiz • Listening exercises • Pronunciation practice • Role play activities	
Total Hours	30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):	
1. Self-introduction in German: Students introduce themselves using simple German sentences. 2. Greetings and Basic Conversation: Students practice greetings and everyday expressions in German. 3. Listening Comprehension Exercise: Students listen to short German audio clips and answer questions. 4. Picture Description in German: Students describe simple pictures using basic German vocabulary. 5. German Culture Presentation: Students present topics related to German culture, food, or festivals.	
Text Books	
1. Stefanie Dengler, “Netzwerk A1 (Textbook + Workbook + Glossar)”, Hachette , ISBN: 9788183077033, (Goyal Publishers) 2. Monika Reimann Daniela Niebisch , Sylvette Penning-Hiemstra , Angela Pude , Franz Specht , Monika Bovermann, “ Schritte international Neu 1: Deutsch als Fremdsprache / Kursbuch + Arbeitsbuch mit Audios online”, Hueber Publications, GOYAL Publishers & Distributors Pvt. Ltd, ISBN-13 : 978-3193610829	
Reference Books	
1. Deepak Kushwaha, “German Made Easy Part 1 + German Made Easy Part 2 with Answer”, Goyal Publishers 2. Arnold Leitner, “German Made Simple”, Crown Publications, Penguin Random House India Pvt Ltd 3. Kurs Und Übungsbuch, “Studio-D A1 - Combo of 3 (German)”, Goyal Publishers & Distributers 4. Funk and Kuhn, “Studio D A1 Deutsch Buch “, Cornelsen Verlag (Goyal Publishers India)	
Online Resources	
1. Learn German Language: Complete German Course – Beginners (Udemy): https://www.udemy.com/course/complete-german-course-learn-german-for-beginners/ 2. German A1 - German For Complete Beginners!: https://www.udemy.com/course/german-for-complete-beginners/?couponCode=PMNVD2025 3. DW Learn German: https://learngerman.dw.com/en/learn-german/s-9528 4. Practice German for free (Goethe-Institut Resources): https://www.goethe.de/en/spr/ueb.html 5. Duolingo German: https://www.duolingo.com/course/de/en/Learn-German	

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (OE-1) (Basket No 5 (C)): Japanese Language Module-I										Course Code: 25OEC201G			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Course Objectives:													
1. To identify basic Japanese pronunciation, scripts, and vocabulary. 2. To develop elementary listening and speaking skills in Japanese. 3. To construct simple Japanese sentences using basic grammar. 4. To apply simple Japanese expressions in everyday communication. 5. To develop awareness of Japanese culture and etiquette.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Identify basic Japanese pronunciation, scripts, and vocabulary. CO2. Use simple Japanese expressions for basic communication. CO3. Read and write basic Japanese characters and sentences. CO4. Participate in elementary conversations using simple Japanese expressions. CO5. Demonstrate awareness of Japanese culture and etiquette.													
Course Contents													
Unit I	Nihongo nyūmon (Introduction to Japanese)										06 Hours		
Hiragana and Katakana Greetings and introductions Numbers and dates Pronunciation practice													
Unit II	Kihon-tekina bunpō to goi (Basic Grammar and Vocabulary)										06 Hours		
Sentence patterns Particles Basic verbs Pronouns and nouns													
Unit III	Nichijō no komyunikēshon (Everyday Communication)										06 Hours		
Self-introduction Family and hobbies Daily activities Asking simple questions Kanji –Lesson 1 (Textbook 1)													
Unit IV	Dokkairyoku to sakubun nōryoku (Reading and Writing Skills)										06 Hours		
Reading simple scripts Vocabulary exercises Writing practice Sentence construction													

Kanji –Lesson 2 (Textbook 1)		
Unit V	Risuningu to supīkingu no renshū (Listening and Speaking Practice)	06 Hours
Listening exercises Pronunciation practice Role play activities Guided communication Kanji –Lesson 3 (Textbook 1)		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
1. Self-introduction in Japanese: Students introduce themselves using simple Japanese expressions. 2. Greetings and Classroom Conversation: Students practice basic greetings and classroom communication in Japanese. 3. Listening Comprehension Exercise: Students listen to short Japanese audio clips and answer simple questions. 4. Picture Description in Japanese: Students describe pictures using simple Japanese vocabulary. 5. Japanese Culture Presentation: Students present topics related to Japanese culture, food, or festivals.		
Text Books		
1. 3A Corporation, “Minna No Nihongo 1-1,1-2,2-1,2.2 Main Textbook elementary”, ISBN-13: 9789388141147, Goyal Publishers & Distributors Pvt. Ltd, India 2. Eri Banno, Yoko Ikeda, Yutaka Ohno, Chikako Shinagawa, Kyoko Tokashiki, “Genki 1 Textbook: An Integrated Course in Elementary Japanese”, ISBN-13 : 978-4789014403		
Reference Books		
1. The Japan Foundation, “Marugoto: Japanese Language and Culture Starter A1 Coursebook for Communicative Language Activities”, Goyal Publishers 2. The Japan Foundation, “Marugoto Starter (A1) Rikai - Course Book For Communicative Language Competences”, Goyal Publishers, ISBN-13: 9788183078047 3. The Japan Foundation, “Marugoto Starter (A1) Katsudoo”, Goyal Publishers 4. “Japanese for Busy People,3rd edition”, Association for Japanese Language Teaching, Kodansha Tokyo Japan Kodansha International, November, 2011., 5. Tae Kim, “A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar”, Createspace Independent Pub, ISBN-13 : 978-1495238963, Bookswagon, 2/13 Ansari Road, Daryaganj, New Delhi 110002 6. Nyumon Nihongo- ALC Press, U.K 7. Nihongo Soomatome N5, ASK Publishing, Tokyo		
Online Resources		
1. Introduction to Japanese Language And Culture: Prof Vatsala Misra, IIT Kanpur (NPTEL) https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_hs83 2. Online Japanese Beginner Course (Udemy): https://www.udemy.com/course/online-japanese-beginner-course 3. JF-Japanese e-learning: https://minato-jf.jp/ 4. Learn Japanese Language: Free Online Courses: https://www.busuu.com/en/course/learn-japanese-online		

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (PCC(L)): Artificial Intelligence Lab										Course Code: 25AIPCC201L			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	25	25	-	1	-	1
Prerequisite:													
Fundamentals of Data Structures, Discrete Structures and Graph Theory													
Course Objectives:													
1. Apply heuristic search techniques like A* and Hill-Climbing for AI problem solving. 2. Analyze and implement AI algorithms for planning and decision-making tasks. 3. Develop intelligent systems using expert systems and PROLOG concepts. 4. Demonstrate NLP, logical reasoning, and knowledge representation skills..													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Apply heuristic search algorithms for solving classical AI problems. CO2. Analyze and implement AI decision-making and planning techniques. CO3. Design expert systems using rule-based approaches and PROLOG. CO4. Apply NLP and predicate logic for intelligent system development.													
List of Experiments: Perform any 8 of 11 and Mini project is compulsory													
1. Implement Tic-Tac-Toe using A* algorithm 2. Implement 3 missionaries and 3 cannibal problems depicting appropriate graphs. Use A* algorithm. 3. Solve 8-puzzle problem using A* algorithm. Assume any initial configuration and define goal configuration clearly. 4. Define the operators for controlling domestic robots; use these operators to plan an activity to be executed by the robot. For example, transferring two/three objects one over the other from one place to another. Use Means-Ends analysis with all the steps revealed. 5. Implement any one of the following Expert System, Medical Diagnosis of 10 diseases based on adequate symptoms Identifying birds of India based on characteristics 6. Implement alpha-beta pruning graphically with proper examples and justify the pruning. 7. Implement syntax analysis for assertive English statements. The stages to be executed are, · Sentence segmentation · Word tokenization · Part-of-speech/morpho syntactic tagging · Syntactic parsing (Use any of the parser 8. Use Heuristic Search Techniques to Implement Hill-Climbing Algorithms. 9. Implementation predicate logic using PROLOG 10. Implementation of Expert system using PROLOG Note: Total 8 assignments to be implemented. Experiments 9 and 10 are mandatory.													

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (PCC(L)): Data Structures and Algorithm Lab										Course Code: 25AIPCC203L			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	4	-	-	-	-	25	-	50	25	-	2	-	2
Prerequisite:													
Programming and Problem Solving													
Course Objectives:													
1. Understand the implementation and applications of non-linear data structures. 2. Identify suitable data structures for real-world problem solving. 3. Analyze advanced data structures, sorting algorithms, and file organization techniques.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Identify suitable data structures and algorithms for problem solving. CO2. Apply and analyze non-linear data structures for complex problems. CO3. Analyze data structure efficiency for effective engineering solutions.													
List of Experiments													
1. It is decided that weekly greetings are to be furnished to wish the students having their birthdays in that week. The consolidated sorted list with desired categorical information is to be provided to the authority. Write a program for array of structures to store students PRNs with date and month of birth. Let Array A and Array B be the two arrays for two SE AIML_ divisions. Arrays are sorted on date and month. Merge these two arrays into third array Array SE_AIML_DOB resulting in sorted information about Date of Birth of SE AIML students. 2. Second year Computer Engineering class, set A of students like Vanilla Ice-cream and set B of students like butterscotch ice-cream. Write a program to store two sets using linked list. compute and display- - Set of students who like either vanilla or butterscotch or both - Set of students who like both vanilla and butterscotch - Set of students who like only vanilla not butterscotch - Set of students who like only butterscotch not vanilla - Number of students who like neither vanilla nor butterscotch 3. Implement a program for expression conversion as infix to postfix and its evaluation using stack based on given conditions - Operands and operator, both must be single character. - Input Postfix expression must be in a desired format. - Only '+', '-', '*' and '/' operators are expected a. Pizza parlor accepting maximum M orders. Orders are served in first come first served basis. Order once placed cannot be cancelled. Write a program to simulate the system using circular queue using array.													

- b. A Dictionary stores keywords & its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Binary Tree for implementation.
- c. Beginning with an empty binary search tree, Construct binary search tree by inserting the values in the order given. After constructing a binary tree -
 - i. Insert new node,
 - ii. Find number of nodes in longest path from root,
 - iii. Minimum data value found in the tree,
 - iv. Change a tree so that the roles of the left and right pointers are swapped at every node,
 - v. Search a value
- d. Represent a given graph using adjacency matrix/list to perform DFS and using adjacency list to perform BFS. Use the map of the area around the college as the graph. Identify the prominent land marks as nodes and perform DFS and BFS on that.
- e. There are flight paths between cities. If there is a flight between city A and city B then there is an edge between the cities. The cost of the edge can be the time that flight takes to reach city B from A, or the amount of fuel used for the journey. Represent this as a graph. The node can be represented by airport name or name of the city. Use adjacency list representation of the graph or use adjacency matrix representation of the graph. Justify the storage representation used.

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (Vocational and Skill Enhancement Course-I): Digital Marketing and Social Media										Course Code: 25AIVSE201			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	25	-	25	-	1	-	1
Prerequisite:													
Understanding design thinking and planning is essential.													
Course Objectives:													
1. This course aims at enabling students, 2. Understand the core concepts of digital, mobile, and email marketing. 3. Gain familiarity with commonly used digital marketing tools and develop practical skills to use them effectively. 4. Learn to strategically select and implement appropriate marketing tools based on objectives and target audiences.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Understand the core concepts of Digital, Email, and Mobile Marketing. CO2. Apply digital marketing tools and techniques, including SEO and social media marketing, for effective campaigns. CO3. Implement strategic digital advertising using tools like Mailchimp, WordPress, Google Ads, Canva, and YouTube to create engaging content and campaigns..													
Course Deliverables for Practical Sessions													
Introduction to Digital marketing The Concept, Need & Evolution of Digital Marketing, Reason for growing Importance of Digital Marketing in India, Digital Marketing: Types & Examples. The concept of Digital Marketing Mix, 7 P's of Online Marketing: Product, Price, Promotion, Place People, Process, Physical evidence, Methods of Online Marketing promotion. Case Study on Digital Marketing.													
Social Media Analytics Types of Analytics in Social Media: Analytics, Listening, Advertising Analytics, Analytics from CMS and CRM, The Analytics Process, Metrics, Dashboards, and Reports. Google Analytics Features, Benefits, and Limitations, Google Analytics Reports, Creating custom reports, Dashboard and Segments.													
Key Performance Indicators Selecting and Preparing KPIs, Pages and Landing Pages, Event Tracking and AdSense, Site Search, Optimizing Your Search Engine Marketing Consumer Generated Contents (CGC), Impact of social media, Advantages and Disadvantages of social media, Types of social media, social media for Business use, Community Building Principles.													
DM tools Overview of Hootsuite: Dashboard and Features, Social Media Listening and Monitoring,													

Social Media Publishing and Scheduling. Campaign using Mailchimp: Overview of Mailchimp Features and Interface, Building Email Lists and Segmentation, Creating Email Campaigns: Templates and Content Design. Advertising tools: Google Ads, Canva Interface.

List of Assignment (Note: Any 6 Assignment)

1. Keyword Research and SEO Optimization

Using SEO tools such as SEMrush, conduct keyword research for a specific industry or topic: Create a list of high-volume and relevant keywords, and propose on-page and off-page SEO optimizations for a hypothetical website based on the keyword research findings.

2. Social Media Content Calendars

Select a social media management tool like Hootsuite. Plan and create a social media content calendar for a one-week period, including content types, posting schedule, and target audience segments. Use the scheduling feature of the chosen tool to schedule posts across different Social media platforms.

3. Email Marketing Campaign

Choose an email marketing platform such as Mailchimp or Constant Contact. Design and execute an email marketing campaign for a fictional product or service. Create email templates, segment the email list, and schedule the campaign. Analyze the campaign performance metrics such as open rates, click-through rates, and conversions

4. Social Media Advertising Campaign

Create a Facebook Business Manager account. Develop a social media advertising campaign on Facebook or Instagram for a chosen target audience. Define campaign objectives, audience targeting criteria, ad formats, and budget allocation. Monitor campaign performance metrics Such as reach, engagement, and conversion rates.

5. Leveraging Instagram Influencers for Brand Promotion

Create an Instagram influencer outreach plan to promote a new line of eco-friendly skincare products, aiming to increase brand visibility and drive online sales among environmentally- conscious consumer

6. Creating Canva Designs for YouTube Channel Branding

Design graphics for branding a YouTube channel focused on cooking tutorials. The channel name is "Tasty Bites Kitchen." The graphics to be created include a channel banner, a profile Picture (channel logo), and a thumbnail template for video thumbnails.

7. Understand web analytics using tools like Google Analytics

Analyze website performance using Google Analytics and identify areas for optimization and improvement

8. Create website using Word Press

Using Word press Plug-ins- Different Plug-ins, social media Plug-ins, page builder plug-ins: the elementor, how to insert a section, Google Micro sites create a website.

Text Books

1. The digital marketing Handbook, A step by step guide, Mohit Pawar, 2015 Edition.
2. Advanced Web Metrics with Google Analytics, SYBEX, Brian Clifton, Second Edition. Social Media Analytics Strategy,Alex Goncalves, Apress

Reference Books

1. Ian Dodson, The art of Digital Marketing, 2016, Wiley, 978-1-119-26570-2.
2. Vandana Ahuja, Digital Marketing, Oxford University Press,2015,ISBN-10. ISBN:0199455449.

Online Resources:

e Courses

1. https://skillshop.exceedlms.com/student/collection/648385-digital_marketing
2. <https://www.coursera.org/courses?query=digital%20marketing>

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (HSSM)-I: Engineering Economics										Course Code: 25HSM201A			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	50	-	-	50	-	-	2	2
Prerequisite:													
1. Basic Mathematics 2. Basic Economics 3. General Engineering Knowledge													
Course Objectives:													
1. To develop a comprehensive understanding of the principles of engineering economics among students. 2. To equip students with analytical skills and knowledge required for evaluating engineering projects. 3. To build a fundamental understanding of accounting principles, financial analysis, and various funding strategies. 4. To enable students to understand market structures, pricing strategies, and the impact of government policies and economic factors. 5. To examine the role of engineers in industrialization and economic development.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Apply engineering economic concepts such as cost analysis, time value of money, break-even analysis, and investment evaluation. CO2. Use cost estimation techniques, evaluate asset depreciation, perform capital budgeting, and carry out replacement analysis. CO3. Interpret financial statements, analyze financial ratios, evaluate different sources of finance, manage working capital, and perform project appraisal. CO4. Analyze various market structures and pricing strategies, and assess the impact of government policies, taxation, and inflation on engineering projects. CO5. Analyze emerging trends such as circular economy concepts and Industry 4.0 from an economic perspective.													
Course Contents													
Unit I	Introduction to Engineering Economics										06 Hours		
Basic Concepts: Definition and importance of engineering economics, principles and applications in decision making, cost estimation, investment analysis, profitability assessment, resource optimization, risk management, comparison with traditional economics, and overview of microeconomics and macroeconomics. Cost Concepts: Fixed, variable, marginal, sunk, and opportunity costs. Time Value of Money: Present worth, future worth, annuities, and compounding techniques. Break-even Analysis: Cost–volume–profit (CVP) analysis and contribution margin.													

