Dr. D. Y. Patil Educational Federation's

Dr. D. Y. Patil College of Engineering and Innovation

APPROVED BY AICTE, RECOGANIZED BY GOVT. OF MAHARASHTRA,

AUTONOMOUS INSTITUTE AFFILIATED TO SAVITRIBAI PHULE PUNE UNIVERSITY

Accredited by NAAC with "A" Grade

ACADEMIC COURSE STRUCTURED

AND

DETAILED SYLLABUS

S.Y B. Tech.

Artificial Intelligence and Machine Learning (AI-ML)

B. Tech. 4 YEAR UG COURSE

(Applicable for the batches admitted from A.Y. 2025-2026 at FY)

Dr. D. Y. Patil College of Engineering & Innovation

Survey No. 27/A/1/2C, Varale Campus,

Near Talegaon Railway Station,

Tal. Maval, Dist. Pune 410 507,

Ph: 020 48522561, 565,566

Web Site: https://www.dypcoei.edu.in,

Email: principal.dypcoei@dypatilef.com

Vision and Mission of the Institute

Vision of DYPCOEI

To achieve excellence in quality education through value based rapidly changing technologies and create technical Human-Resource with proficiencies of accepting new challenges.

Mission of DYPCOEI

M1: Continuously strive to impart value-based education to elevate the satisfaction level of all stakeholders.

M2: Take dedicated efforts to create competent professionals by effective teaching learning process with passion of lifelong learning attitude.

M3: Our endeavour is to promote and support innovative research, entrepreneurship and development activities through Industry Interaction.

Vision and Mission of the Department

Vision of Department

To cultivate innovative professionals who can apply Artificial Intelligence and Machine learning concepts to real-world problems and contribute to the society and industry through interdisciplinary knowledge and skills.

Mission of Department

M1: To impart skill-based (Artificial Intelligence and Machine Learning) education through a effective teaching-learning process.

M2: To establish Innovation and Entrepreneur ecosystem which provides solutions for the technological challenges of industry, society and the nation.

M3: To set-up an industry-institute interface and research environment for the development of students through research and team work activities.

Program Educational Objectives (PEOs)

PEO1: Prepare graduates who will be able to apply the concepts of Machine Learning while deriving solutions for real-life problems.

PEO2: Inculcate ability of communication, soft skills, ethics and work in a team while demonstrating the professionalism in the corporate world.

PEO3: Impart life-long learning towards Artificial Intelligence while using new trends and technologies.

PEO4: Develop research ability among students while understanding, analysing the problems and designing solutions innovatively.

Knowledge and Attitude Profile (WK)

A Knowledge and Attitude Profile (KAP), often represented as WK (Knowledge and Attitude Profile) in some contexts, is a framework or assessment tool used to evaluate an individual's knowledge and attitudes related to a specific area, topic, or domain

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 behaviour 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)

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)

PSO1: Inculcate ability to apply and analyse key concepts of Artificial Intelligence and Machine Learning to find solutions to real world problems.

PSO2: Rigorous hand-on training to enhance the skills in emerging trends and technologies while implementing Machine Learning.

PSO3: Train the students for their understanding towards their responsibility, working in a team and contributing while developing of model, product or application as part of student's projects.

Program Outcomes (PO) Mapping with WA & WK (As per National Board of Accreditation (NBA))												
			Knowledge and Attitude Profile (WK)									
PO	**Domain**	**WA**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
PO1	Engineering Knowledge	**WA1**	X	X	X	X						**Analysis of problems & synthesis of solutions**
PO2	Problem Analysis	**WA2**	X	X	X							
PO3	Design/development of solutions	**WA3**					X					
PO4	Investigation	**WA4**								X		
PO5	Tool Usage	**WA5**		X				X				
PO6	The Engineer and the World	**WA6**	X				X		X			**Responsibilities**
PO7	Ethics	**WA7**									X	
PO8	Individual and Collaborative Team work	**WA8**									X	**Required In work place**
PO9	Communication	**WA9**										
PO10	Project Management and Finance	**WA10**										
PO11	Lifelong learning	**WA11**								X		