Unit II	Cost Estimation and Capital Budgeting	06 Hours
Cost Estimation Techniques: Direct and Indirect Costs, Overheads Depreciation Methods: Straight Line, Declining Balance, and Sum of Years' Digits Capital Budgeting: Payback Period, Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index Replacement Analysis: Economic Life and Useful Life of Equipment		
Unit III	Financial Management and Accounting	06 Hours
Basic Accounting Principles: Balance Sheet, Profit and Loss Statement, Cash Flow Financial Ratios: Liquidity, Profitability, and Solvency Ratios Sources of Finance: Equity, Debt, Venture Capital, Working Capital Management Project Appraisal: Feasibility Studies, Risk Analysis in Investment Decisions		
Unit IV	Market Structures and Economic Decision Making	06 Hours
Market Structures: Perfect competition, monopoly, oligopoly, and monopolistic competition. Pricing Strategies: Cost-based pricing, market-based pricing, penetration pricing, and skimming pricing. Government Policies and Taxation: GST, income tax, corporate tax, and industrial incentives. Inflation: Concept of inflation and its impact on engineering projects		
Unit V	Industrial Economics and Engineering Ethics	06 Hours
Industrialization and Economic Development: Role of engineers in economic growth. Public and Private Sector Enterprises: Comparison of public sector and private sector enterprises. Engineering Ethics and Professionalism: Corporate social responsibility (CSR) and sustainable development. Emerging Trends: Green economics, circular economy, Industry 4.0, and their economic impacts.		
Total Hours		30
Course Activities for Term Work evaluation:		
1. Cost Estimation and Budgeting Exercise Students prepare detailed cost estimates for a simple engineering product or project including material, labour, overhead, and profit calculations using practical data. 2. Case Study on Engineering Economic Decisions Students analyze real-life engineering projects related to investment decisions, cost control, depreciation, or resource allocation and present economic solutions. 3. Capital Budgeting and Financial Analysis Activity Students perform Payback Period, NPV, and IRR calculations for different investment alternatives using spreadsheets and interpret the results. 4. Market Survey and Pricing Strategy Analysis Students conduct a survey on pricing methods, market competition, and consumer demand for engineering products and prepare an analytical report. 5. Mini Project on Industrial Economics and Sustainability Students study an industry or startup and prepare a report on production systems, financial planning, CSR activities, green economics, or Industry 4.0 practices.		
Text Books		
1. Engineering Economics by R. Panneerselvam Publisher- PHI learning private limited 2. "Engineering Economy (16th Edition)" by William G. Sullivan & Elin M. Wicks 3. "Fundamentals of Engineering Economics (2nd Edition)" by Chan S. Park 4. "Principles of Engineering Economic Analysis" by John A. White, Kenneth E. Case, David B. Pratt		

Reference Books

1. Principles of Engineering Economy by Eugene L. Grant
2. Engineering Economy: Analysis of Capital Expenditures by Gerald W. Smith
3. Applied Economic Analysis for Technologists, Engineers, and Managers by Michael S. Bowman
4. Engineering Economics for Capital Investment Analysis by Tung Au and Thomas P. Au
5. Schaum's Outline of Engineering Economics by Jose A. Sepulveda and William E. Souder

MOOC / NPTEL Courses/Online Resources:

1. Engineering Economic Analysis – NPTEL (IIT Roorkee) by Prof. Pradeep K. Jha:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_me98
2. Project Management for Managers by By Prof. Mukesh Kumar Barua, IIT Roorkee:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_mg71
3. Financial Accounting By Prof. Puran Singh, IIT Mandi:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_mg65
4. Introduction to Market Structures By Prof. Amarjyoti Mahanta, IIT Guwahati:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_hs84
5. Ethics in Engineering Practice By Prof. Susmita Mukhopadhyay, IIT Kharagpur:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg42

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (HSSM)-I: Entrepreneurship Development and IPR										Course Code: 25HSM201B			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	50	-	-	50	-	-	2	2
Prerequisite:													
1. Market study 2. Break even analysis 3. Profit loss 4. Accounting													
Course Objectives:													
1. To understand the concepts, role, and importance of entrepreneurship and innovation in economic and social development. 2. To identify and evaluate business opportunities, especially technology-based and sustainable ventures. 3. To develop entrepreneurial mindset, creativity, and problem-solving ability. 4. To understand startup ecosystem, government policies, IPR, funding, and incubation support. 5. To prepare a basic business plan incorporating ethical, financial, and sustainability considerations.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain concepts of entrepreneurship, innovation, and their role in economic and societal development. CO2. Identify entrepreneurial opportunities using creativity, design thinking, and market analysis tools. CO3. Analyze feasibility of a business idea considering technical, financial, legal, and social aspects. CO4. Apply knowledge of startup ecosystem, IPR, funding, and government initiatives to venture creation. CO5. Develop and present a basic business plan demonstrating teamwork, communication, ethics, and lifelong learning attitude.													
Course Contents													
Unit I	Introduction to Entrepreneurship										06 Hours		
Entrepreneurship: Definition, types, and characteristics, Entrepreneur vs Manager, Role of entrepreneurship in economic development, Innovation: Types and sources, Case studies of successful entrepreneurs (Indian & global).													
Unit II	Creativity, Innovation & Opportunity Identification										06 Hours		
Entrepreneurial mindset and creativity, Design Thinking for innovation, Idea generation techniques, Opportunity identification and screening, Market research and customer validation, Technology-based entrepreneurship.													

Unit III	Feasibility Analysis & Business Models	06 Hours
Technical, market, and financial feasibility, Business Model Canvas (BMC), Costing, pricing, and break-even analysis, Risk analysis and mitigation, Ethics and sustainability in entrepreneurship.		
Unit IV	Startup Ecosystem, IPR & Funding	06 Hours
Startup India initiative and government schemes (MSME, SIDBI, DPIIT), Incubation centers, accelerators, and angel networks, Basics of Intellectual Property Rights (Patents, Copyrights, Trademarks), Sources of funding: Bootstrapping, venture capital, crowdfunding, Legal aspects of starting a venture.		
Unit V	Business Plan Development & Entrepreneurial Skills	06 Hours
Business plan preparation and structure, Team building and leadership, Communication and pitching skills. Social entrepreneurship and sustainable startups, Future trends and lifelong learning for entrepreneurs.		
Total Hours		30
Course Activities for Term Work evaluation:		
1. Business Idea Identification and Opportunity Analysis Students identify innovative business ideas, analyze market opportunities, customer needs, and prepare a brief opportunity assessment report. 2. Case Study on Successful Entrepreneurs and Startups Students study successful entrepreneurs or startups and analyze their business models, innovation strategies, challenges, and growth factors. 3. Business Model Canvas (BMC) Activity Students prepare a Business Model Canvas for a startup idea covering value proposition, customer segments, revenue streams, and key resources. 4. Mini Project on Startup Ecosystem and IPR Students explore startup support systems such as MSME, Startup India, incubation centers, patents, trademarks, and funding schemes and prepare a report. 5. Business Plan Presentation and Pitching Activity Students develop and present a basic business plan including marketing, financial planning, costing, break-even analysis, and sustainability considerations.		
Text Books		
1. Vasant Desai – Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House. 2. S. S. Khanka – Entrepreneurial Development, S. Chand & Company. 3. Donald F. Kuratko – Entrepreneurship: Theory, Process and Practice, Cengage Learning. 4. Peter F. Drucker – Innovation and Entrepreneurship, Harper Business.		
Reference Books		
1. Osterwalder & Pigneur – Business Model Generation, Wiley. 2. Barringer & Ireland – Entrepreneurship: Successfully Launching New Ventures, Pearson. 3. Robert Hisrich et al. – Entrepreneurship, McGraw-Hill.		
MOOC / NPTEL Courses/Online Resources:		
1. NPTEL1, Entrepreneurship, By Prof. C Bhaktavatsala Rao, IIT Madras: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg70 2. NPTEL2, Entrepreneurship Essentials By Prof. Manoj Kumar Mondal, IIT Kharagpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_ge08		

3. NPTEL3, Innovation, Business Models and Entrepreneurship, By Prof. Rajat Agrawal, Prof. Vinay Sharma, IIT Roorkee:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg63
4. NPTEL4, Patent Drafting for Beginners, By Prof. Feroz Ali IIT Madras:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_hs04
5. NPTEL5, Intellectual Property Rights and Competition Law, By Prof. KD Raju, Prof. Niharika Sahoo Bhattacharya, IIT Kharagpur:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg96

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (HSSM)-I: Project Management & Business Planning										Course Code: 25HSM201C			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	50	-	-	50	-	-	2	2
Prerequisite:													
Basic understanding of management principles, Fundamental knowledge of engineering project work, Basic knowledge of economics and finance, Familiarity with planning and organizational concepts													
Course Objectives:													
1. To introduce the concepts and methodologies of project management in engineering and business sectors. 2. To develop skills for project planning, scheduling, monitoring, and control. 3. To understand financial and risk aspects associated with project management. 4. To provide knowledge about entrepreneurship and business planning. 5. To enable students to prepare and evaluate comprehensive business plans.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain the fundamentals, life cycle, and organizational aspects of project management. CO2. Apply project planning and scheduling techniques such as WBS, CPM, and PERT. CO3. Analyze project costs, budgeting methods, and risk management strategies. CO4. Identify business opportunities and develop feasible business models. CO5. Prepare and evaluate a complete business plan for new ventures or engineering projects.													
Course Contents													
Unit I	Introduction to Project Management										06 Hours		
Definition and characteristics of a project, Concept and importance of project management, Types of projects (engineering, infrastructure, IT, industrial), Project life cycle: initiation, planning, execution, monitoring, and closure, Project stakeholders and their roles, Project management knowledge areas, Role and responsibilities of a project manager, Organizational structures for project management (functional, matrix, projectized), Overview of project management tools and techniques.													
Unit II	Project Planning and Scheduling										06 Hours		
Project planning process, Work Breakdown Structure (WBS) and task identification, Activity sequencing and dependency relationships, Project scheduling techniques, Gantt charts and milestone charts, Network diagrams and project network analysis, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Resource allocation and resource levelling, Project scheduling software tools overview.													
Unit III	Project Cost & Risk Management										06 Hours		
Project cost estimation techniques, Budget preparation and financial planning, Project financing and funding sources, Cost control and cost performance monitoring, Earned Value Management (EVM) concept, Risk identification and classification, Risk assessment and analysis methods, Risk													

mitigation and contingency planning, Quality management in projects, Project monitoring, evaluation, and control techniques.		
Unit IV	Business Planning and Entrepreneurship	06 Hours
Introduction to entrepreneurship and innovation, Characteristics of successful entrepreneurs, Identification of business opportunities, Business idea generation and screening, Feasibility analysis (technical, economic, market feasibility), Market research and demand analysis, Product and service planning, Business model development, Legal requirements and regulatory framework for starting a business.		
Unit V	Business Plan Preparation and Evaluation	06 Hours
Structure and components of a business plan, Executive summary preparation, Marketing plan and competitive analysis, Operations and production planning, financial planning (cost, revenue, profit projections), Break-even analysis and financial feasibility, Funding sources and venture capital, Business plan presentation and pitching, Evaluation of business proposals, Case studies of successful startups and business ventures.		
Total Hours		30
Course Activities for Term Work evaluation:		
1. Project Planning and Scheduling Activity Students prepare a Work Breakdown Structure (WBS), Gantt chart, network diagram, and project schedule for a small engineering or business project using practical examples. 2. Case Study on Project Management and Risk Analysis Students analyze real-life engineering or business projects focusing on project planning, cost estimation, risk management, delays, and corrective actions. 3. Hands-on Activity using Project Management Tools Students use project planning tools/software to perform CPM, PERT, resource allocation, scheduling, and project tracking activities. 4. Business Plan Development and Presentation Students prepare and present a business plan including market analysis, feasibility study, budgeting, marketing strategy, and financial projections. 5. Mini Project on Entrepreneurship and Business Feasibility Students identify a startup/business idea and conduct feasibility analysis covering technical, economic, operational, and financial aspects.		
Text Books		
1. Project Management: A Managerial Approach – Jack R. Meredith, Samuel J. Mantel Jr., Scott M. Shafer, John Wiley & Sons, 9th / 10th / 11th Edition, 2. Project Management in Practice –Jack R. Meredith, Samuel J. Mantel Jr., Scott M. Shafer, Margaret M. Sutton, John Wiley & Sons,6th / 7th Edition, Year: 2020		
Reference Books		
1. Project Management: A Systems Approach to Planning, Scheduling, and Controlling –: Harold Kerzner. Publisher: John Wiley & Sons,12th Edition, 2017. 2. Operations Management – William J. Stevenson, Publisher: McGraw Hill Education, Edition: 13th Edition. 3. Business Plan Preparation: Entrepreneurship Development –, S. S. Khanka Publisher: S. Chand Publishing. 4. Entrepreneurship Development and Small Business Enterprises –: Poornima M. Charantimath Publisher: Pearson Education		

MOOC / NPTEL Courses/Online Resources:

1. Introduction to Project Management: Principles & Practices By Dr. Nimisha Singh, Quality Council of India:
https://onlinecourses.swayam2.ac.in/e-learning/preview/imb25_mg80
2. Business Planning and Project Management by Dr. Ravi Ahuja, SPPU, Pune:
https://onlinecourses.swayam2.ac.in/e-learning/preview/cec23_mg06
3. Project Management By Prof. Ramesh Anbanandam, IIT Roorkee:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_mg01
4. Project Management: Planning, Execution, Evaluation and Control by By Prof. Sanjib Chowdhury, IIT Kharagpur:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_mg78
5. Project Planning & Control, By Prof. Koshy Varghese, IIT Madras:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ce91

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (HSSM)-I: Financial Management for Engineers										Course Code: 25HSM201D			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	50	-	-	50	-	-	2	2
Prerequisite:													
1. Basic knowledge of Engineering Mathematics 2. Fundamentals of Economics and Accounting 3. Analytical and quantitative reasoning skills													
Course Objectives:													
1. To introduce the principles and scope of financial management for engineering professionals. 2. To enable students to interpret and analyze financial statements. 3. To develop ability to evaluate engineering investments using capital budgeting techniques. 4. To understand cost of capital and financing decisions in organizations. 5. To apply financial tools for techno economic evaluation of engineering projects.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Understand fundamental concepts of financial management and its role in engineering organizations. CO2. Analyze financial statements and evaluate financial performance. CO3. Apply capital budgeting methods for evaluating engineering investment decisions. CO4. Evaluate cost of capital and capital structure decisions. CO5. Apply working capital and financial planning concepts for engineering projects.													
Course Contents													
Unit I	Introduction to Financial Management										06 Hours		
Role and scope of financial management in engineering organizations Financial environment, financial markets and institutions Time value of money: present value, future value, annuity concepts Financial statements: balance sheet, income statement and cash flow statement Ratio analysis and financial performance indicators													
Unit II	Cost of Capital and Capital Structure										06 Hours		
Concept and importance of cost of capital Cost of debt, equity and preference capital Weighted average cost of capital (WACC) Capital structure theories: Net income approach, Net operating income approach, Modigliani–Miller theory Leverage analysis: operating leverage, financial leverage and combined leverage													
Unit III	Capital Budgeting										06 Hours		
Nature and significance of capital budgeting Cash flow estimation for engineering projects Investment evaluation methods: Payback period, accounting rate of return													

Discounted cash flow methods: Net present value (NPV), Internal rate of return (IRR), Profitability index. Risk and uncertainty in capital budgeting		
Unit IV	Working Capital Management	06 Hours
Concept and importance of working capital Operating cycle and cash conversion cycle Management of cash, receivables and inventory Short term financing sources Working capital policies and risk–return trade off		
Unit V	Financial Decision Making in Engineering Projects	06 Hours
Techno economic feasibility analysis Project financing and financial planning Budgeting and cost control techniques Break even analysis and sensitivity analysis Introduction to financial modelling using spreadsheets		
Total Hours		30
Course Activities for Term Work evaluation:		
1. Financial Statement Analysis Activity Students analyze balance sheets, income statements, and cash flow statements of companies and interpret financial performance using ratio analysis. 2. Case Study on Capital Budgeting Decisions Students evaluate engineering investment projects using Payback Period, NPV, IRR, and Profitability Index methods and recommend suitable decisions. 3. Hands-on Activity using Financial Spreadsheet Tools Students perform budgeting, break-even analysis, sensitivity analysis, and financial modelling using spreadsheet software. 4. Mini Project on Working Capital Management Students study working capital practices of an industry or business and prepare a report on inventory, receivables, cash management, and short-term financing. 5. Presentation on Financial Decision Making in Engineering Projects Students prepare and present techno-economic feasibility analysis, project financing methods, cost control strategies, and risk-return evaluation for engineering projects.		
Text Books		
1. Prasanna Chandra – Financial Management: Theory and Practice, McGraw Hill. 2. I. M. Pandey – Financial Management, Vikas Publishing. 3. Eugene F. Brigham and Michael C. Ehrhardt – Financial Management: Theory & Practice, Cengage Learning.		
Reference Books		
1. Brealey, Myers and Allen – Principles of Corporate Finance, McGraw Hill. 2. Van Horne & Wachowicz – Fundamentals of Financial Management, Pearson. 3. Jonathan Berk and Peter DeMarzo – Corporate Finance, Pearson. 4. Ross, Westerfield and Jordan – Fundamentals of Corporate Finance, McGraw Hill.		
MOOC / NPTEL Courses/Online Resources:		

1. Financial Management for Managers by Prof. Anil K. Sharma, IIT Roorkee:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_mg31
2. Corporate Finance by Prof. Abhijeet Chandra, IIT Kharagpur:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg93
3. Foundations of Accounting & Finance By Prof. Arun Kumar Gopalaswamy, IIT Madras:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_ec01
4. Working Capital Management By Prof. Anil K. Sharma, IIT Roorkee:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc19_mg40
5. Engineering Economic Analysis By Prof. Pradeep Kumar Jha, IIT Roorkee:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_me98

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name (VEC): Universal Human Values										Course Code: 25VEC201			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	50	-	-	50	-	-	2	2
Prerequisite:													
The course requires openness to self-reflection and willingness to understand ethical and value-based perspectives in personal and professional life.													
Course Objectives:													
1. To help students understand the importance of human values in personal & professional life. 2. To develop ethical awareness and responsible decision-making. 3. To create harmony between individual, society, and nature. 4. To encourage engineers to contribute towards sustainable and value-based development.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain the concept of human values and self-exploration, and recognize their importance in personal life, professional life, and the role of engineers in society. CO2. Understand the importance of sustainable development, environmental responsibility, and ecological balance, and evaluate the impact of technology on society and nature. CO3. Apply values such as trust, respect, empathy, and responsibility to maintain harmony in family and society and practice ethical behavior in social interactions. CO4. Demonstrate professional ethics, value-based decision making, leadership, and teamwork in engineering practice for the welfare of society. CO5. Understand the relationship between self and body, differentiate their needs, and develop self-awareness and balanced lifestyle practices for personal well-being.													
Course Contents													
Unit I	Introduction to Human Values										06 Hours		
Meaning and importance of human values, Basic needs of values, need for value based education in Engineering, Types of Human Values, Importance of human values to full fill happy and successful life, Values in personal life and professional life,, Factors affecting human values-Cultural, societal factors, personal factors , experiences, Concept of self-exploration, How to cultivate both values and skill in person’s life that navigate him to face life’s challenges and opportunities, Role of Engineer in society. Technology and values.													
Unit II	Harmony in Nature										06 Hours		
Understanding of harmony in Nature, Four orders of nature, Physical, Bio, Animal, Human order, interconnectedness and mutual fulfilment among four orders. Basic characteristic of nature, perseverance, bravery, Generosity, recyclability and self-regulation in nature, Holistic perception of harmony at all levels of existence, human being as a cause of imbalance in nature-pollution, depletion of resources, and role of technology in nature. Understanding existence of human being as a co-existence of mutually interacting units -in all pervasive space. Sustainable development,													