Program – B. Tech. (Artificial Intelligence and Machine Learning)

(Autonomous Curriculum Structure for students admitted from A.Y, 2025-26 at FY)

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
2 Hours Practical (Lab) per week	1 credit

B. Range of Credits:

Student will become eligible to get Under Graduate (UG) **B. Tech. degree in Artificial Intelligence and Machine Learning** after earning **160 credits.** A student will be eligible to get Under **Graduate degree with Honors** or additional **Minor Engineering**, if he/she completes an additional **20 credits from SEM-V to SEM-VIII.**

C. Credit for B. Tech. Degree in Artificial Intelligence and Machine Learning

Sr. No.	Year	Semester	Credits
1	First Year	I	22
2		II	22
3	Second Year	III	21
4		IV	23
5	Third Year	V	18
6		VI	18
7	Final Year	VII	18
8		VII	18
Total Credits			**160**

D. Structure of B. Tech. program

Abbreviation	Course Type	Credit
BSC	Basic Science Courses	18
ESC	Engineering Science Courses	12
PCC	Program Core Courses	44
PEC	Program Elective Courses	20
CEP	Community Engagement Project	02
VEC	Value Education Courses	04
IAP	Internship and Project	14
MDM	Multidisciplinary Minor	14
OEC	Open Elective Courses	08
VSE	Vocational and Skill Enhancement Course	06
REM	Research Methodology	04
EMC	Entrepreneurship and Management Courses	04
AEC	Ability Enhancement Course	04
CCC	Co-curricular Courses	04
IKS	Indian Knowledge System	02
	Total	**160**

Course Category Credits Summary

SEM	Total Marks	No. of Credits for Course Category															Total Credit
		BSC	ESC	PCC	PEC	MDM	OEC	VSE	AEC	EMC	IKS	VEC	REM	CEP	IAP	CCC	
I	700	9	6	4				1	2								**22**
II	700	9	6	3				1			2					1	**22**
III	700			9		2	4			2		2		2			**21**
IV	700			8		2	2	2	2	2		2			2	1	**23**
V	700			4	8	4	2										**18**
VI	700			4	4	2		2							4	2	**18**
VII	700			6	2	2							4		4		**18**
VIII	700			6	6	2									4		**18**
Total	**5600**	**18**	**12**	**44**	**20**	**14**	**8**	**6**	**4**	**4**	**2**	**4**	**4**	**2**	**14**	**4**	**160**

#	**Semester End Examination (SEE)** based on subjective questions.
$	**LAB /Practical or Hands-on/ Activity based Evaluation.**
*	**Comprehensive Continuous Evaluation (CCE)** based on Unit Tests, Home Assignment/Comprehensive, Presentation/Group Discussion/Laboratory Work/Course Project/Viva Voce/Blog Writing/Case Study/Survey/Multiple-Choice Question (MCQ) examination.
@	**For MOOCs:** Assignments marks will be converted on the scale of 60 marks.
%	**For MOOCs:** Score of examination conducted by the respective authority of MOOC or Score of SEE Conducted by Institute will be converted on the scale of 60 marks.

Department Autonomous Co-ordinator
DYPCOEI

Head of Department
Artificial Intelligence and Machine Learning
DYPCOEI

Dean Academics
DYPCOEI

Director
DYPCOEI

2.0 Course Structure – Artificial Intelligence and Machine Learning

2.1 Course Structure – S.Y. B.Tech. (Artificial Intelligence and Machine Learning)

Artificial Intelligence and Machine Learning - Second Year (Semester –III)												
Level - 5												
Sr. No.	Code	Course Title	Hours/week			Credits	Examination scheme					
			L	T	P		CCE	SEE	TW	PR	OR	Total
1	AMPCC201T	Transforms and Numerical Methods	3	--	--	3	50	50	--	--	--	100
2	AMPCC202T	Data Structures	2	--	--	2	50	50	---	--	--	100
3	AMPCC203T	Artificial Intelligence	2	--	--	2	50	50	--	--	--	100
4	ILMDM201T	Multidisciplinary Minor-I	2	--	--	2	50	50	--	--	--	100
5	AMPCC204P	Data Structures using Artificial Intelligence Laboratory	--	--	4	2	--	--	25	50	25	100
6	AMVEC205W	Social Well-being	1	1	--	2	--	--	25	--	--	25
7	AMCEP206O	Community Engagement - Field Project	--	--	4	2	--	--	25	--	50	75
8	ILOEC201O	Open Elective Courses I	2	--	--	2	--	--	25	--	25	50
9	ILOEC202W	Open Elective Courses II	2	--	--	2	--	--	25	--	--	25
10	AMEMC207W	Entrepreneurship and Start-up Ecosystem	1	1	--	2	--	--	25	--	--	25
Total			**15**	**02**	**08**	**21**	**200***	**200#**	**150$**	**50$**	**100$**	**700**

MDM-I (ILMDM201T)	
ILMDM201T-1	Smart cities and intelligent infrastructure
ILMDM201T-2	Fundamentals of autonomy and intelligent behaviour
ILMDM201T-3	Introduction to smart and precision agriculture
ILMDM201T-4	Fundamentals of electric vehicles and comparison with ICE vehicles
ILMDM201T-5	Fundamentals of additive manufacturing
ILMDM201T-6	Fundamentals of healthcare systems and digital health
ILMDM201T-7	Microcontrollers and Industrial Applications

Open Elective -I (ILOEC201O)		Open Elective -II (ILOEC202W)	
ILOEC201O-1	Engineering Economics	ILOEC202W-1	MOOC- I
ILOEC201O-2	AI in Finance Management	ILOEC202W-2	Foreign Language- I
ILOEC201O-3	Digital Finance	ILOEC202W-3	UHV

Artificial Intelligence and Machine Learning - Second Year (Semester –IV)												
Level - 5												
Sr. No.	Code	Course Title	Hours/week			Credits	Examination scheme					
			L	T	P		CCE	SEE	TW	PR	OR	Total
1	AMPCC208T	Operating systems	2	--	--	2	50	50	--	--	--	100
2	AMPCC209T	Data Structures and Algorithms	2	--	--	2	50	50	--	--	--	100
3	AMPCC210T	Machine Learning Algorithms	2	--	--	2	50	50	--	--	--	100
4	ILMDM202T	Multidisciplinary Minor-II	2	--	--	2	50	50	--	--	--	100
5	AMPCC211P	Data Structures and Algorithms using Machine Learning Laboratory	--	--	4	2	--	--	25	50	--	75
6	AMVSE212P	Power BI for Beginners Laboratory	--	--	4	2	--	--	--	50	--	50
7	AMIAP213W	Internship	--	--	4	2	--	--	25	--	--	25
8	AMVEC214W	Sustainable Development	2	--	--	2	--	--	25	--	--	25
9	ILOEC203O	Open Elective Courses III	2	--	--	2	--	--	25	--	25	50
10	AMAEC215W	Reasoning and Aptitude Development	1	1	--	2	--	--	25	--	--	25
11	AMEMC216O	Technology Commercialization and start-up Development	1	1	--	2	--	--	--	--	25	25
12	AMCCC217W	Co-Curriculum Course-II	--	--	2	1	--	--	25	--	--	25
Total			**14**	**02**	**14**	**23**	**200***	**200#**	**150$**	**50$**	**100$**	**700**