Environmental responsibility, Resource conservation, Ecological balance, Technology and its impact on society.		
Unit III	Harmony in Family and Society	06 Hours
Family as the basic unit of society: role of family in developing values, mutual understanding, and responsibility. Values in relationships: trust, respect, affection, care, guidance, and gratitude in maintaining harmony in family and society. Ethical behavior in society: honesty, responsibility, empathy, cooperation, and respect for diversity in social interactions. Social harmony and responsible citizenship: duties and responsibilities of individuals towards society and community. Professional ethics and social responsibility: role of engineers and professionals in promoting ethical practices and sustainable development. Role of values in building a harmonious society: importance of value-based decision making in personal, social, and professional life.		
Unit IV	Holistic Development and Professional Ethics	06 Hours
Holistic approach to life and education: integration of intellectual, emotional, ethical, and social development for balanced personal and professional growth. Human values and ethical principles: understanding honesty, integrity, empathy, responsibility, and respect in personal and social life. Professional ethics: ethical conduct in professional practice, integrity in work, accountability, and commitment to societal welfare. Ethical decision making: identifying ethical dilemmas and applying value-based reasoning in professional situations. Social and environmental responsibility of professionals: contribution of engineers and professionals towards sustainable development and societal well-being. Role of values in leadership and teamwork: importance of trust, cooperation, and ethical behaviour in professional environments.		
Unit V	Harmony Between Self and Body	06 Hours
Understanding the Self and the Body: distinction between the conscious self (I) and the physical body. Self–body coexistence: relationship between the self as the experiencer and the body as the instrument of action. Needs of the self and the body: physical needs (food, rest, health) and psychological needs (happiness, values, purpose). Harmony in the individual: maintaining balance between mental well-being and physical health through responsible living. Role of self-awareness and self-regulation: understanding thoughts, emotions, and behavior for a balanced life. Importance of healthy lifestyle: discipline, proper habits, and value-based living for overall well-being.		
Total Hours		30
Activities for term work Evaluation:		
1. Group Discussion on Human Values and Ethics 2. Case Study Analysis on Ethical Issues in Society and Profession 3. Reflective Journal Writing on Self-Development and Values 4. Role Play / Skit on Social Responsibility and Moral Values 5. Poster Presentation on Environmental Awareness and Sustainability 6. Debate on Contemporary Ethical and Social Issues 7. Community Service / Social Outreach Activity Report 8. Seminar / Presentation on Professional Ethics and Leadership 9. Essay Writing on Family Values, Harmony, and Responsibility 10. Participation in Workshops, Expert Talks, and Value-Based Activities		
Text Books		
1. R. R. Gaur, R. Sangal, and G. P. Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi. 2. R. R. Gaur, R. Sangal, and G. P. Bagaria, Universal Human Values – Understanding Harmony AICTE / Excel Books.		
Reference Books		
1. Mike W. Martin and Roland Schinzinger, Ethics in Engineering McGraw Hill.		

2. Charles B. Fleddermann, Engineering Ethics Pearson.
Online References
1. Exploring Human Values – Visions of Happiness & Perfect Society- A. K. Sharma, IIT Kanpur 2. Moral Thinking – An Introduction to Values and Ethics: Prof. Vineet Sahu, IIT Kanpur
MOOC / NPTEL Courses
1. Human values and Professional Ethics, By Dr. Kounsar Jan, Deptt of education University of Kashmir https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg125 2. Moral Thinking – An Introduction to Values and Ethics by Prof. Vineet Sahu, IIT Kanpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_hs169

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- III													
Course Name: Community Engagement Project										Course Code: 25AIELC201			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	25	-	-	25	-	1	-	1
Prerequisite:													
1. It is an experiential learning approach that combines community service, community development, education and learning. 2. Project involves students in community development and service activities and applies the experience to personal and academic development. 3. The targeted contribution of college students to the village/local development will benefit the community.													
Course Objectives:													
1. Establish a mutually beneficial relationship between the college and the community. 2. Opportunities to engage with their local community, fostering empathy, teamwork, and problem- solving skills while contributing positively to their surroundings. 3. An understanding of the challenges faced by the local community and the role of engineering in addressing those challenges. 4. The ability to apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community. 5. The skills to evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Identify and analyze local community needs and challenges by engaging with stake- holders and evaluating real-world problems. CO2. Design and implement practical, creative, and context-specific solutions using engineering principles to address community issues. CO3. Reflect and evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations.													
Guidelines:													
1. A group of 3 to 4 students or a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay/college premise. 2. Each group is allotted to a faculty member of the department as a mentor. 3. The group of students will be associated with a government official / village authorities /NGOs etc. concerned, allotted by the district administration, during the duration of the project. 4. The Community Engagement Project should be different from the regular programmes of NSS/NC- C/Green Club/Hobby Clubs, Special Interests Groups etc. 5. An activity book has to be maintained by each of the students to record the activities undertaken/involved and will be countersigned by the concerned mentor/HoD. 6. Project report shall be submitted by each student/group of students.													

7. An internal evaluation shall also be conducted by a committee constituted by the HoD.
8. Evaluation to be done based on the active participation of the student and marks could be awarded by the mentor/HoD.
9. Students' groups can conduct an awareness programme on Health and Hygiene or in Organic Farming or in Fisheries or in advocating prohibition of liquor or about renewable energy, e-waste management or any other activity in an area of their studies and as per his/her aptitude.

List of Topics

The below lists are not exhaustive and open for HoD's or mentors to add, delete or modify. It is expected that the focus should be on specific local issues in their nearby areas. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a student/group of students shall.

- Use and/or miss-use of cell phones
- Career orientation of youth
- Water facilities and drinking water availability
- Health and hygiene of the school going students, home makers and old personals
- Health intervention and awareness programmes
- Horticulture Herbal and Nutrition
- Traditional and Modern health care methods
- Food habits
- Air /Sound /Water pollution
- Plantation and Soil protection
- Renewable energy and Solar Systems
- Yoga awareness and practice
- Health care awareness programmes and their impact
- Organic farming, IoT implementations
- Food adulteration
- Incidence of Diabetes and other chronic diseases
- Blood groups and blood levels
- Chemicals in daily life
- Music and dance
- Women education and empowerment

Project Scope

- Conduct workshops or awareness drives on topics like digital literacy, environmental sustainability, mental health, or career planning for local stakeholders.
- Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
- Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.
- Promote health through awareness programs on hygiene, nutrition, and exercise.
- Teach basic computer or technical skills to students, staff, or the community

Text Books

1. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997.
2. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016.

Online References

MOOC / NPTEL/YouTube Links:

NPTEL course: Ecology and Society

https://onlinecourses.nptel.ac.in/noc20_hs77/preview

Web Links:

1. UNESCO: Education for Sustainable Development <https://www.unesco.org>
2. EPICS (Engineering Projects in Community Service) <https://engineering.purdue.edu/EPICS>
3. Ashoka: Innovators for the Public <https://www.ashoka.org>
4. Design for Change <https://www.dfcworld.com>



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S.Y.B. Tech. Artificial Intelligence and Machine Learning

(2025 Pattern)

Curriculum Structure: Semester IV

(With effect from Academic Year 2026-27)

S.Y.B. Tech. Artificial Intelligence and Machine Learning (2025 Pattern)

Curriculum Structure: Semester IV

Course Category	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
PCC	25AIPCC204	Database Management Systems	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25AIPCC205	Foundation of Machine Learning	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25AIPCC206	Object Oriented Programming and Computer Graphics	3	-	-	20	30	50	-	-	-	100	3	-	-	03
MDM	25AIMDM202	Multidisciplinary Minor-II	2	-	-	20	30	50	-	-	-	100	2	-	-	02
OEC	25OEC202	Open Elective Course-II	2	-	-	20	30	50	-	-	-	100	2	-	-	02
PCC(L)	25AIPCC204L	Database Management Systems Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
PCC(L)	25AIPCC205L	Foundation of Machine Learning Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
PCC(L)	25AIPCC206L	Object Oriented Programming and Computer Graphics Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
VSEC	25AIVSE202	Vocational and Skill Enhancement Course-II	-	2	-	-	-	-	-	-	25	25	-	1	-	01
ACE	25AEC201	Modern Indian Language (MIL)	2	-	-	-	-	-	-	25	25	50	2	-	-	02
HSSM	25HSM202	Entrepreneurship/Economics/Management Course-II	-	-	2	-	-	-	-	-	50	50	-	-	2	02
VEC	25VEC202	Indian Constitution and Governance	-	-	1	-	-	-	-	-	25	25	-	-	1	01
Total			15	08	03	100	150	250	50	50	125	725	15	04	03	22

Multidisciplinary Minor-II:

Sr. No.	Course Code	Course Name
1	25RAMDM202	Internet of Things

Open Elective-II:

Basket No.	Sr. No.	Course Code	Course Name
1	1	25OEC202A	Leadership and Team Dynamics
2	2	25OEC202B	Green Practices and ESG Frameworks
3	3	25OEC202C	Innovation and Business Strategy
4	4	25OEC202D	Stress Management and Mental Well-Being
5 (A)	5	25OEC202E	French Language Module-II
5 (B)	6	25OEC202F	German Language Module-II
5 (C)	7	25OEC202G	Japanese Language Module-II

Vocational and Skill Enhancement Course-II:

Sr. No.	Course Code	Course Name
1	25AIVSE202	Data science and Visualization Techniques

Entrepreneurship/Economics/Management Courses (HSSM)-II:

Sr. No.	Course Code	Course Name
1	25HSM202A	Business Fundamentals for Entrepreneurs
2	25HSM202B	Entrepreneurship and Start-ups
3	25HSM202C	Fundamentals of Accounting and Finance
4	25HSM202D	Business Intelligence and Analytics

Modern Indian Language (MIL)

Sr. No.	Course Code	Course Name
1	25AEC201A	Marathi
2	25AEC201B	Sanskrit

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (PCC): Database Management System										Course Code: 25AIPCC204			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	20	30	50	-	-	-	100	3	-	-	3
Prerequisite:													
Programming and Problem Solving , Discrete Mathematics and Graph Theory													
Course Objectives:													
1. To understand database concepts, design principles, and ER/EER modeling. 2. To develop SQL and PL/SQL skills for efficient database operations and procedural programming. 3. To apply normalization techniques for designing well-structured relational databases. 4. To explore database transactions, concurrency control methods, and recovery mechanisms. 5. To analyze NoSQL database models and their role in managing unstructured data.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain the fundamentals of database management systems, including data models, ER modeling, and database design. CO2. Develop and execute SQL and PL/SQL programs to manage and manipulate relational data. CO3. Apply normalization techniques to improve database design and ensure data integrity. CO4. Analyze transaction management concepts and concurrency control techniques for reliable database systems CO5. Evaluate NoSQL database types and explain their suitability for handling unstructured data.													
Course Contents													
Unit I	Introduction to Database Management System										08 Hours		
Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Enterprise Constraints Data Models, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, Converting E-R & EER diagram into tables.													
Unit II	SQL and PL/SQL										08 Hours		
SQL: Relational Algebra, DDL, DML, Select Queries, String, Date and Numerical Functions, Aggregate Functions, View, Indexes, Group by and Having Clause, Join Queries, Set operation, Set membership, Nested queries, DCL, TCL PL/SQL: Control Statement, Cursor, Stored Procedure and Function, Trigger													
Unit III	Relational Database Design										08 Hours		
Relational Model: Basic concepts, Attributes and Domains, CODD’s Rules, Relational Integrity, Referential Integrities, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, 2NF, 3NF, BCNF.													

Unit IV	Database Transactions and Concurrency Management	08 Hours
Basic concept of a Transaction, Transaction Management, Properties of Transactions, ACID, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules. Concurrency Control: Need for Concurrency Control, Lock-based protocols, Time stamp based protocol, Validation-based protocol, Multiple Granularity, Deadlock. Recovery Techniques: Shadow-Paging, Log-based Recovery, Check Point.		
Unit V	AI-Driven Data Management and Emerging Trends	08 Hours
Introduction to NoSQL Database, NoSQL data models, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, MongoDB: CRUD Operations, Indexing and Aggregation, Fundamentals of distributed and cloud databases including data partitioning, replication, scalability, and Database-as-a-Service (DBaaS). Introduction to big data concepts, types of data (structured, semi-structured, unstructured), and comparison between data warehouses and data lakes. Graph databases and their applications in social networks and knowledge representation, recommendations, fraud detection.		
Total Hours		40
Course Activities for Continuous Comprehensive Assessment (CCA): <i>(Any Two – CCA1 Compulsory)</i>		
CCA1		10 Marks
Application Based Course Activities (Any One) Activity 1: Database Design and Implementation Design and implement a database application such as Library Management System, Student Information System, Hospital Management System, or Inventory Management System using ER diagrams, normalization, SQL queries, and database constraints. Activity 2: SQL and PL/SQL Programming Develop SQL and PL/SQL programs demonstrating DDL, DML, joins, views, procedures, functions, cursors, and triggers for a real-world database application. Activity 3: NoSQL and MongoDB Mini Project Develop a simple MongoDB-based application demonstrating CRUD operations, indexing, aggregation, and comparison with relational databases.		
CCA2		10 Marks
Case Study / Survey • Case Study on Database Design for Banking Management Systems • Case Study on E-Commerce Database Systems (Amazon/Flipkart) • Case Study on MongoDB Applications in Modern Web Development • Case Study on Cloud Databases and Database-as-a-Service (DBaaS) • Case Study on Graph Databases in Social Networks and Recommendation Systems • Survey of NoSQL Databases and CAP Theorem • Survey of Big Data Technologies and Data Lakes		
CCA3		10 Marks
Seminar: Any topic from unit I to V		
Text Books		
1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition 2. Connally T., Begg C., "Database Systems", 4th Edition, Pearson Education, 2002, ISBN 8178088614 3. DT Editorial Services "BIG DATA Black Book", Dream tech Press ISBN 13 : 9789351199311		

Reference Books

1. C J Date, “An Introduction to Database Systems”, Addison-Wesley, ISBN: 0201144719
2. S.K.Singh, “Database Systems: Concepts, Design and Application”, Pearson Education, ISBN 978-81-317-6092-5
3. Kristina Chodorow, Michael Dierolf, “MongoDB: The Definitive Guide”, O Reilly Publications, ISBN: 978 -1-449- 34468-9
4. Adam Fowler, “NoSQL For Dummies”, John Wiley & Sons, ISBN-1118905628
5. Kevin Roebuck, “Storing and Managing Big Data - NoSQL, HADOOP and More”, Emereopty Limited, ISBN: 1743045743, 9781743045749
6. Joy A. Kreibich, “Using SQLite”, O’REILLY, ISBN: 13:978-93-5110-934-1
7. Ivan Bayross, “SQL, PL/SQL the Programming Language of Oracle”, BPB Publications ISBN: 9788176569644, 9788176569644.

Online References

MOOC / NPTEL Courses:

1. Data Base Management System by Prof. Partha Pratim Das & Prof. Samiran Chattopadhyay (IIT Kharagpur) (SWAYAM-NPTEL)
(This course covers all the fundamental concepts of Database Management Systems including relational databases, ER modeling, SQL, normalization, query processing, transaction management, concurrency control, recovery techniques, and database applications.)
https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_cs75
2. Introduction to Database Systems by Sreenivasa Kumar (IIT Madras) (SWAYAM-NPTEL)
(This course introduces database concepts, relational models, SQL, indexing, normalization, query processing, transaction processing, concurrency control, and recovery techniques.)
https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_cs55

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (PCC): Foundation of Machine Learning										Course Code: 25AIPCC205			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	20	30	50	-	-	-	100	3	-	-	3
Prerequisite:													
Data Structures and Algorithms, Artificial Intelligence.													
Course Objectives:													
1. To introduce fundamental concepts of Machine Learning and its relationship with Artificial Intelligence and Data Science. 2. To understand various types of machine learning techniques and their applications. 3. To study supervised learning methods including classification and regression algorithms. 4. To explore unsupervised learning techniques such as clustering and association rule mining. 5. To learn the basics of neural networks and deep learning concepts.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Understand fundamental concepts, types, and models of Machine Learning. CO2. Apply classification techniques and evaluate models using appropriate metrics. CO3. Analyze regression models and optimization techniques for predictive analysis. CO4. Implement unsupervised learning methods such as clustering and association rules. CO5. Understand and apply basic concepts of neural networks for real-world problems.													
Course Contents													
Unit I	Introduction to Machine Learning									08 Hours			
Introduction to Machine Learning: Human vs Machine Learning, Traditional Programming vs ML, Relation with Artificial Intelligence and Data Science. Types of ML: Supervised, Unsupervised, Semi-supervised, Reinforcement Learning. ML Models: Geometric, Probabilistic, Logical, Parametric & Non-Parametric Models. Key Elements: Data Formats, Learnability, Statistical Learning. Mathematical Foundations: Probability, Bayes’ Theorem, Distributions, Matrices, Eigenvalues. Data & Dimensionality: Feature Extraction, Selection, Transformation, PCA, Matrix Factorization.													
Unit II	Supervised Learning – Classification									08 Hours			
Types of Supervised Learning: Regression and Classification, Model Evaluation and Validation: Confusion Matrix, Cross-validation. Classification Algorithms: Naive Bayes Classifier, Bayesian Network, k-Nearest Neighbors (k-NN), Decision Trees (ID3, Gini Index, CART), Overfitting. Ensemble Methods: Bagging (Random Forest), Boosting (XGBoost). Support Vector Machines (SVM), Multiclass Classification Techniques: One vs One, One vs Rest. Data Preprocessing and Feature Engineering: Normalization, Scaling, Standardization, Handling Missing Values.													
Unit III	Supervised Learning – Regression									08 Hours			

Foundational Concepts: Types of Regression Models, Distributions, Hypothesis Testing, Confidence Intervals. Concepts of Bias, Variance, Generalization, Overfitting and Underfitting. Linear Regression – Model Representation, Univariate Regression, Least Square Method for Estimation of Regression Coefficients, Cost Functions: Mean Squared Error (MSE), Mean Absolute Error (MAE), R-Square. Optimization using Gradient Descent Algorithm. Multivariate Regression, Regularization Techniques – Ridge Regression and Lasso Regression.		
Unit IV	Unsupervised Learning	08 Hours
Introduction to Unsupervised Learning, Applications of Unsupervised Learning. Types of Unsupervised Learning: Clustering Algorithms – Partitioning Methods (K-Means, K-Medoids), Hierarchical Methods (Agglomerative, Divisive), Density-Based Methods (DBSCAN), Spectral Clustering. Association Rule Learning – Apriori Algorithm. Outlier Analysis – Isolation Factor, Local Outlier Factor. Evaluation Metrics and Scoring Methods – Elbow Method, Intrinsic and Extrinsic Evaluation Methods.		
Unit V	Introduction To Neural Networks	08 Hours
Introduction to Artificial Neural Networks: Single Layer Neural Network, Multilayer Perceptron, Back Propagation Learning, Activation functions, Introduction to Recurrent Neural Networks and Convolutional Neural Networks.		
Total Hours		40
Course Activities for Continuous Comprehensive Assessment (CCA): <i>(Any Two (CCA1 Compulsory))</i>		
CCA1		10 Marks
Application Based Course Activities (Any One) 1. Product Review Sentiment Analysis using Machine Learning - Collect product review data and develop a sentiment classification model using Naïve Bayes or Decision Tree algorithms. - Analyze model accuracy and evaluate performance using confusion matrix and F1-score. 2. House Price Prediction using Regression Techniques - Develop a machine learning model using Linear Regression to predict house prices. - Compare performance using MSE, MAE, and R^2 metrics. 3. Customer Classification using Decision Tree and K-NN - Build classification models to categorize customers based on purchasing behavior. - Compare prediction accuracy of Decision Tree and K-NN algorithms. 4. Dimensionality Reduction for Data Visualization - Apply PCA or LDA on a high-dimensional dataset. - Visualize transformed data and analyze the impact on classification performance.		
CCA2		10 Marks
List of Case Studies - Machine Learning Applications in Product Recommendation Systems - Predictive Analytics for Stock Market Forecasting - Fraud Detection using Classification Algorithms - Customer Segmentation using Clustering Techniques - Disease Prediction and Diagnosis using Machine Learning Techniques - Credit Risk Assessment and Loan Approval Prediction using Supervised Learning Models - Sentiment Analysis of Social Media Data using Machine Learning - Email Spam Detection using Classification Algorithms - Predictive Maintenance in Manufacturing using Machine Learning		

10. Student Performance Prediction using Data Analytics and Machine Learning 11. Traffic Flow Prediction for Smart City Applications 12. Customer Churn Prediction in Telecommunication Industry.	
CCA3	10 Marks
Seminar: Any topic from unit I to V	
Text Books	
1. Tom M. Mitchell, —Machine Learningll, McGraw Hill 2. Ethem Alpaydin,” Introduction to Machine Learning”, MIT Press, Prentice Hall of India, 3rd Edition2014. 3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar” Foundations of Machine Learning”, MIT Press,2012.	
Reference Books	
1. Kevin P. Murphy, —Machine Learning — A Probabilistic Perspectivell, MIT Press 2. Stephen Marsland, —Machine Learning an Algorithmic Perspectivell, CRC Press 3. Shai Shalev-Shwartz, Shai Ben-David, —Understanding Machine Learningll, Cambridge University Press 4. Peter Harrington, —Machine Learning in Actionll, DreamTech Press 5. S Sridhar and M Vijayalakshmi, “Machine Learning”, Oxford University Press, 2021. 6. M N Murty and Ananthanarayana V S, “Machine Learning: Theory and Practice”, Universities Press (India) Pvt. Limited, 2024.	
Online References	
e-Books 1. https://info.deeplearning.ai/machine-learning-yearning-book 2. https://home-wordpress.deeplearning.ai/wp-content/uploads/2022/03/andrew-ng-machine-learning-yearning.pdf NPTEL: Control Systems, IIT Madras 1. Foundations of Machine Learning by Prof. J. SakethaNath (IIT Hyderabad) (NPTEL) (Introduces fundamental concepts of machine learning, optimization, bias-variance tradeoff, regularization, generative models, and modern machine learning theory.) https://nptel.ac.in/courses/106106001 2. Machine Learning by Prof. P. B. Ravindran (Department of Computer Science and Engineering, IIT Madras) (Covers supervised learning, unsupervised learning, reinforcement learning, regression, classification, support vector machines, neural networks, decision trees, clustering, and learning theory.) https://nptel.ac.in/courses/106106139 3. Introduction to Machine Learning by Prof. Sudeshna Sarkar (IIT Kharagpur) (NPTEL) (This course provides a broad introduction to machine learning including statistical learning methods. The course will cover basic notions on machine learning the various issues and different supervised learning algorithms and a basic introduction to unsupervised learning.) https://nptel.ac.in/courses/106105152	

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (PCC): Object-Oriented Programming and Computer Graphics										Course Code: 25AIPCC206			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	20	30	50	-	-	-	100	3	-	-	3
Prerequisite:													
Programming for Problem Solving (C Programming), Basic Mathematics (Coordinate Geometry), and Fundamentals of Data Structures.													
Course Objectives:													
1. To understand fundamental concepts of Object-Oriented Programming using C++. 2. To apply OOP principles for real-world problem solving. 3. To introduce core concepts of computer graphics and visualization. 4. To understand geometric transformations and rendering techniques. 5. To develop basic graphics applications.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Apply OOP concepts like classes, inheritance, and polymorphism in C++. CO2. Design and implement modular and reusable code. CO3. Understand basic graphics systems and drawing algorithms. CO4. Perform geometric transformations on objects. CO5. Develop simple computer graphics applications.													
Course Contents													
Unit I	Introduction to OOP using C++										08 Hours		
Basics of Object-Oriented Programming, Procedural vs Object-Oriented Programming, Structure of C++ program, Tokens in C++ (keywords, identifiers, constants), Data types, Variables and scope, Operators and expressions, Control structures (if, switch, loops), Functions (call by value, call by reference), Introduction to classes and objects, Access specifiers (public, private, protected), Inline functions, Default arguments.													
Unit II	Advanced OOP Concepts in C++										08 Hours		
Constructors (default, parameterized, copy), Destructors, Function overloading, Operator overloading, Inheritance (single, multiple, multilevel, hierarchical, hybrid), Base and derived classes, Polymorphism (compile-time and runtime), Virtual functions, Friend functions and classes, Static members, File handling (text and binary files, file streams), Exception handling basics.													
Unit III	Introduction to Computer Graphics										08 Hours		
Basics of Computer Graphics, Applications of Computer Graphics, Components of graphics system, Introduction, graphics primitives - pixel, resolution, aspect ratio, frame buffer. Display devices, applications of computer graphics s, Line drawing algorithms (DDA, Bresenham), Circle drawing algorithms (Midpoint circle algorithm, Bresenham), Introduction to OpenGL basics.													
Unit IV	2D Transformations and Viewing										08 Hours		

Basic transformations (translation, rotation, scaling, reflection, shear), Homogeneous coordinates, Transformation matrices, Composite transformations, Windowing and viewport transformation, Viewing pipeline, Clipping algorithms (Cohen-Sutherland line clipping,), Polygon clipping (Sutherland-Hodgman, Generalized Clipping), Introduction to 2D viewing in OpenGL		
Unit V	3D Graphics and Rendering	08 Hours
Introduction to 3D graphics, 3D coordinate systems, 3D transformations (translation, rotation, scaling), Projection techniques (parallel projection, perspective projection), 3D viewing pipeline, Visible surface detection methods (back-face detection, Z-buffer algorithm), Illumination models (basic), Shading techniques (flat, Gouraud, Phong shading), Introduction to rendering pipeline in 3D OpenGL		
Total Hours		40
Course Activities for Continuous Comprehensive Assessment (CCA): (Any Two (CCA1 Compulsory))		
CCA1	10 Marks	
Application Based Course Activities (any one) Activity 1: Student Management System using OOP (10 Marks) Develop a C++ application using classes, objects, constructors, and file handling to manage student records. Activity 2: Bank Account Management System (10 Marks) Design a banking application demonstrating inheritance, polymorphism, and exception handling for account operations. Activity 3: Library Management System (10 Marks) Create a library management software using OOP concepts such as classes, objects, and file handling.		
CCA2	10 Marks	
Case Study / Survey 1. Case Study on OOP Implementation in Banking Management Systems • Use of classes, inheritance, and file handling in software development. 2. Survey of Graphics Rendering Techniques in Modern Video Games • Flat, Gouraud, and Phong Shading methods. 3. Case Study on Computer Graphics Applications in Medical Imaging • Visualization, image reconstruction, and diagnostic systems. 4. Survey of 3D Graphics and Animation in Virtual Reality (VR) and Augmented Reality (AR) • 3D transformations, projections, and rendering pipelines. 5. Case Study on OpenGL-Based Graphics Applications		
CCA3	10 Marks	
Seminar: Any topic from unit I to V		
Text Books 1. Object Oriented Programming with C++ – E. Balagurusamy 2. The C++ Programming Language – Bjarne Stroustrup 3. Computer Graphics C Version – Donald Hearn		
Reference Books 1. Let Us C++ – Yashavant Kanetkar 2. Object-Oriented Programming in C++ – Robert Lafore		

3. Fundamentals of Computer Graphics – Peter Shirley
4. Interactive Computer Graphics – Edward Angel

Online References

NPTEL Courses:

1. Programming in Modern C++ By Prof. Partha Pratim Das, IIT Kharagpur
(Covers OOP in C++ Inheritance, Polymorphism, Exceptions and Templates)
https://onlinecourses.nptel.ac.in/noc24_cs44/preview
2. Computer Graphics, by Prof. Samit Bhattacharya, IIT Guwahati
(covers Object representation, Modeling transformations, Illumination and shading, 3D viewing, Clipping and hidden surface removal)
https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_cs90

Coursera Courses

1. Interactive Computer Graphics by Instructor: Takeo Igarashi (covers 2D, 3D, Animation)
<https://www.coursera.org/learn/computer-graphics>
2. Microsoft Introduction to C++ Programming, Instructor: Microsoft, (covers all basic C++ programming)
<https://www.coursera.org/learn/c-plus-plus-a>

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (MDM-II): Internet of Things										Course Code: 25RAMDM202			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
Digital Electronics and Logic Design													
Course Objectives:													
1. To understand fundamentals of Internet of Things (IoT) and Embedded Systems													
2. To acquire knowledge of sensor, actuators													
3. To understand IoT Access technologies and understand application protocols for IoT													
4. To comprehend cloud and services in the field of IoT													
5. To develop various applications in IoT.													
Course Outcomes:													
At the end of the course, students will be able to:													
CO1. Understand the fundamentals and needs of Embedded Systems for the Internet of Things													
CO2. Interface different sensors and actuators with IoT development boards.													
CO3. Analyze IoT protocols for making IoT devices communication													
CO4. Use of cloud and its services.													
CO5. Design and Develop secured IoT applications.													
Course Contents													
Unit I	Fundamentals of IoT										06 Hours		
Foundations and Core Concepts of IoT: Definition, Characteristics of IoT, Evolution and Growth of IoT, IoT Challenges and Issues, IoT Enabling Technologies, Functional blocks of IoT Ecosystem, Introduction to IoT System Design, IoT Deployment Templates, Components of Deployment Templates, Embedded System Definition, Characteristics of Embedded System, Real time systems, Real time tasks. Processor basics: General Processors in Computer Vs Embedded Processors, Microcontrollers, Microcontroller Properties, Components of Microcontrollers, Introduction to embedded processor.													
Unit II	Sensors and Actuators in IoT Systems										06 Hours		
Sensors: Fundamentals of Sensors, Working Principles and Types, Overview of Sensors: Classification, Characteristics and Applications. Actuators: Basics of Actuators and Their Working Principles, Actuator Systems: Types, Characteristics and Applications, Introduction to Actuation Mechanisms in IoT, Control and Actuation Devices: Concepts and Classification, Actuators in Embedded and IoT Systems. IoT Hardware Platforms and Development Boards: Introduction to Embedded Platforms for IoT Development, Arduino IDE and Types, Raspberry Pi, IoT Prototyping Using Development Boards													
Unit III	Protocols for IoT										06 Hours		

Protocol Standardization for IoT, M2M and WSN Protocols, RFID Protocol, Modbus Protocol, Transport Protocols - Zigbee, Bluetooth, IP based Protocols: MQTT (Secure), 6LoWPAN, LoRa , IoT Application Layer Protocols – CoAP and MQTT		
Unit IV	Cloud for IoT	06 Hours
Fundamentals of Cloud Computing, Types of Cloud services- AWS, Azure, Adafruit, IoT with Cloud, Challenges faced in cloud services, selection of cloud for IoT applications. Emerging Trends in Cloud IoT- AI/ML integration (AIoT), 5G-enabled IoT.		
Unit V	IoT Applications and Security	06 Hours
Smart Cities – Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance Environment – Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection. Introduction, Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling. Key elements of IoT Security: Identity establishment, Access control, Data and message security, Challenges in designing IOT applications.		
Total Hours		30
Course Activities for Continuous Comprehensive Assessment (CCA): (Any Two (CCA1 Compulsory)).		
CCA1 (Compulsory)		10 Marks
Application Based Course Activities (any one) Activity 1: Smart Home Automation System (10 Marks) Develop an IoT-based Smart Home Automation System using sensors, actuators, and an IoT development board (Arduino/Raspberry Pi). Monitor and control home appliances through cloud connectivity. Activity 2: Environmental Monitoring System (10 Marks) Design an IoT application for monitoring environmental parameters such as temperature, humidity, air quality, or noise levels using sensors. Store and visualize data on a cloud platform. Activity 3: Smart Parking Management System (10 Marks) Implement an IoT-based Smart Parking solution using ultrasonic sensors and microcontrollers to detect parking slot availability and display real-time information through a cloud dashboard.		
CCA2		10 Marks
Case Study 1. Fundamentals of Internet of Things and Embedded Systems 2. Sensors and Actuators in IoT Systems 3. IoT Communication Protocols 4. Cloud Computing for IoT Applications 5. IoT Security and Privacy Challenges		
CCA3		10 Marks
Seminar: Any topic from unit I to V		
Text Books		
1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, “IoT Fundamentals – Networking Technologies, Protocols, and Use Cases for the Internet of Things”, 1st Edition, Published by Pearson Education, Inc, publishing as Cisco Press, 2017. 2. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on Approach”, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515 3. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, 2nd Edition, Wiley Publication, ISBN: 978-1-119-99435-0		

Reference Books

1. Raj Kamal, Internet of Things: Architecture and Design Principles, McGraw Hill Education, 1st Edition, 2017
2. Adrian McEwen & Hakim Cassimally, “Designing the Internet of Things”, 1st Edition, Wiley, 2014.
3. David Hanes, Gonzalo Salgueiro, IoT Fundamentals Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 1st Edition, 2017.
4. Donald Norris, “Raspberry Pi – Projects for the Evil Genius”, 2nd Edition, McGraw Hill, 2014.

Online References

MOOC / NPTEL Courses:

1. Introduction of internet of things by Prof. sudip mishra, IIT Kharagpur
(covers, fundamentals of IOT, applications and components)
https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs161
2. Foundation of Cloud in IOT by Prof. Rajiv Misra IIT Patna.
(covers, IoT applications, IoT hub, AWS IoT platform)
https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs75
3. Introduction: Sensing & actuation By Prof. Sudip Misra|IIT Kharagpur
https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs160
4. Introduction to Internet of Things by Prof. Sudip Mishra, IIT Kharagpur
(covers, IOT Protocols, connectivity technology)
<https://nptel.ac.in/courses/106105166>

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (OE-2) (Basket No 1): Leadership and Team Dynamics										Course Code: 25OEC202A			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
Basic communication and interpersonal skills													
Course Objectives:													
1. Introduce concepts of leadership, organizational behaviour, and group dynamics. 2. Develop communication, interpersonal, and collaborative leadership skills. 3. Explain leadership styles, motivation theories, and team processes. 4. Enhance conflict resolution, negotiation, and decision-making abilities. 5. Prepare students for leadership roles in multicultural and multidisciplinary organizations.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain leadership theories, organizational behavior, and group dynamics concepts. CO2. Apply communication and interpersonal skills in team environments. CO3. Analyze leadership styles, group processes, and motivational approaches. CO4. Evaluate team effectiveness, conflict management, ethics, and leadership challenges. CO5. Develop leadership strategies for professional and global organizational environments.													
Course Contents													
Unit I	Foundations of Leadership and Organizational Behaviour										06 Hours		
Introduction to leadership and team management Leadership versus management Leadership myths and leadership development Organizational behavior fundamentals Groups and types of groups Stages of group development Emotional intelligence and self-awareness.													
Unit II	Leadership Theories and Leadership Development										06 Hours		
Trait and behavioural leadership theories Situational and contingency leadership models Path-goal theory and Leader-Member Exchange (LMX) theory Transformational and transactional leadership Power, influence, and persuasion Leadership ethics, values, and credibility.													
Unit III	Communication, Motivation, and Interpersonal Behaviour										06 Hours		
Communication process and barriers Verbal and non-verbal communication Social networks, rumors, and grapevine Motivation theories and leadership Transactional analysis and JOHARI Window Coaching, mentoring, and feedback mechanisms.													