MDM-II (ILMDM202T)	
ILMDM202T-1	Sustainable energy and environment
ILMDM202T-2	Perception, sensing, and sensor fusion
ILMDM202T-3	Robotics and automation in farming operations
ILMDM202T-4	Electric powertrain architecture and motor technologies
ILMDM202T-5	3D printing processes: FDM, SLA, SLS, DMLS, Binder Jetting, etc.
ILMDM202T-6	AI techniques (ML, DL, NLP, CV) in diagnostics and prognosis
ILMDM202T-7	Introduction to Embedded Processors

Open Elective -III (ILOEC203O)	
ILOEC203O-1	Digital Marketing
ILOEC203O-1	Critical Thinking and Problem Solving
ILOEC203O-3	Ethics in Artificial Intelligence

Co-Curriculum Course II (ADCCC217W)
• Technical Events/Quiz/Paper Contest/Project Contest / Model Making etc.
• MOOC/ NPTEL/ SWAYAM/ Coursera etc. related to Professional Development and Social Activity
• Competitions/ Events Conducted by Professional Societies (ISTE, IEI, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.)
• Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at IITs/ NITs/ Reputed Institutes/ Universities
• Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at DYPCOEI
• Paper Presentation in National/ International Conference of High Repute
• Poster Presentation in National/ International Conference of High Repute
• Paper Publication in National/ International Journal of High Repute
• Industrial Training/ Internship (at least for 04 Weeks)
• Participation in Institute Level Student Clubs
• Elected Student Representative of Student Council (University Representative, General Secretary, Cultural, Sports, NSS Secretary, Ladies Representative, Academic Toppers, Invitee Members)
• Office Bearer of Professional Society Chapter (ISTE, IEI, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.)
• Office Bearer of Institute Level Student Club
• Office Bearer of Departmental Student Association
• Office Bearer of ECell, Digital Content Lab etc.
• Student Ambassador for Mayura AICTE IDEA Lab/ NIDHI iTBI etc.
• Editorial Board Member of Annual Magazine
• Editorial Board Member of E-Newsletter
• Member of Governance Committee/ Statutory Committee

Artificial Intelligence and Machine Learning

Second Year (Semester – III)

Syllabus

Second Year Artificial Intelligence and Machine Learning (2025 Course) Transforms and Numerical Methods			
Course Code	AMPCC201T	**Credit**	03
Contact Hours	**TH:** 03 Hrs/Weeks(L)	**Type of Course**	Lecture
Examination Scheme	**CCE:** 50 Marks **SEE:** 50 Marks	**Total Marks**	100

TOP

Pre-requisites: Discrete Mathematics and Graph Theory.

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Comprehensive Continuous Evaluation (CCE)	Internal	50*
2.	Semester End Evaluation (SEE)	Internal	50#

Course Objectives	
1	To **develop** skills to use Transforms and its applications in the field of Computer Engineering.
2	Transform techniques such as Laplace transform, Fourier transform, Z-Transform and applications to Image processing.
3	To provide suitable and effective Numerical method for obtaining approximate representative numerical results of the problem.
4	To **solve** complex mathematical problems using only simple mathematical operations. The approach involves formulation of mathematical models of physical situations that can be solved with arithmetic operations.

Course Outcomes	
CO1	**Define and list** discrete probability distributions including binomial and Poisson distributions.
CO2	**Describe** continuous probability distributions and **explain** their mean and variance.
CO3	**Apply** Laplace Transform techniques to solve differential equations and evaluate integrals in engineering applications.
CO4	**Analyze** and differentiate inverse Laplace transform methods, including convolution and partial fraction techniques, to solve and interpret ordinary differential equations.
CO5	**Evaluate** the effectiveness of Z-Transform techniques in analyzing discrete-time systems and solving difference equations, and justify the selection of appropriate methods for given problems.