Unit IV	Team Dynamics and Conflict Management	06 Hours
Group dynamics and team processes Team formation and team effectiveness Cooperation, competition, and cohesiveness Delegation and empowerment Conflict management and negotiation Virtual and multicultural teams.		
Unit V	Organizational Ethics and High-Performance Leadership	06 Hours
Organizational justice and ethical behavior Corporate Social Responsibility (CSR) Positive organizational scholarship Building trust and credibility in teams High-performance team development Global leadership and leadership challenges in modern organizations		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
Leadership Style Role Play Students perform role plays demonstrating different leadership styles, communication approaches, and conflict management situations. Team Building & Group Dynamics Activity Practical activities/games to study teamwork, cooperation, delegation, trust-building, and group decision-making. Case Study Analysis on Organizational Behaviour Analyze real-life organizational situations related to motivation, leadership challenges, ethics, or team conflicts and present solutions. Communication & Negotiation Workshop Hands-on practice sessions on verbal/non-verbal communication, negotiation skills, feedback mechanisms, and interpersonal behaviour. Self-Assessment & Leadership Development Report Students prepare a report based on personality tests, emotional intelligence assessment, JOHARI window, or leadership skill evaluation with improvement plans.		
Text Books		
Hughes, R.L., Ginnett, R.C., & Curphy, G.J., Leadership: Enhancing the Lessons of Experience, 9th Edition, McGraw Hill Education, 2019.		
Reference Books		
- Robbins, S.P., Judge, T.A. & Vohra, N., Organizational Behavior, 18th Edition, Pearson Education, 2019. - Parek, U. & Khanna, S., Understanding Organizational Behavior, 4th Edition, Oxford University Press, 2018. - Greenberg, J. & Baron, R., Behavior in Organizations, 10th Edition, Pearson-Prentice Hall, 2009. - Luthans, F., Organizational Behavior, 10th Edition, McGraw-Hill, 2004. - Cameron, K.S. & Spreitzer, G.M., The Oxford Handbook of Positive Organizational Scholarship, Oxford University Press, 2012. - Baron, R.A. & Byrne, D., Social Psychology, 10th Edition, Pearson Education, 2004.		

Online Resources

1. Organizational Behaviour: Individual Dynamics in Organization by Prof. Abraham Cyril Issac:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg20
2. Leadership and Team Effectiveness by Prof. Santosh Rangnekar:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_mg39
3. Leadership & Management:
https://swayam-plus.swayam2.ac.in/courses/course-details?id=F_WADHW_26
4. Harvard Business Review Leadership Resources:
<https://hbr.org/topic/subject/leadership-and-managing-people>
5. <https://www.edx.org/learn/leadership>

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (OE-2) (Basket No 2): Green Practices & ESG Frameworks										Course Code: 25OEC202B			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
Basic knowledge of environmental science and sustainability, Understanding of industrial processes and resource utilization, Basic awareness of corporate management and ethics													
Course Objectives:													
1. To introduce the principles of sustainability and green practices in engineering and industry. 2. To understand Environmental, Social, and Governance (ESG) frameworks used in modern organizations. 3. To analyse environmental impacts and promote sustainable resource management. 4. To study social responsibility and governance practices for sustainable development. 5. To apply ESG reporting standards and sustainability assessment tools in organizations.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain the concepts of sustainability, green practices, and ESG frameworks. CO2. Analyse environmental impacts and adopt green technologies for sustainable development. CO3. Evaluate social responsibility and stakeholder engagement practices in organizations. CO4. Understand governance principles, ethical leadership, and regulatory frameworks. CO5. Apply ESG reporting standards and sustainability assessment methods in industries.													
Course Contents													
Unit I	Fundamentals of Sustainability and Green Practices										06 Hours		
Concept of sustainability and sustainable development, Environmental challenges: climate change, global warming, biodiversity loss, resource depletion, Principles of green practices and environmental responsibility, Green economy and circular economy concepts, Sustainable Development Goals (SDGs) and global sustainability initiatives, Sustainable consumption and production patterns, Role of engineering and technology in sustainable development, Importance of green practices in industrial and organizational activities.													
Unit II	Environmental Sustainability and Green Technologies										06 Hours		
Environmental sustainability and environmental protection strategies, Environmental Impact Assessment (EIA) and its importance, Carbon footprint analysis and greenhouse gas emissions, Carbon management strategies and carbon neutrality initiatives, Renewable energy technologies: solar, wind, hydro, biomass, Energy efficiency and energy conservation methods, Waste management techniques: reduce, reuse, recycle (3R concept), Water resource management and pollution control, Green manufacturing, eco-friendly materials, and cleaner production technologies.													
Unit III	Social Responsibility and Sustainable Development										06 Hours		
Concept and importance of Corporate Social Responsibility (CSR), Employee welfare, workplace health, and safety standards, Labour rights and fair working conditions, Diversity, equity, and													

inclusion in organizations, Stakeholder engagement and community development initiatives, social impact assessment and community sustainability programs, Ethical business conduct and responsible supply chain management, Role of organizations in social and economic development.		
Unit IV	Governance and Ethical Business Practices	06 Hours
Concept and principles of corporate governance, Governance structures and roles of board of directors, Transparency, accountability, and ethical leadership, Risk management and compliance mechanisms, Business ethics and anti-corruption policies, Legal and regulatory frameworks related to corporate governance, Sustainability governance and corporate responsibility policies, Governance practices for long-term organizational sustainability.		
Unit V	ESG Reporting, Assessment, and Implementation	06 Hours
Introduction to ESG metrics and sustainability performance indicators, ESG reporting frameworks and standards, Global Reporting Initiative (GRI) guidelines, Integrated reporting and sustainability disclosure practices, ESG ratings, benchmarking, and performance evaluation, Green finance, sustainable investments, and climate finance, Implementation of ESG strategies in organizations, Challenges in ESG adoption and reporting, Case studies of ESG implementation in industries and multinational companies.		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
Campus Green Audit & Waste Segregation Study Students conduct a sustainability audit of the campus/department by analyzing waste generation, segregation practices, energy usage, and water consumption. Submit findings with improvement recommendations. Carbon Footprint Calculation Project Students calculate the carbon footprint of a household, classroom, or small organization using standard carbon calculators and prepare a report suggesting carbon reduction strategies. ESG Reporting Case Analysis Students select a company and study its ESG or sustainability report (based on GRI/SDG framework). Prepare a presentation evaluating environmental, social, and governance practices. Sustainable Product / Process Design Activity Teams design an eco-friendly product, packaging solution, or green operational process applying principles of reduce–reuse–recycle and resource efficiency. Community Awareness & Social Responsibility Campaign Organize and document an awareness activity such as tree plantation, plastic-free drive, energy conservation campaign, or social impact survey, followed by submission of outcomes and reflections.		
Text Books		
- Understanding Sustainability Principles and ESG Policies: Colin Read, Springer Nature.2023 - The ESG and Sustainability Deskbook for Business, Kristyn Noeth, Springer, 2024		
Reference Books		
- Values at Work: Sustainable Investing and ESG Reporting, Daniel C. Esty, Todd Cort, Palgrave Macmillan, Year: 2020 - Business Responsibility and Sustainability in India, Bimal Arora, Pawan Budhwar, Divya Jyoti Publisher: Palgrave Macmillan, Year: 2019 - Looking at and Beyond Corporate Governance in India, Authors: Seema Joshi, Ruchi Kansil Publisher: Springer / Palgrave Macmillan Year: 2023 . - Dharmanomics: An Indigenous and Sustainable Economic Model, Author: Sriram Balasubramanian Publisher: Bloomsbury India, Year: 2024		

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (OE-2) (Basket No 3): Innovation and Business Strategy										Course Code: 25OEC202C			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
Basic understanding of technology, creativity, and problem-solving concepts.													
Course Objectives:													
1. Introduce concepts of innovation, creativity, and business strategy. 2. Develop strategic thinking and innovation management skills. 3. Explain business models, entrepreneurship, and technology innovation processes. 4. Familiarize students with sustainability, intellectual property rights, and innovation ecosystems. 5. Prepare students for innovation-driven business and entrepreneurial environments.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain concepts of innovation, creativity, and business strategy. CO2. Apply innovation management and strategic thinking tools for business problem-solving. CO3. Analyze business models, technology innovation, and entrepreneurial strategies. CO4. Evaluate sustainability, intellectual property, and innovation management practices. CO5. Develop innovative business solutions and strategic growth approaches.													
Course Contents													
Unit I	Foundations of Innovation and Creativity										06 Hours		
Innovation and creativity: concepts and importance Innovation in the current business environment Types of innovation Schools of innovation Challenges of innovation Divergent and convergent thinking													
Unit II	Innovation Management and Design Thinking										06 Hours		
Innovation management process Idea management systems Design thinking and entrepreneurship Experimentation and prototyping Co-creation and idea championship Incubation and entrepreneurship ecosystems.													
Unit III	Business Models and Strategic Innovation										06 Hours		
Business models and value proposition Entrepreneurship and social entrepreneurship Blue Ocean Strategy Strategic positioning and competitive advantage Business model failure: reasons and remedies													

Innovation-driven business growth		
Unit IV	Technology Innovation and Intellectual Property Rights	06 Hours
Technology innovation process Technology forecasting and planning Technological innovation management strategies Management of innovation Intellectual Property Rights (IPR) Patents, copyrights, and patents in India.		
Unit V	Sustainable Innovation and Future Business Trends	06 Hours
Sustainability innovation and entrepreneurship Innovation for sustainable development SME involvement in sustainability Material efficiency and sustainable business models Managing investors for innovation Future markets and innovation opportunities for India		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
Innovation Idea Pitch Presentation Students identify a real-world problem and present an innovative product, service, or business solution using creativity and design thinking tools. Business Model Canvas Workshop Teams prepare a Business Model Canvas for a startup or sustainable business idea, explaining value proposition, customer segments, revenue streams, and competitive advantage. Prototype Development & Demonstration Students create a basic prototype/mock-up of an innovative product or digital solution and demonstrate its functionality and market relevance. Case Study Analysis on Successful Innovations Analyze companies known for innovation and strategy (e.g., startups or technology firms) and present factors behind their success, business strategy, and innovation practices. IPR & Patent Search Activity Students perform a patent/trademark search related to a chosen innovation area and prepare a short report on intellectual property protection and commercialization opportunities.		
Text Books		
1. Krishnan, R.T. & Dabholkar, V., 8 Steps to Innovation: Going from Jugaad to Excellence, HarperCollins India.		
Reference Books		
- Drucker, Peter F., Innovation and Entrepreneurship, Routledge. - Harvard Business Review Series, Innovation and Entrepreneurship, Harvard Business School Publishing. - Osterwalder, A. & Pigneur, Y., Business Model Generation, Wiley. - Kim, W. Chan & Mauborgne, Renée, Blue Ocean Strategy, Harvard Business Review Press. - Tidd, J. & Bessant, J., Managing Innovation, Wiley Publications.		
Online Resources		
1. Innovation Business Models and Entrepreneurship by Prof. Vinay Sharma, Prof. Rajat Agrawal https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_mg95		

2. Entrepreneurship & IP strategy by Prof. Gouri Gargate:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_hs213
3. Managing Innovation by Rishiksha T Krishnan and Vinay Dabholkar:
https://onlinecourses.swayam2.ac.in/e-learning/preview/imb19_mg05
4. Business Strategy Specialization by University of Virginia:
<https://www.coursera.org/specializations/business-strategy>
5. Design Thinking for Beginners: Develop Innovative Ideas (Udemy):
<https://www.udemy.com/course/design-thinking-for-beginners/?couponCode=PMNVD2025>
6. Strategic Management Resources:
<https://www.hbsp.harvard.edu/catalog/collections/strategic-management-resources>
7. <https://www.edx.org/learn/innovation>

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (OE-2) (Basket No 4): Stress Management and Mental Well Being										Course Code: 25OEC202D			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
Basic awareness about personal health, emotions, and daily life challenges.													
Course Objectives:													
1. To introduce the concept of stress, mental health, and wellbeing. 2. To help students identify stressors in academic and professional life. 3. To develop effective coping strategies and stress management skills. 4. To promote emotional intelligence and resilience. 5. To encourage healthy lifestyle habits for long-term wellbeing.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain the concepts of stress, mental health, and wellbeing CO2. Identify sources of stress and analyze their impact CO3. Apply stress management techniques CO4. Demonstrate emotional intelligence and coping strategies CO5. Design a personal wellbeing and stress management plan.													
Course Contents													
Unit I	Fundamentals of Stress and Mental Health										06 Hours		
Concept and definition of stress and mental wellbeing, Types of stress: Eustress and Distress, Stress response and General Adaptation Syndrome (GAS), Causes and symptoms of stress, Mind–body relationship, Impact of stress on academic performance and productivity. Difference between stress, anxiety, and depression.													
Unit II	Sources of Stress and Emotional Awareness										06 Hours		
Academic, professional, social, and personal stressors; Personality types and stress (Type A and Type B personality); Emotional intelligence: Self-awareness, Self-regulation, Motivation, Empathy, Social skills; Identifying negative thinking patterns.													
Unit III	Stress Management Techniques										06 Hours		
Relaxation techniques: Deep breathing, Progressive muscle relaxation; Meditation and mindfulness, Yoga and physical exercises for stress reduction, Time management and goal setting, Positive thinking and cognitive restructuring.													
Unit IV	Mental Wellbeing and Healthy Lifestyle										06 Hours		
Importance of sleep, nutrition, and physical activity, managing emotions: anxiety, anger, frustration, Building resilience and self-confidence, Work–life balance, Digital wellbeing and social media stress.													

Unit V	Personal Development and Coping Strategies	06 Hours
Interpersonal communication and relationship management, Coping strategies for change and uncertainty, Conflict management and emotional regulation, Developing a personal wellbeing plan, Case studies on stress management in student and workplace environments.		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
1. Stress Diary & Self-Assessment Activity Students maintain a weekly stress journal to identify stress triggers, emotional responses, and coping methods, followed by a reflective analysis report. 2. Mindfulness and Relaxation Practice Session Conduct guided activities such as meditation, deep breathing, yoga, or progressive muscle relaxation and submit observations on stress reduction outcomes. 3. Case Study Analysis on Mental Wellbeing Analyze real-life or workplace/student stress management cases and suggest coping strategies, emotional intelligence techniques, and wellbeing solutions. 4. Work–Life Balance & Digital Wellness Survey Students design and conduct a survey on stress, screen time, sleep, or work–life balance among peers, then present findings with recommendations. 5. Personal Wellbeing and Stress Management Plan Prepare an individual wellness plan including fitness, sleep, nutrition, time management, and emotional wellbeing strategies for long-term mental health improvement.		
Text Books		
1. Leahy, Robert L. The Worry Cure. Three Rivers Press, 2006. 2. Carnegie, Dale. How to Stop Worrying and Start Living. Simon & Schuster, 1948. 3. Johnstone, Matthew. I Had a Black Dog. Robinson Publishing, 2005.		
Reference Books		
1. Goleman, Daniel. Emotional Intelligence: Why It Can Matter More Than IQ. Bantam Books, 1995. 2. Kabat-Zinn, Jon. Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life. Hyperion, 1994. 3. Covey, Stephen R. The 7 Habits of Highly Effective People. Free Press, 1989.		
Online Resources		
1. NPTEL course on Stress Management by Prof. Rajlakshmi Guha, IIT Kharagpur: https://nptel.ac.in/courses/121105009 2. NPTEL course on Psychology of Stress, Health and Well-being by Prof. Dilwar Hussain, IIT Guwahati: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_hs29		

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (OE-2) (Basket No 5(A)): French Language Module-II										Course Code: 25OEC202E			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
French Language Module-I.													
Course Objectives:													
1. To strengthen beginner-level communication skills in French. 2. To improve listening, reading and writing abilities. 3. To develop confidence in practical conversations. 4. To introduce travel and public communication vocabulary. 5. To prepare students for DELF A1 level competency.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Use basic French expressions confidently. CO2. Understand simple dialogues and instructions. CO3. Read and write short paragraphs. CO4. Participate in guided conversations. CO5. Apply French in practical situations.													
Course Contents													
Unit I	Voyages (Travel)										06 Hours		
Talking about one’s dream travel destination The near future tense Prepositions Giving a reason (parce que / car).													
Unit II	Au magasin... au restaurant (At the store... at the restaurant)										06 Hours		
Clothes and accessories Shopping dialogues French cuisine and some famous dishes Restaurant communication													
Unit III	La vie quotidienne (Daily life)										06 Hours		
Pronominal verbs Talk about one’s routine Talk about one’s favourite outings Conversation to plan outings.													
Unit IV	Quand j’étais petie ...(When I was little...)										06 Hours		
Past tense (Le passé compose) Talk about some activities in the past Past continuous (L’imparfait) Talk about one’s childhood													

Unit V	La francophonie (The French-speaking world)	06 Hours
Francophone countries Talking about seasons and climate Expressing emotions Conversations.		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
1. Shopping Role Play: Students perform shopping conversations using French vocabulary and expressions. 2. Restaurant Communication Activity: Students practice ordering food and interacting in French. 3. Travel Conversation Simulation: Students perform dialogues related to travel and directions. 4. Paragraph Writing in French: Students write short paragraphs on daily routines or hobbies. 5. French Culture Presentation: Students present information on French-speaking countries or traditions.		
Text Books		
1. Véronique M Kizirian, Emmanuelle Daill, Annie Berthet, Catherine Hugot, “Alter Ego+ (A1)”, Hachette, ISBN: 9782011558107, (Goyal Publishers) 2. Nathalie Hirschsprung, Tony Tricot, “Cosmopolite 1-A1”, Textbook +Workbook (2 Book Set) (Goyal Publishers), ISBN: 9788194434108.		
Reference Books		
1. Annie Heminway, “Practice Makes Perfect: Complete French Grammar”, McGraw-Hill Education, ISBN-13 : 978-1259642371 2. Claire Miquel, “Vocabulaire progressif du français - Niveau debutant (A1)”, Cle International, ISBN-13 : 978-2090380170, Bookswagon, 2/13 Ansari Road, Daryaganj, New Delhi 110002 3. Evelyne Siréjols, “Communication En Dialogues”, CLE international, ISBN: 9782090380637 (Goyal Publishers) 4. Myrna Bell Rochester, “Easy French Step-By-Step: Master High-Frequency Grammar for French Proficiency—Fast”, McGraw Hill, ISBN-13 : 978-0071453875 5. Claire Miquel, “Communication Progressive du Français A1”, CLE International, Atlantic Publishers and Distributors (P) Ltd., 7/22, Ansari Road, Darya Ganj, New Delhi – 110002 6. Ranjit, Mahita & Singh, Monica, Apprenons le français', Part 2, Saraswati House Pvt. Ltd., New Delhi. Second Revised Edition, 2007 7. Ranjit, Mahita & Singh, Monica, Cahier d'exercices', (Apprenons le français) Part 2., Saraswati House Pvt. Ltd., New Delhi. Second Revised Edition, 2007.		
Online Resources		
1. The Complete French Course : Learn French – Beginners: https://www.udemy.com/course/french-for-beginners-a1/?couponCode=PMNVD2025 2. Francés Introductorio: https://www.coursera.org/learn/frances-introductorio 3. Français Débutant A1: https://www.coursera.org/learn/french-beginner 4. The Complete French Course : Learn French - Low Intermediate: https://www.udemy.com/course/the-complete-french-course-learn-french-low-intermediate/?couponCode=PMNVD2025 5. Complete French Course: Learn French for Beginners: https://www.udemy.com/course/complete-french-course/?couponCode=PMNVD2025		

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (OE-2) (Basket No 5(B)): German Language Module-II										Course Code: 25OEC202F			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
German Language Module-I.													
Course Objectives:													
1. To strengthen beginner-level communication skills in German. 2. To improve reading, writing and listening abilities. 3. To develop confidence in practical conversations. 4. To introduce travel and public communication vocabulary. 5. To prepare students for Goethe A1 level competency.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Use beginner-level German expressions confidently. CO2. Understand simple dialogues and instructions. CO3. Read and write short passages. CO4. Participate in practical conversations. CO5. Apply German in everyday situations.													
Course Contents													
Unit I	Wohnen und Leben (Housing and life)										06 Hours		
Topics and Vocabulary - House (different types of houses and things inside a house) - Furniture - Renting Grammar - Accusative case - Definite, Indefinite articles in accusative case - Accusative case – Personal Pronouns - Accusative case – Possessive Pronouns Skills - Speaking: describe room/home - Reading: advertisements Writing: a message to friends to invite for celebration													
Unit II	Stadt und Orientierung (City and Orientation)										06 Hours		
Topics and Vocabulary - Places in city - Means of transport - Directions - Travel - Planning and hotel booking Grammar - Types of sentences and formation- statement, interrogative sentence, imperative sentence													

- Past tense formation- haben, sein Skills - Speaking: asking/giving directions - Listening: friends planning a trip - Writing: My last trip - Reading: trip blogs and experiences Activity - Navigation task		
Unit III	Essen und Trinken (Food and Drink)	06 Hours
Topics and Vocabulary - Food - Beverages - Restaurant expressions - Shopping and cooking Grammar - Perfekt tense introduction - haben/sein - Adjectives Skills - Reading and writing: food blogs - Speaking: ordering food, expressing likes/dislikes Activity - café roleplay		
Unit IV	Gesundheit und Körper (Health and body)	06 Hours
Topics and Vocabulary - Body parts - Symptoms - Medicine Grammar - Conjunctions - Modal auxiliary- function, usage, structure Skills - Email writing/ message writing- unable to attend an event because of illness - Reading- health related small text Activity - Doctor-patient conversations		
Unit V	Intercultural Communication (Intercultural Communication)	06 Hours
Topics - German etiquette - Punctuality - University culture - Workplace culture Skills - Intercultural awareness Formal communication		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
1. Shopping Role Play: Students perform shopping conversations using German vocabulary and expressions. 2. Restaurant Communication Activity: Students practice food ordering conversations in German.		

3. Travel Conversation Simulation: Students perform dialogues related to travel situations and directions. 4. Paragraph Writing in German: Students write short paragraphs on familiar topics in German. 5. German Culture Presentation: Students present information about German-speaking countries and traditions.
Text Books
1. Stefanie Dengler, “Netzwerk A1 (Textbook + Workbook + Glossar)”, Hachette , ISBN: 9788183077033, (Goyal Publishers) 2. Kurs Und Übungsbuch, “Studio-D A1 - Combo of 3 (German)”, Goyal Publishers & Distributers.
Reference Books
1. Martin Durrell, “Hammer's German Grammar and Usage”, Fifth Edition: Volume 1, Hodder Education 2. Harriette Lanzer, Anne Lise Gordon, “German Vocabulary Builder”, OUP Oxford 3. Funk and Kuhn, “Studio D A1 Deutsch Buch “, Cornelsen Verlag (Goyal Publishers India).
Online Resources
1. DW Learn German: https://learngerman.dw.com/en/learn-german/s-9528 2. Practise German for free (Goethe-Institut Resources): https://www.goethe.de/en/spr/ueb.html 3. Learn German Easily: https://learn-german-easily.com/ 4. BBC Languages German: https://www.bbc.co.uk/languages/german/ 5. Gothe Exam A1 practice material: https://www.goethe.de/ins/mm/en/spr/prf/gzsd1/ueb.html 6. Best Way to Learn German Language: Full Beginner (A1.1): https://www.udemy.com/course/best-way-to-learn-german-full-beginner-starter-kit/?couponCode=PMNVD2025 7. Best Way to Learn German Language: Beginner Level 2 (A1.2) : https://www.udemy.com/course/learn-german-for-the-advancing-beginner-a1-a2/?couponCode=PMNVD2025

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (OE-2) (Basket No 5(C)): Japanese Language Module-II										Course Code: 25OEC202G			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	20	30	50	-	-	-	100	2	-	-	2
Prerequisite:													
Japanese Language Module-I.													
Course Objectives:													
1. To strengthen beginner-level Japanese communication skills. 2. To improve reading and writing abilities in Japanese. 3. To develop confidence in practical conversations. 4. To introduce travel and public communication vocabulary. 5. To prepare students for JLPT N5 level competency.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Communicate using beginner-level Japanese expressions. CO2. Understand short dialogues and passages. CO3. Read and write basic Japanese sentences. CO4. Participate in practical conversations. CO5. Apply Japanese in everyday situations.													
Course Contents													
Unit I	Kihon bunpō (tsudzuki) (Basic Grammar Continuation)										06 Hours		
Verb forms Adjectives Particle usage Question and negative forms													
Unit II	Jissen-tekina komyunikēshon (Practical Communication)										06 Hours		
Shopping conversations Travel communication Restaurant communication Asking directions Communication with Doctor Kanji –Lesson 4 (Textbook 1 &2)													
Unit III	Risuningu to supīkingu no sukiru (Listening and Speaking Skills)										06 Hours		
Pronunciation improvement Listening comprehension Dialogue practice Group conversation Kanji –Lesson 5 (Textbook 1 &2)													
Unit IV	Yomikaki (Reading and Writing)										06 Hours		

Reading short passages Writing paragraphs Vocabulary enhancement Translation practice Kanji –Lesson 6 (Textbook 1 & 2)		
Unit V	Bunka-teki oyobi shakai-teki komyunikēshon (Cultural and Social Communication)	06 Hours
Japanese culture and etiquette Social conversations Telephone communication Presentation activities Kanji –Lesson 7 (Textbook 1 & 2)		
Total Hours		30
List of Course Activities for Continuous Comprehensive Assessment (Any Two):		
1. Shopping Role Play: Students perform shopping conversations using Japanese vocabulary and expressions. 2. Restaurant Communication Activity: Students practice ordering food and basic interaction in Japanese. 3. Travel Conversation Simulation: Students perform dialogues related to travel and directions in Japanese. 4. Paragraph Writing in Japanese: Students write short paragraphs on daily routines or hobbies. 5. Japanese Culture Presentation: Students present information about Japanese traditions or festivals.		
Text Books		
1. 3A Corporation, “Minna No Nihongo 1-1,1-2,2-1,2.2 Main Textbook elementary”, ISBN-13: 9789388141147, Goyal Publishers & Distributors Pvt. Ltd, India 2. Banno Eri, “Genki: An Integrated Course in Elementary Japanese II Textbook [third Edition]”, ISBN-13 : 978-4789017329, Japan Times.		
Reference Books		
1. The Japan Foundation, “Marugoto: Japanese Language and Culture Starter A1 Coursebook for Communicative Language Activities”, Goyal Publishers 2. The Japan Foundation, “Marugoto Starter (A1) Rikai - Course Book For Communicative Language Competences”, Goyal Publishers, ISBN-13: 9788183078047 3. The Japan Foundation, “Marugoto Starter (A1) Katsudoo”, Goyal Publishers 4. “Japanese for Busy People,3rd edition”, Association for Japanese Language Teaching, Kodansha Tokyo Japan Kodansha International, November, 2011., 5. Tae Kim, “A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar”, Createspace Independent Pub, ISBN-13 : 978-1495238963, Bookswagon, 2/13 Ansari Road, Daryaganj, New Delhi 110002 6. Timothy G. Stout , Kaori Hakone, “Japanese Kanji for Beginners: (JLPT Levels N5 & N4) First Steps to Learn the Basic Japanese Characters”, Tuttle Publishing UK, Verseas Press India Pvt Ltd.		
Online Resources		
1. Online Japanese Beginner Course (Udemy): https://www.udemy.com/course/online-japanese-beginner-course 2. JF-Japanese e-learning: https://minato-jf.jp/		

3. Introduction to Japanese Language : Prof Vatsala Misra (NPTEL):
https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_hs83
4. Learn Japanese Language: Free Online Courses:
<https://www.busuu.com/en/course/learn-japanese-online>
5. Marugoto OOnline:
<https://www.marugoto-online.jp/info/>
6. JLPT N5 Practice Material:
<https://www.jlpt.jp/e/samples/sampleindex.html>

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (PCC-L): Database Management Systems Lab										Course Code: 25AIPCC204L			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	25	25	-	1	-	1
Prerequisite:													
Data Structures													
Course Objectives:													
1. To understand and apply the concepts of database design by formulating case studies, creating E-R diagrams, and mapping them to the relational model. 2. To develop and execute SQL queries for creating, modifying, and managing database structures using DDL, DML, DCL, and TCL commands. 3. To implement advanced SQL operations, including aggregate functions, joins, subqueries, views, stored procedures, and triggers, for efficient database management. 4. To explore NoSQL databases by designing and implementing CRUD operations in MongoDB, understanding document-based storage and retrieval.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Apply the concepts of database design by creating E-R diagrams and converting them into relational models. CO2. Develop and execute SQL queries for data manipulation, transaction control, and access management using DML, DCL, and TCL commands. CO3. Analyze and implement SQL operations, including joins, views, subqueries, stored procedures, and triggers, to optimize data retrieval and integrity. CO4. Design and Implement CRUD operations in MongoDB, demonstrating an understanding of NoSQL database concepts and their practical applications.													
List of Experiments:													
1. Develop a case study and design its Entity-Relationship (ER) Diagram. Convert the ER model into a relational model. 2. Write and execute SQL Data Definition Language (DDL) commands such as CREATE, ALTER, DROP, RENAME, and TRUNCATE to define and modify tables. Insert data into the tables and apply appropriate integrity constraints such as NOT NULL, UNIQUE, PRIMARY KEY, FOREIGN KEY, and CHECK. 3. SQL Queries for Data Manipulation, Access Control, and Transactions Design and run SQL queries to demonstrate the following: a) Data Manipulation (DML): Use SQL statements to INSERT, UPDATE, and DELETE records. Apply arithmetic, logical, set operators, pattern matching, and string functions. b) Access Control (DCL): Use GRANT, REVOKE, and ROLE commands to manage user access. c) Transaction Control (TCL): Apply START TRANSACTION, COMMIT, ROLLBACK, and SAVEPOINT commands to manage transactions.													

4. Use aggregate functions along with GROUP BY and HAVING clauses to retrieve summarized data from the database.
5. Perform various types of JOIN operations to extract meaningful relationships between tables. Create and manage different database views.
6. Write and execute subqueries to retrieve data from one table based on results from another.
7. Create and execute stored procedures / function using cursors
8. Implement and test triggers to maintain data integrity in database.
9. Design and implement basic Create, Read, Update, and Delete (CRUD) operations using MongoDB. Use the save method and logical operators where necessary.
10. Using the database concepts covered in above assignments, develop an application. Student should develop application in group of 3-4 students and submit the Project Report which will consist of documentation
Title of the Project, Abstract, Introduction, Software Requirement Specification, Conceptual Design using ER features, Relational Model in appropriate Normalize form, Graphical User Interface, Source Code, Testing document, Conclusion.

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (PCC-L): Foundation of Machine Learning Lab										Course Code: 25AIPCC205L			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	25	-	25	-	1	-	1
Prerequisite:													
Basic Concepts of Machine Learning													
Course Objectives:													
1. To apply the fundamental concepts of supervised and unsupervised machine learning algorithms and Feature extraction techniques 2. To apply classification algorithm techniques and evaluate the performance 3. To apply regression algorithm techniques and evaluate the performance 4. To apply unsupervised learning techniques.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Apply the fundamental concepts of supervised and unsupervised machine learning algorithms and Feature extraction techniques CO2. Apply classification algorithm techniques and evaluate the performance CO3. Apply regression algorithm techniques and evaluate the performance CO4. Apply unsupervised learning techniques.													
List of Experiments:													
1. Implement assignment based on implementation of Supervised and Unsupervised Machine Learning Techniques using Python (scikit-learn) Customer Segmentation for a Retail Store: A retail company wants to segment its customers based on purchasing behavior to tailor marketing strategies. Unsupervised Technique: K-Means Clustering (for customer grouping) Supervised Technique: Decision Tree Classifier (to predict segment of new customers after labeling clusters). 2. Implement assignment based on feature extraction techniques for effective Machine Learning model building Resume Classification System: A recruitment platform wants to automatically classify candidate resumes into different job roles such as software developer, data analyst, and manager. Since resumes are in text format, feature extraction techniques are required to convert unstructured resume data into numerical features for effective model building. Unsupervised Technique: Hierarchical Clustering (for grouping similar resumes) Supervised Technique: Support Vector Machine (SVM) (to classify resumes into job categories after labeling clusters) 3. Implement assignment based on Naïve Bayes Classifier and evaluate the performance (confusion matrix, accuracy, precision, recall, F1-Score)													

Credit Card Fraud Detection: A financial institution wants to detect fraudulent credit card transactions based on transaction details such as amount, location, time, and user behavior. The goal is to build a machine learning model using labeled transaction data to classify transactions as fraudulent or legitimate. Algorithm Used: Naïve Bayes Classifier

4. Implement assignment based on decision tree classifier and evaluate the performance (confusion matrix, accuracy, precision, recall, F-1 Score).

Loan Approval Prediction System: A bank wants to automate the loan approval process using a machine learning model. The model should predict whether a loan will be approved or rejected based on the applicant's profile.

5. Implement assignment based on simple linear regression and evaluate the performance (Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE), R-squared (R^2 Score))

Predicting House Prices Based on Area: A real estate analyst wants to predict the price of a house based on its area (in square feet). A dataset is available containing house areas and their corresponding prices.

6. Implement assignment based on logistic regression for binary classifier and evaluate the performance, Predicting Online Purchase Behavior: An e-commerce company wants to predict whether a user will make a purchase (1) or not (0) based on user behavior such as time spent on the website, number of pages visited, and previous purchases. A dataset is available containing user activity data and purchase status.

7. Implement assignment based on K-Means clustering algorithm and evaluate the performance Image Compression using Clustering:

A digital media company wants to reduce the size of images for faster storage and transmission without significantly affecting quality. The dataset consists of pixel values (RGB color intensities) of images. By applying K-Means Clustering, similar colors are grouped into clusters, and each pixel is replaced with the centroid of its cluster. This reduces the number of distinct colors in the image, effectively compressing it. The approach helps optimize storage space and improve processing efficiency without using labeled data.

8. Implement assignment based on K-Medoid clustering algorithm and evaluate the performance Telecommunication Customer Plan Grouping:

To segment telecom customers into meaningful clusters based on their usage behavior, such as call duration, data consumption, and text message usage. This segmentation helps telecom companies design personalized plans and offers.

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (PCC-L): Object Oriented Programming and Computer Graphics Lab										Course Code: 25AIPCC206L			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	25	25	-	1	-	1
Prerequisite:													
1. Basic knowledge of C Programming (variables, loops, functions) 2. Understanding of basic mathematics (coordinate geometry, matrices) 3. Familiarity with fundamentals of data structures 4. Basic problem-solving and logical thinking skills													
Course Objectives:													
1. To develop programming skills using C++ and Object-Oriented concepts 2. To understand and apply modular and reusable code design 3. To introduce fundamental concepts of computer graphics and visualization 4. To implement graphics algorithms and geometric transformations 5. To build simple real-world and graphical applications .													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Apply OOP concepts such as classes, inheritance, and polymorphism using C++ CO2. Design and implement structured, modular, and reusable programs CO3. Implement basic computer graphics algorithms for drawing primitives CO4. Apply 2D transformations to graphical objects CO5. Develop simple computer graphics applications													
List of Experiments:													
1. Design and implement a menu-driven calculator program in C++ that performs arithmetic operations such as addition, subtraction, multiplication, and division. The program should demonstrate the use of data types, operators, and control structures (if-else, switch, loops). 2. Develop a C++ program to demonstrate the concept of functions using call by value and call by reference. The program should include: - Swapping two numbers - Finding factorial of a number - Generating Fibonacci series - Also, demonstrate the use of inline functions and default arguments. 3. Create a class named Student with appropriate data members (roll number, name, marks) and member functions to input and display student details. Use proper access specifiers and demonstrate object creation and method invocation. 4. Design a class Complex to represent complex numbers. Implement: - Default, parameterized, and copy constructors - Overload the '+' operator to add two complex numbers													

- Display the result using member function
- 5. Develop a C++ program to demonstrate inheritance and polymorphism by creating a base class Shape and derived classes such as Circle and Rectangle.
 - Implement function overriding for area calculation
 - Use virtual functions to achieve runtime polymorphism
- 6. Write a C++ program to manage student records using file handling. The program should:
 - Store and retrieve data from a file (text or binary)
 - Implement exception handling for errors such as file not found or invalid input
- 7. Implement and compare the following computer graphics algorithms using C++:
 - DDA Line and Bresenham Line Drawing Algorithm
 - Bresenham Circle Drawing Algorithm
- 8. Develop a C++ program to demonstrate 2D geometric transformations (translation, rotation, scaling) on basic shapes.
- 9. Mini Graphics Application
Additionally, design a mini graphics application (e.g., moving car, rotating windmill, or simple animation) using these transformations.