Topics covered:		
UNIT-I:	**Discrete Probability Distributions**	**(6 Hrs.)**
Discrete Probability Distributions: Discrete Random Variables, Probability distribution function, Cumulative distribution function. Mean and Variance of Discrete Probability Distribution. Binomial Distribution-Mean and variance. Poisson Approximation to the Binomial Distribution. Poisson distribution-Mean and variance.		
UNIT-II:	**Continuous Probability Distribution**	**(6 Hrs.)**
Continuous Probability Distributions: Continuous Random Variable, Probability density function, Cumulative density function, Mean and variance. Normal Distribution, Mean and variance (without proof). Uniform Distribution. Mean and variance. Exponential Distribution, Mean and variance.		
UNIT-III:	**Laplace Transform**	**(6 Hrs.)**
Laplace transform definition and their properties, transform of derivatives and integrals, evaluation of integrals by Laplace Transform, Laplace transforms of periodic function, Unit step function, Unit Impulse function.		
UNIT-IV:	**Inverse Laplace**	**(6 Hrs.)**
Transform Inverse Laplace Transform. & its properties, Inverse Laplace transform using Properties, convolution theorem and Partial fraction method, applications of Laplace transform to solve ordinary differential equations.		
UNIT-V:	**Z- Transform**	**(7 Hrs.)**
Definition of Z- Transforms and Inverse Z- Transform, properties of Z- Transforms, Z-Transform of some standard sequences, Inverse Z- Transform using Power series method, Partial fraction method and Inversion integral method, Convolution Theorem, Application of Z-Transform to solve difference equations with constant coefficients.		

Text Books	
1	B. S. Grewal, —Higher Engineering Mathematics‖ Khanna Publication, 43th edition
2	H. K. Dass, _Engineering Mathematics‘, S. Chand Publication 20e, New Delhi.
3	Introductory Methods of Numerical Analysis " , S.S.Sastry ,4th edition
Reference Books	
1	Erwin Kreyszig, —Advanced Engineering Mathematics‖, 9e, Wiley India
2	Robert A.Gabel , Richard A.Roberts ; Siglnals and linear systems ; John Wiley & Sons

3	Jain, R.K. and Iyengar,S.R.K, Advanced Engineering Mathematics, 3rd Edition, New Delhi, Narosa Publishers, 2007
E- Books	
1	http://www.math.ust.hk/~machas/numerical-methods.pdf
2	Foundation of Machine Learning: https://cs.nyu.edu/~mohri/mlbook/

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	1	2	-	-	-	-	-	-
CO4	3	3	2	2	2	-	-	-	-	-	-
CO5	3	3	3	2	2	-	-	-	-	-	-

Second Year Artificial Intelligence and Machine Learning (2025 Course) Data Structures			
Course Code	AMPCC202T	**Credit**	02
Contact Hours	**TH:** 02 Hrs./Weeks(L)	**Type of Course**	Lecture
Examination Scheme	**CCE:** 50 Marks **SEE:** 50 Marks	**Total Marks**	100

TOP

Pre-requisites: Programming and Problem Solving

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Comprehensive Continuous Evaluation (CCE)	Internal	50*
2.	Semester End Evaluation (SEE)	Internal	50#

Course Objectives	
1	To understand the standard and abstract data representation Method and develop logical ability to solve the problem in time efficient way.
2	To expose students to career opportunities in the fields of data structure design, data handling implementation, and the development of efficient sorting and searching techniques.
3	To enable students to select and apply appropriate data structures and algorithms for efficient problem solving.
4	To understand and apply various algorithmic strategies for effective problem solving using appropriate data structures.

Course Outcomes	
CO1	**Define** fundamental concepts of data structures and algorithms and identify time and space complexity
CO2	**Describe** different searching and sorting techniques and their basic working principles.
CO3	**Apply** linked list data structures and their operations to implement and analyze simple computational problems.
CO4	**Analyze** computational problems to identify and differentiate appropriate use of stack data structures and recursion techniques for effective problem-solving.
CO5	**Evaluate** the effectiveness of queue and deque data structures in solving real-world scheduling problems by comparing their performance, suitability, and limitations.