Virtual Laboratories:

<https://cse18-iiith.vlabs.ac.in/List%20of%20experiments.html>

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (VSEC): Data Science and Visualization Techniques										Course Code: 25AIVSE202			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	25	-	-	25	-	1	-	1
Prerequisite:													
Database Management System													
Course Objectives:													
1. To Understand and apply statistical methods for data preprocessing 2. To Analyze and utilize various tools and techniques for effective data visualization 3. To Evaluate the key components and principles of data visualization for designing meaningful visual representations.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Apply statistical methods for data preprocessing and analysis. CO2. Design and create effective data visualizations. CO3. Apply data visualization techniques in various application domains..													
List of Experiments: Perform any 8 of 10 and Mini project is compulsory													
1. Compare various data visualization tools. Study any one of the tools in detail. 2. The Titanic disaster of 1912 resulted in the loss of many lives, and analyzing the survival patterns of passengers can provide valuable insights into factors that influenced survival rates. Using the Titanic dataset from Kaggle, perform data preprocessing, handle missing values, and create meaningful visualizations to explore relationships between variables such as passenger class, age, gender, and survival rate 3. Perform the following operations using R/Python on the data sets Compute and display summary statistics for each feature available in the dataset. (e.g. minimum value, maximum value, mean, range, standard deviation, variance and percentiles · Data Visualization-Create a histogram for each feature in the dataset to illustrate the feature distributions. · Data cleaning · Data integration · Data transformation · Data model building (e.g. Classification) 4. To study different types of data visualizations Techniques on various data structures like Temporal, Hierarchical, Network, Multidimensional, Geospatial Dataset: Monthly Sales Dataset (Date vs Sales) 5. Study and Implementation of Exploratory Data Analysis and Visualization Techniques using Python. (Apply visualization techniques, Create interactive dashboard) Dataset: Superstore Sales Dataset (orders, profit, category, region) 6. Create visualization for temporal dataset and plot graphs like Scatter plots, Polar area diagrams, Time series, sequences, Line graphs. 7. Mini Project: Create a dashboard by using above visualization techniques.													

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (AEC): Modern Indian Language (Marathi)										Course Code: 25AEC201A			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	-	-	-	25	25	-	50	2	-	-	2
Course Objectives (अभ्यासक्रमाची उद्दिष्ट्ये):													
१. प्रगत भाषिक कौशल्यांची क्षमता विकसित करणे. २. प्रसारमाध्यमातील संज्ञापनातील स्वरूप आणि स्थान स्पष्ट करणे. ३. व्यक्तिमत्त्व विकास आणि भाषा यांच्यातील सहसंबंध स्पष्ट करणे ४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांचे परस्पर संबंध स्पष्ट करणे. ५. प्रसारमाध्यमांची लेखनक्षमता विकसित करणे.													
Course Outcomes (अभ्यासक्रम पररणाम):													
हा अभ्यासक्रम पूर्ण केल्यानंतर विद्यार्थी पुढील बाबी साध्य करू शकतील : CO१. मराठी भाषेतील प्रगत भाषिक कौशल्यांचा प्रभावीपणे वापर करून संवाद साधू शकतील. CO२. प्रसारमाध्यमांतील संज्ञापनाचे विविध प्रकार, स्वरूप व समाजातील त्यांचे स्थान स्पष्ट करू शकतील. CO३. व्यक्तिमत्त्व विकासामध्ये भाषेचे महत्त्व ओळखून प्रभावी संवादकौशल्य विकसित करू शकतील. CO४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांतील परस्परसंबंधांचे विश्लेषण करू शकतील. CO५. प्रसारमाध्यमांसाठी विविध प्रकारचे लेखन कौशल्य आत्मसात करून प्रभावी लेखन करू शकतील.													
Course Contents (अभ्यासक्रम विषयवस्तू)													
Unit I	घटक १									06 Hours			
मराठी भाषेची आविष्कार रूपे भाषा आणि व्यक्तिमत्त्व विकास: सहसंबंध लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे.													
Unit II	घटक २									06 Hours			
वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितशोधन आकाशवाणीसाठी भाषणाची संहितालेखन दूरचित्रवाणीसाठी माहितीपटासाठी संहितालेखन समीक्षणात्मक लेखन: पुस्तक समीक्षण, चित्रपट समीक्षण													
Unit III	घटक ३									06 Hours			

भाषा, जीवन व्यवहार आणि नवमाध्यमे, समाजमाध्यमे

नवमाध्यमे आणि समाजमाध्यमांचे प्रकार: ब्लॉग, फेसबुक, ट्विटर

नवमाध्यमे आणि समाजमाध्यमांविषयक साक्षरता, दक्षता, वापर, परिणाम

Unit IV	घटक ४	06 Hours
वेबसाईट आणि ब्लॉग, ट्विटरसाठी लेखन, ई-मेल व्यावहारिक लेखन कौशल्य : अर्जलेखन व पत्रलेखन		
Unit IV	घटक ५	06 Hours
अनुवाद कौशल्य (Translation): इंग्रजी किंवा इतर भाषांमधून मराठीत अनुवाद करणे. कथा/कादंबरी/संवाद लेखन: सर्जनशील साहित्याची निर्मिती, पटकथा आणि संवाद लेखन.		
Total Hours		30
Term Work Evaluation <i>Subject teacher should frame minimum 10 assignments-based covering on all five units</i>		
1. सारांश लेखन (Summary Writing) विद्यार्थ्यांनी उतारा वाचून स्वतःच्या शब्दात एक संक्षिप्त सारांश लिहावा. Students read a passage and write a short summary in their own words.		
2. भाषांतर (Translation Assignment) विद्यार्थ्यांनी इंग्रजी भाषेतील मजकूर मराठीमध्ये भाषांतरित करावा. Students translate text from English to Marathi . Example - Short technical paragraph translation - Daily communication sentences		
3. पत्र लेखन (Letter Writing) विद्यार्थ्यांनी वेगवेगळ्या प्रकारची औपचारिक व अनौपचारिक पत्रे लिहावी Types - औपचारिक पत्र (Formal Letter) - अनौपचारिक पत्र (Informal Letter) - अर्ज लेखन		
4. गटक्रिया (Group Activity) विद्यार्थ्यांनी खालीलपैकी एक गट क्रियाकलाप करावा. Example - रोड शो - स्किट प्ले - एकांकिका		
5. सादरीकरण (Presentation Assignment) विद्यार्थ्यांनी तंत्रज्ञान, पर्यावरण, सामाजिक इ . कोणत्याही एका विषयावर सादरीकरण करावे. Students present a topic in Marathi. Examples तंत्रज्ञानातील नवीन शोध		

- पर्यावरण विषयक सादरीकरण

6. गटचर्चा (Group Discussion)

विद्यार्थ्यांनी गटांमध्ये एखाद्या विषयावर चर्चा करावी.

Students discuss a topic in groups.

Example Topics

- सोशल मीडियाचा प्रभाव
- ऑनलाइन शिक्षणाचे फायदे व तोटे

7. मराठी ब्लॉग लिहणे

विद्यार्थ्यांनी त्यांच्या अभ्यासाच्या क्षेत्रातील विकासावर २०० शब्दांपर्यंत ब्लॉग लिहून पोस्ट लिहून सोशल मीडियावर पोस्ट कराव्या.

Write blogs and posts on social media up to 200 words on recent development in their field of study.

8. पुस्तक परीक्षण (Book Review)

विद्यार्थ्यांना मराठी पुस्तक किंवा लेख वाचावे आणि त्यावर समीक्षा लिहावी.

Students read a Marathi book or article and write a **review**.

9. चित्रपट परीक्षण (Marathi film Review)

विद्यार्थ्यांनी उपलब्ध असलेला सामाजिक मराठी चित्रपट पाहवा आणि त्यावर समीक्षा लिहून, ती त्यांच्या आवडीच्या सोशल मीडियावर पोस्ट करावी.

Social Marathi movie available and write a review on post it on social media of their choice.

10. स्पर्धांमध्ये सहभाग (Participation in Competition)

पुरुषोत्तम, फिरोदिया, दाजीकाका गाडगीळ करंडक, आणि श्रीटेज करंडक या स्पर्धांमध्ये सहभाग नोंदवावा.

Participation in Purushottam karandam, Firodia karandak, Dajikaka Gadgil Karandak and Shreetej Karandak.

Text Books

सायबर संस्कृती : डॉ. रमेश वरखडे

२. व्यावहारिक मराठी: डॉ. ल. रा. नसिराबादकर, फडके प्रकाशन, कोल्हापूर

३. उपयोजित मराठी : संपादक डॉ. केतकी मोडक, संतोष शेणई, सुजाता शेणई

४. आधुनिक माहिती तंत्रज्ञानाच्या विश्वात , दीपक शिक्रापूरकर, उज्ज्वल मराठे, उत्कर्ष प्रकाशन, पुणे

५. व्यावहारिक मराठी, पुणे विद्यापीठ प्रकाशन, पुणे

६. प्रसारमाध्यमांसाठी लेखन कौशल्य, यशवंतराव चव्हाण मुक्त विद्यापीठ, नाशिक

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (AEC): Modern Indian Language (Sanskrit)										Course Code: 25AEC201B			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	-	-	-	25	25	-	50	2	-	-	2
Prerequisite:													
Basic ability to read Devanagari script is helpful but not mandatory													
Course Objectives:													
1. To introduce engineering students to the basic structure of the Sanskrit language. 2. To highlight the relevance of Sanskrit in modern fields such as Computational Linguistics and Artificial Intelligence. 3. To encourage appreciation of Indian Knowledge Systems and their applications in modern engineering and research.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Understand the basic structure, phonetics, and grammar of the Sanskrit language. CO2. Construct simple Sanskrit sentences using basic grammatical rules. CO3. Interpret selected Sanskrit verses related to science, mathematics, and philosophy. CO4. Recognize the contributions of ancient Indian scholars to science and engineering. CO5. Appreciate the relevance of Sanskrit in modern fields such as computational linguistics, knowledge.													
Course Contents													
Unit I	Introduction to Sanskrit Language										06 Hours		
Importance and historical development of Sanskrit, Characteristics of Sanskrit as a scientific language, Sanskrit alphabet (Varnamala): vowels and consonants, Pronunciation rules and phonetics, Basic introduction to Sanskrit grammar • पठित अवबोधनम् गद्यान्श् अपेक्षित कार्य : प्रश्नोत्तरामी तथा निर्देशानुसार कृतयः • पठित अवबोधनम् पद्यान्श्													
Unit II	Basic Sanskrit Grammar										06 Hours		
Introduction to nouns (Subanta), Gender and number (Vachana), Case system (Vibhakti), Introduction to verbs (Dhatu), Present tense forms, Formation of simple sentences सन्धिकार्यम् समास प्रत्ययाः त्यकार अव्ययाः समय लेखनम् - अनुप्रयुक्त-व्याकरणम्													
Unit III	Reading and Interpretation of Sanskrit Texts										06 Hours		
Reading simple Sanskrit shlokas, Vocabulary building for scientific and technical terms, Translation of selected Sanskrit passages, Interpretation of verses related to logic, mathematics, and nature, Practice exercises in sentence construction and translation													
Unit IV	Reading and Interpretation of Sanskrit Texts										06 Hours		

Translation of selected Sanskrit passages, Interpretation of verses related to logic, mathematics, and nature Practice exercises in sentence construction and translation लेखनकौशलम् वृत्तान्तलेखनम्, चित्रपटवर्णनम्, निबन्धलेखनम्		
Unit V	Sanskrit and Modern Science & Technology	06 Hours
Sanskrit and computational linguistics Logic and knowledge representation in Sanskrit texts References to engineering concepts in ancient texts Sanskrit terminology used in mathematics, astronomy, and architecture. Mathematical problems from Lilavati by Bhaskara II Structure of Sanskrit grammar and its relevance to computer science Applications of Sanskrit in modern research Overview of Sanskrit influence on Artificial Intelligence and language processing		
Total Hours		30
Term Work Evaluation <i>Subject teacher should frame minimum 10 assignments-based covering on all five units</i>		
1. Summary Writing: Students read a passage and write a short summary in their own words. 2. Translation Assignment: Students translate text from English to Sanskrit. 3. Short technical paragraph translation 4. Daily communication sentences 5. Letter Writing 6. Group Discussion 7. Book Review 8. Film review 9. Blog writing 10. Participation in a Competition		
Text Books		
1. सरस्वती - मणिका संस्कृत व्याकरणम् 2. नवम तथा दशम कक्षा 'मणिका' पुस्तकम् 3. संस्कृत आल्हादः - दादशी कक्षा तथा निबन्धसोपनः		
Reference Books		
1. Panini Ashtadhyayi – Panini 2. Selected Sanskrit texts related to science and mathematics.		

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (HSSM) -II: Business Fundamentals for Entrepreneurs										Course Code: 25HSM202A			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	50	-	-	50	-	-	2	2
Prerequisite:													
• Basic understanding of economics and management principles • Analytical thinking and problem-solving skills • Awareness of technological innovations and industry trends													
Course Objectives:													
1. To introduce engineering students to fundamental concepts of entrepreneurship and business management. 2. To develop the ability to identify and evaluate entrepreneurial opportunities in technology-driven markets. 3. To provide knowledge of basic marketing, financial, and operational aspects required to start and manage a business. 4. To enable students to understand business models, startup ecosystems, and funding mechanisms. 5. To develop the capability to prepare a structured business plan for a technology-based venture.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain the role of entrepreneurship in economic and technological development. CO2. Identify and analyze business opportunities using systematic tools and techniques. CO3. Apply marketing and financial fundamentals for planning entrepreneurial ventures. CO4. Design sustainable business models and evaluate startup feasibility. CO5. Develop and present a comprehensive business plan for a technology-based enterprise.													
Course Contents													
Unit I	Introduction to Entrepreneurship										06 Hours		
Concept and evolution of entrepreneurship, Entrepreneur vs manager. Types of entrepreneurs: techno-entrepreneurs, social entrepreneurs, women entrepreneurs, intrapreneurs. Characteristics of successful entrepreneurs. Role of entrepreneurship in economic development. Entrepreneurial ecosystem in India – Startup India, Make in India, Atmanirbhar Bharat initiatives.													
Unit II	Opportunity Identification and Business Environment										06 Hours		
Creativity and innovation in entrepreneurship. Idea generation techniques – brainstorming, design thinking, TRIZ basics. Opportunity recognition and feasibility analysis. Environmental scanning – PESTLE analysis. Industry and market analysis.													

Legal forms of business organizations: sole proprietorship, partnership, LLP, private limited company.		
Unit III	Marketing Fundamentals for Entrepreneurs	06 Hours
Introduction to marketing management. Market research and customer discovery. Market segmentation, targeting and positioning (STP). Product development and product life cycle. Pricing strategies for startups. Digital marketing tools and social media marketing for new ventures		
Unit IV	Financial Fundamentals for Startups	06 Hours
Introduction to accounting and financial statements. Cost concepts and break-even analysis. Financial planning and budgeting. Sources of startup funding – angel investors, venture capital, bank loans, incubators, crowdfunding. Government schemes supporting startups in India. Basics of financial risk management.		
Unit V	Business Planning and Startup Management	06 Hours
Business models and Business Model Canvas. Preparation of a business plan – structure and components. Operations management for startups. Intellectual Property Rights (IPR) and regulatory compliance. Startup growth strategies and scaling. Sustainability and ethical practices in entrepreneurship.		
Total Hours		30
Course activities for term work evaluation		
Business Opportunity Identification Activity Students identify innovative startup ideas, analyze market needs, customer problems, and prepare an opportunity assessment report. Case Study on Successful Startups and Entrepreneurs Students study successful startups or entrepreneurs and analyze their business models, innovation strategies, marketing approaches, and growth factors. Hands-on Activity using Business Planning Tools Students prepare SWOT analysis, Business Model Canvas (BMC), customer segmentation, and basic market analysis using practical examples. Mini Project on Startup Ecosystem and Funding Students explore startup support systems such as Startup India, incubators, venture capital, crowdfunding, and government schemes and prepare a report. Business Plan Development and Pitch Presentation Students develop and present a business plan including product idea, marketing strategy, financial planning, pricing, budgeting, and startup feasibility analysis.		
Text Books		
- Hisrich, R. D., Peters, M. P., & Shepherd, D. A., Entrepreneurship, McGraw Hill Education. - Barringer, B. R., & Ireland, R. D., Entrepreneurship: Successfully Launching New Ventures, Pearson Education. - Kuratko, D. F., Entrepreneurship: Theory, Process and Practice, Cengage Learning.		
Reference Books		
Drucker, P., Innovation and Entrepreneurship, Harper Business.		

2. Ries, E., The Lean Startup, Crown Publishing.
3. Desai, V., Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House.
4. Blank, S., & Dorf, B., The Startup Owner's Manual, K & S Ranch Press.
5. Timmons, J. A., & Spinelli, S., New Venture Creation, McGraw Hill.

Online References

MOOC / NPTEL Courses:

1. NPTEL Course on Entrepreneurship, By Prof. C Bhaktavatsala Rao, IIT Madras:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg70
2. NPTEL course on Business Fundamentals for Entrepreneurs by Prof. Devdip Purkayastha, IIT Bombay:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg11
3. NPTEL Course on Entrepreneurship and Start-ups, By Dr. P. Jakulin Divya Mary, National Institute of Technical Teachers' Training and Research, Chennai:
https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr25_ed60
4. NPTEL Course on Business Development: From Start to Scale Prof. C Bhaktavatsala Rao, IIT Madras:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_mg61

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (HSSM) -II: Entrepreneur and Start-ups										Course Code: 25HSM202B			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	50	-	-	50	-	-	2	2
Prerequisite:													
1. Market study 2. Break even analysis 3. Profit loss 4. Accounting													
Course Objectives:													
1. Understand the concepts, role, and importance of entrepreneurship and innovation in economic and social development 2. Identify and evaluate business opportunities, especially technology-based and sustainable ventures. 3. Develop entrepreneurial mindset, creativity, and problem-solving ability 4. Understand startup ecosystem, government policies, IPR, funding, and incubation support. 5. Prepare a basic business plan incorporating ethical, financial, and sustainability considerations.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain concepts of entrepreneurship, innovation, and their role in economic and societal development. CO2. Identify entrepreneurial opportunities using creativity, design thinking, and market analysis tools. CO3. Analyze feasibility of a business idea considering technical, financial, legal, and social aspects. CO4. Apply knowledge of startup ecosystem, IPR, funding, and government initiatives to venture creation. CO5. Develop and present a basic business plan demonstrating teamwork, communication, ethics, and lifelong learning attitude.													
Course Contents													
Unit I	Introduction to Entrepreneurship										06 Hours		
Entrepreneurship: Definition, types, and characteristics, Entrepreneur vs Manager, Role of entrepreneurship in economic development, Innovation: Types and sources, Case studies of successful entrepreneurs (Indian & global)													
Unit II	Creativity, Innovation & Opportunity Identification										06 Hours		
Entrepreneurial mindset and creativity Design Thinking for innovation Idea generation techniques Opportunity identification and screening													

Market research and customer validation Technology-based entrepreneurship		
Unit III	Feasibility Analysis & Business Models	06 Hours
Technical, market, and financial feasibility Business Model Canvas (BMC) Costing, pricing, and break-even analysis Risk analysis and mitigation Ethics and sustainability in entrepreneurship		
Unit IV	Startup Ecosystem, IPR & Funding	06 Hours
Startup India initiative and government schemes (MSME, SIDBI, DPIIT) Incubation centers, accelerators, and angel networks Basics of Intellectual Property Rights (Patents, Copyrights, Trademarks) Sources of funding: Bootstrapping, venture capital, crowdfunding Legal aspects of starting a venture		
Unit V	Business Plan Development & Entrepreneurial Skills	06 Hours
Business plan preparation and structure Team building and leadership Communication and pitching skills Social entrepreneurship and sustainable startups Future trends and lifelong learning for entrepreneurs		
Total Hours		30
Course activities for term work evaluation:		
Business Opportunity Identification Activity Students identify innovative startup ideas, analyze market needs, customer problems, and prepare an opportunity assessment report. Case Study on Successful Startups and Entrepreneurs Students study successful startups or entrepreneurs and analyze their business models, innovation strategies, marketing approaches, and growth factors. Hands-on Activity using Business Planning Tools Students prepare SWOT analysis, Business Model Canvas (BMC), customer segmentation, and basic market analysis using practical examples. Mini Project on Startup Ecosystem and Funding Students explore startup support systems such as Startup India, incubators, venture capital, crowdfunding, and government schemes and prepare a report. Business Plan Development and Pitch Presentation Students develop and present a business plan including product idea, marketing strategy, financial planning, pricing, budgeting, and startup feasibility analysis.		
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Reference Books		
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3. Desai, V., Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House.
4. Blank, S., & Dorf, B., The Startup Owner's Manual, K & S Ranch Press.
5. Timmons, J. A., & Spinelli, S., New Venture Creation, McGraw Hill.

Online References

1. NPTEL course on Entrepreneurship and Start-ups by Dr. P. Jakulin Divya Mary, National Institute of Technical Teachers' Training:
https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr25_ed60
2. NPTEL Course on Entrepreneurship, By Prof. C Bhaktavatsala Rao, IIT Madras:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg70
3. NPTEL Course on Business Development: From Start to Scale Prof. C Bhaktavatsala Rao, IIT Madras:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_mg61
4. Government Schemes for Start-ups:
<https://www.startupindia.gov.in/content/sih/en/government-schemes.html>

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (HSSM) -II: Fundamentals of Accounting and Finance										Course Code: 25HSM202C			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	50	-	-	50	-	-	2	2
Prerequisite:													
Basic knowledge of arithmetic and percentages, along with the ability to interpret simple numerical data and tables. No prior background in accounting or finance is required.													
Course Objectives:													
1. This course introduces basic concepts of financial accounting and corporate finance to engineering students. 2. It helps students understand financial statements, 3. Apply accounting principles, and use financial tools for decision-making.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Apply key accounting principles in business contexts. CO2. Interpret financial statements and reports. CO3. Understand working capital and its components. CO4. Evaluate capital budgeting decisions. CO5. Gain awareness of financial markets and financing options.													
Course Contents													
Unit I	Introduction to Accounting										06 Hours		
Meaning and purpose of accounting, Users of accounting information, Accounting principles, concepts and conventions, Types of accounts and rules of debit and credit Journal, Ledger and Trial Balance, Preparation of Final Accounts (simple adjustments)													
Unit II	Financial Statements and Analysis										06 Hours		
Introduction to Financial Statements, Balance Sheet: Classification of assets and liabilities, Profit and Loss Statement, Cash Flow Statement – Format and Components, Financial Ratio Analysis – Concept and Uses, Computation of Liquidity and Profitability Ratios													
Unit III	Cost Concepts and Working Capital										06 Hours		
Meaning and classification of costs, Fixed vs Variable costs, Break-even analysis – concept and formula, Importance of working capital, Working capital cycle, Techniques for managing working capital													
Unit IV	Introduction to Finance and Time Value of Money										06 Hours		
Meaning and scope of finance, Financial goals and functions, Time Value of Money – Concept, Present value and future value, Simple and compound interest, Annuities and perpetuities													
Unit V	Capital Budgeting and Financial Markets										06 Hours		
Introduction to capital budgeting, Payback period, Net Present Value (NPV), Internal Rate of Return (IRR), Overview of financial markets, Financing options – Equity and Debt.													

Total Hours	30
Course activities for term work evaluation:	
1. Accounting Principles and Journal Preparation Activity Students prepare journal entries, ledgers, and trial balances for simple business transactions to understand the fundamentals of accounting practices. 2. Financial Statement Analysis Case Study Students analyze balance sheets, profit and loss statements, and cash flow statements of companies to evaluate financial performance and decision-making. 3. Cost Analysis and Break-even Calculation Exercise Students perform cost classification, break-even analysis, and working capital calculations using numerical examples and practical business scenarios. 4. Time Value of Money and Investment Analysis Activity Students solve problems related to simple and compound interest, annuities, present value, future value, NPV, and IRR for financial decision-making. 5. Mini Project on Capital Budgeting and Financial Markets Students study capital budgeting techniques, financing options, equity and debt markets, and prepare a report on investment and financing decisions.	
Text Books	
1. S. A. Siddiqui & A. S. Siddiqui – Fundamentals of Financial Accounting – PHI Learning 2. Paul D. Kimmel, Jerry J. Weygandt, Donald E. Kieso – Financial Accounting: Tools for Business Decision Making – Wiley 3. Mike Piper – Accounting Made Simple – CreateSpace	
Reference Books	
1. Prasanna Chandra – Financial Management: Theory & Practice – McGraw-Hill 2. Stephen A. Ross, Randolph W. Westerfield & Jeffrey Jaffe – Corporate Finance – McGraw-Hill 3. Ray H. Garrison, Eric W. Noreen & Peter C. Brewer – Managerial Accounting – McGraw-Hill 4. Jerry J. Weygandt, Paul D. Kimmel, Donald E. Kieso – Accounting Principles – Wiley	
Online References	
1. NPTEL course on Foundations of Accounting & Finance by Prof. Arun Kumar Gopalaswamy, IIT Madras: https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ec10 2. NPTEL Course on Financial Markets, Institutions and Financial Services By Prof. Divya Verma, Guru Gobind Singh Indraprastha University, Delhi: https://onlinecourses.swayam2.ac.in/e-learning/preview/cec26_mg12 3. NPTEL Course on Working Capital Management by Prof. Anil K. Sharma, IIT Roorkee: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg61 4. Time value of money- Concepts and Calculations http://digimat.in/nptel/courses/video/109107115/109107115.html	

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (HSSM) -II: Business Intelligence and Analytics										Course Code: 25HSM202D			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	50	-	-	50	-	-	2	2
Course Objectives:													
1. To introduce the concepts of Business Intelligence (BI) and Business Analytics (BA) in modern organizations. 2. To understand the role of Decision Support Systems and Data Warehousing in business decision-making. 3. To learn techniques of data analysis, reporting, and visualization used in BI tools. 4. To develop knowledge of data preparation, predictive analytics, and machine learning applications in business.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Understand the concepts of Decision Support Systems, Business Intelligence, and Business Analytics. CO2. Understand the architecture of Data Warehouses and OLAP systems used in business intelligence. CO3. Apply data preparation, reporting, and visualization techniques to analyze business data. CO4. Analyze the impact of predictive analytics, machine learning, and analytics applications CO5. Apply Machine Learning in BI.													
Course Contents													
Unit I	Introduction to Data-Driven Business Intelligence and Analytics										06 Hours		
Decision Support Systems (DSS): Definition of system, representation of decision-making process, evolution of information systems, Decision Support System, development of DSS, Simon’s four stages of decision-making process, strategies and approaches of decision makers. Business Intelligence (BI): Definition of BI, components of BI, BI architecture, data–information–knowledge concepts, setting up data for BI, role of mathematical models, business intelligence architectures, ethics in business intelligence. Business Analytics (BA): Definition of business analytics, types of analytics – descriptive, diagnostic, predictive and prescriptive analytics, concept of insights, business analytics in practice, importance of data in business analytics, types of data, data quality, 5Vs of big data, data sources and collection methods, data privacy, security and ethical considerations.													
Unit II	Analytical Decision-Making and Architecture of DW & BI										06 Hours		
Analytical decision-making process, characteristics, framing business problems into analytical questions, skills of a business analyst. Data exploration and visualization (Excel, Tableau, Power BI), concept of statistical analysis and hypothesis testing. Data visualization, exploratory data analysis (EDA), data cleaning and inspection. BI and DW architecture, relation between BI and DW, role of DSS, EIS, MIS, digital dashboards, need for BI. OLAP concepts, OLAP vs OLTP, cubes, drill-down, roll-up, slice-and-dice, ROLAP vs MOLAP, schemas: star, snowflake, fact constellation.													

Unit III	Predictive, Prescriptive Analytics and Reporting Authoring	06 Hours
Text analytics and web analytics, report authoring (relational & multidimensional models), types of reports (list, crosstab, statistics, charts, maps, financial), report features (grouping, sorting, filtering, calculations, conditional formatting, summary lines, drill-up, drill-down, drill-through), report scheduling and output formats (PDF, Excel, CSV, XML).		
Unit IV	Business Analytics in Marketing and Finance	06 Hours
Marketing Analytics, Customer segmentation, targeting, and positioning, Campaign management and ROI measurement, Data-driven marketing strategies. Financial Analytics - Risk management and credit scoring, financial forecasting and planning, Case studies: Financial performance improvement through analytics (Non-Statistical - Conceptual Treatment only).		
Unit V	Business Analytics Applications and Machine Learning in BI	06 Hours
Impact of machine learning in BI: classification problems, evaluation of classification models, Bayesian methods, logistic regression. Clustering methods: partition and hierarchical methods, evaluation of clustering models. Association rule mining: structure of association rules and Apriori algorithm.		
Total Hours		30
Course activities for term work evaluation:		
1. Business Intelligence Case Study Analysis: Students analyze real-world business cases to understand the role of Business Intelligence (BI), Decision Support Systems (DSS), and data-driven decision-making in organizations. 2. Data Visualization and Dashboard Development Activity Students create charts, dashboards, and analytical reports using tools such as Excel, Tableau, or Power BI to present business insights effectively. 3. Hands-on Activity on Data Analysis and Reporting Students perform data cleaning, exploratory analysis, report generation, and visualization using business datasets to identify trends and patterns. 4. Marketing and Financial Analytics Mini Project Students analyze customer segmentation, campaign performance, sales trends, and financial data using analytical techniques and prepare a business analytics report. 5. Machine Learning Applications in Business Activity Students explore classification, clustering, association rule mining, and predictive analytics techniques using sample datasets and present their findings and business implications.		
Text Books		
1. Camm, Cochran, Fry, Ohlmann, Anderson, Sweeney, Williams - Essentials of Business Analytics, Cengage Learning. 2. James Evans, Business Analytics, Pearson. 3. Albright Winston, Business Analytics - Data Analysis - Data Analysis and Decision Making, Cengage Learning, Reprint 4. Sahil Raj, Business Analytics, Cengage Learning. 5. Knaflic, C. N. (2015). Storytelling with data: A data visualization guide for business professionals. Wiley. 6. Siegel, E. (2016). Predictive analytics: The power to predict who will click, buy, lie, or die. Wiley.		
Reference Books		
1. Data Mining: Concepts and Techniques, Jiawei Han and Micheline Kamber		
Online References		
e-Books:		
1. https://www.knime.com/sites/default/files/inline-images/KNIME_quickstart.pdf		

2. www.cs.ccsu.edu/~markov/weka-tutorial.pdf
3. http://www.biomedicahelp.altervista.org/Magistrale/Clinics/BIC_PrimoAnno/IdentificazioneModelliDataMining/Business%20Intelligence%20-%20Carlo%20Vercellis.pdf
4. <https://download.e-bookshelf.de/download/0000/5791/06/L-G-0000579106-0002359656.pdf>

MOOC / NPTEL Courses:

1. Business Analytics for management decision By Prof. Rudra P Pradhan, IIT Kharagpur:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_mg11
2. Business analytics and data mining modeling using R By Prof. Gaurav Dixit, IIT Roorkee:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_mg24
3. Business Analysis for Engineers:
<http://www.digimat.in/nptel/courses/video/110106050/110106050.html>
4. Business Intelligence & Analytics By Prof. Saji K Mathew, IIT Madras:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_cs65

S.Y.B. Tech. Artificial Intelligence and Machine Learning													
Semester- IV													
Course Name (VEC): Indian Constitution and Governance										Course Code: 25VEC202			
Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	1	-	-	-	25	-	-	25	-	-	1	1
Prerequisite:													
Basic awareness of Indian history, civic studies at school level, and general understanding of social and political systems.													
Course Objectives:													
1. To introduce students to the philosophy, features, and framework of the Indian Constitution. 2. To understand the structure, powers, and functions of the Union and State governments. 3. To explain Fundamental Rights, Duties, and Directive Principles and their role in democracy. 4. To familiarize students with constitutional bodies and governance mechanisms in India. 5. To develop awareness of contemporary issues related to constitutional values, governance, and citizenship.													
Course Outcomes:													
At the end of the course, students will be able to: CO1. Explain the historical background, features, and structure of the Indian Constitution. CO2. Describe Fundamental Rights, Directive Principles, and Fundamental Duties and their significance. CO3. Apply constitutional provisions to analyze the functioning of Union and State governments. CO4. Analyze the role of constitutional and statutory bodies in Indian governance. CO5. Evaluate contemporary governance issues with reference to constitutional values and ethics.													
Course Contents													
Unit I	Introduction to Indian Constitution										03 Hours		
Meaning and importance of Constitution Historical background and making of the Indian Constitution Salient features of the Indian Constitution Preamble: objectives and significance Citizenship – provisions and amendments													
Unit II	Fundamental Rights, Duties, and Directive Principles Fundamental Rights										03 Hours		
Types, scope and limitations Right to Equality, Freedom, Religion, Constitutional Remedies Directive Principles of State Policy – objectives and classification Fundamental Duties and their relevance Relationship between Fundamental Rights and DPSPs													
Unit III	Union and State Government Structure Union Government										03 Hours		
President, Vice-President, Prime Minister, Council of Ministers Powers and functions of Parliament State Government: Governor, Chief Minister, State Legislature Center–State relations: legislative, administrative, and financial													
Unit IV	Constitutional and Statutory Bodies Election Commission of India										03 Hours		
Composition, powers, and functions Union Public Service Commission (UPSC) and State Public Service Commissions (SPSC): roles and responsibilities Comptroller and Auditor General (CAG) of India: duties and significance in financial accountability Finance Commission: composition,													

functions, and role in centre–state financial relations Judiciary in India: structure, jurisdiction, and role of the Supreme Court and High Courts		
Unit V	Governance, Democracy and Contemporary Issues Concept of democracy and good governance Local self-government	03 Hours
Panchayati Raj and Urban Local Bodies Constitutional amendments and landmark judgments Ethical governance and citizen participation Current issues related to Indian Constitution and governance.		
Total Hours		15
Course activities for term work evaluation:		
1. Group Discussion on Fundamental Rights and Duties 2. Debate on Constitutional and Contemporary Governance Issues 3. Case Study Analysis on Indian Judiciary and Landmark Judgments 4. Seminar / Presentation on Indian Constitution and Democratic Values 5. Poster Making on Fundamental Rights, Duties, and Good Governance 6. Essay Writing on Role of Citizens in Democracy and Nation Building 7. Mock Parliament / Mock Election Activity 8. Assignment on Constitutional Bodies and Their Functions 9. Field Visit / Report on Local Self-Government Institutions 10. Quiz / Awareness Activity on Indian Constitution and Governance Systems		
Text Books		
1. M. V. Pylee, An Introduction to the Constitution of India, Vikas Publishing 2. D. D. Basu, Introduction to the Constitution of India, LexisNexis		
Reference Books		
1. Granville Austin, The Indian Constitution: Cornerstone of a Nation, Oxford University Press 2. Subhash Kashyap, Our Constitution: An Introduction to India's Constitution and Constitutional Law, National Book Trust		
Online References		
• MOOC / NPTEL Courses 1. https://onlinecourses.nptel.ac.in/noc22_hs79/preview (NPTEL1, Introduction to Indian Constitution, Prof. Sudhir Krishnaswamy, National Law School of India University) 2. https://onlinecourses.nptel.ac.in/noc23_hs118/preview (NPTEL2, Indian Constitution: Rights and Governance, Prof. Sudhir Krishnaswamy, National Law School of India University) 3. https://onlinecourses.nptel.ac.in/noc22_hs67/preview (NPTEL3, Constitutional Studies, Prof. Alok Prasanna Kumar, National Law School of India University) 4. https://onlinecourses.nptel.ac.in/noc23_hs89/preview (NPTEL4, Public Policy and Governance, Prof. Anamika Barua, IIT Guwahati) 5. https://onlinecourses.nptel.ac.in/noc24_hs90/preview (NPTEL5, Governance and Public Administration in India, Prof. Anamika Barua, IIT Guwahati)		



Dr Deepali Ujalambkar
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Dr D Y Dhande
Dean Academics



Dr D S Bormane
Principal