Topics covered:		
UNIT-I:	**Introduction to Data Structure**	**(6 Hrs.)**
Introduction: From Problem to Program (Problem, Solution, Algorithm, Data Structure and Program). Data Structures: Data, Information, Knowledge, and Data structure, Abstract Data Types (ADT), Data Structure Classification (Linear and Non-linear, Static and Dynamic, Persistent and Ephemeral data structures). **Algorithms:** Problem Solving, Introduction to algorithm, Characteristics of algorithm, Algorithm design tools: Pseudo-code and flowchart. Complexity of algorithm: Space complexity, Time complexity, Asymptotic notation- Big-O, Theta and Omega, finding complexity using step count method, Analysis of programming Constructs-Linear, Quadratic, Cubic, Logarithmic. Algorithmic Strategies: Introduction to algorithm design strategies- Divide and Conquer, and Greedy strategy.		
UNIT-II:	**Searching and Sorting**	**(6 Hrs.)**
Searching: Search Techniques-Sequential Search/Linear Search, Variant of Sequential Search-Sentinel Search, Binary Search, Fibonacci Search, and Indexed Sequential Search. **Sorting:** Types of Sorting-Internal and External Sorting, General Sort Concepts-Sort Order, Stability, Efficiency, and Number of Passes, Comparison Based Sorting Methods-Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Shell Sort, Non-comparison Based Sorting Methods-Radix Sort, Counting Sort, and Bucket Sort, Comparison of All Sorting Methods and their complexities.		
UNIT-III:	**Linked List**	**(5 Hrs.)**
Linked List: Introduction: Linked Lists, Representation of Linked Lists in Memory, Traversing a Linked List, searching a Linked List, Memory Allocation; Garbage Collection, Insertion into a Linked List, Deletion from a Linked List, Header Linked List, Circularly Linked Lists, Two-Way Lists (or Doubly Linked Lists).		
UNIT-IV:	**Stacks**	**(5 Hrs.)**
Basic concept, stack Abstract Data Type, Representation of Stacks Using Sequential Organization, stack operations, Multiple Stacks, Applications of Stack- Expression Evaluation and Conversion, Polish notation and expression conversion, Need for prefix and postfix expressions, Postfix expression evaluation, Linked Stack and Operations. **Recursion-** concept, variants of recursion**-** direct, indirect, tail and tree, backtracking algorithmic strategy, use of stack in backtracking.		
UNIT-V:	**Queue**	**(5 Hrs.)**
The Queue Abstract Data Type, A Simple Array-Based Queue implementation, lmplernenting a Queue with a Generic Linked List, Round Robin Schedulers, The Deque Abstract Datà Type, implementing a Deque, Deques in the Java Col lections Framework.		

Text Books	
1	A. VAho, J Hopcroft, JD Ullman, Data Structures and Algorithms, Addison- Wesley, 1983.
2	THCormen, CF Leiserson, RL Rivest, C Stein, Introduction to Algorithms, 3rd Ed., MIT Press, 2009.
3	Sahni, S., "Data Structures, Algorithms, and Applications in C++", WCB/McGraw-Hill.
Reference Books	
1	Data Structures & Algorithms, 1e, Alfred V.Aho, Jeffery D. Ullman , Person.
2	MT Goodrich, R Tamassia, DM Mount, Data Structures and Algorithms in Java, 5th Ed., Wiley, 2010. (Equivalent book in C also exists.)
3	Wirth, N., "Algorithms and Data Structures", Prentice-Hall of India.
E- Books	
1	https://apps2.mdp.ac.id/perpustakaan/ebook/Karya%20Umum/Dsa.pdf
2	MT Goodrich, R Tamassia, DM Mount, Data Structures and Algorithms in Java, 5th Ed., Wiley, 2010. (Equivalent book in C also exists.)
3	Wirth, N., "Algorithms and Data Structures", Prentice-Hall of India.

CO-PO Mapping Table:

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CO1	3	2	1	1	-	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	3	2	1	2	-	-	-	-	-	-
CO4	3	3	2	2	2	-	-	-	-	-	-
CO5	3	3	3	2	2	-	-	-	-	-	-

Second Year Artificial Intelligence and Machine Learning (2025 Course) Artificial Intelligence			
Course Code	AMPCC203T	**Credit**	02
Contact Hours	**TH:** 02 Hrs./Weeks(L)	**Type of Course**	Lecture
Examination Scheme	**CCE:** 50 Marks **SEE:** 50 Marks	**Total Marks**	100

TOP

Pre-requisites: Programming and Problem Solving, and Data Structures

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Comprehensive Continuous Evaluation (CCE)	Internal	50*
2.	Semester End Evaluation (SEE)	Internal	50#

Course Objectives	
1	To introduce basic concepts and techniques of Artificial Intelligence (AI).
2	To apply informed search techniques for different applications.
3	To learn various knowledge representation techniques and writing programs.
4	To learn about the latest techniques for developing AI systems

Course Outcomes	
CO1	**Identify** the basic concepts of Artificial Intelligence, intelligent agents, and their environment.
CO2	**Explain** problem-solving and search techniques such as BFS, DFS, A, and game-playing algorithms.
CO3	**Apply** advanced search techniques, knowledge representation methods, and basic machine learning concepts to solve real-world problems.
CO4	**Analyze** and differentiate between supervised, unsupervised, and reinforcement learning techniques to examine their suitability for solving various real-world problems.
CO5	**Evaluate** modern AI applications, ethics, and future trends in Artificial Intelligence.

Topics covered:

UNIT-I: Introduction to Artificial Intelligence (5 Hrs)

Introduction to Artificial Intelligence, Foundations of Artificial Intelligence, History of Artificial Intelligence, State of the Art, Risks and Benefits of AI, Intelligent Agents, Agents and Environments, Good Behavior: Concept of Rationality, Nature of Environments, Structure of Agents.

UNIT-II:	**Problem Solving and Searching Techniques**	**(6 Hrs.)**
Introduction to Artificial Intelligence, background and applications, Turing test, Weak AI, Strong AI, Narrow AI, Artificial General Intelligence, Super AI, rational agent approaches to AI, Introduction to intelligent agents, their structure, behavior and task environment. **Problem Solving and Searching Techniques:** Problem characteristics, production systems, control strategies, breadth-first search, depth first search, hill climbing and its variations, heuristics search techniques: best-first search, A* algorithm, constraint satisfaction problem, means-end analysis, introduction to game playing, min-max and alphabet pruning algorithms.		
UNIT-III:	**Advanced Search and Machine-Learning**	**(6 Hrs.)**
Advanced Search: Constructing Search Trees, Stochastic Search, AO* Search Implementation, Minimax Search, Alpha-Beta Pruning Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem. **Machine-Learning:** Introduction. Machine Learning Systems, Forms of Learning: Supervised and Unsupervised Learning, reinforcement – theory of learning – feasibility of learning – Data Preparation– training versus testing and split.		
UNIT-IV:	**Learning**	**(6 Hrs.)**
Supervised Learning: Regression: Linear Regression, multi linear regression, Polynomial Regression, logistic regression, Non-linear Regression, Model evaluation methods. Classification: – support vector machines (SVM), Naïve Bayes classification **Unsupervised learning** Nearest neighbor models – K-means – clustering around medoids – silhouettes – hierarchical clustering – k-d trees, clustering trees – learning ordered rule lists – learning unordered rule. Reinforcement learning- Example: Getting Lost -State and Action Spaces.		
UNIT-V:	**AI: The Present and The Future**	**(5 Hrs.)**
Symbolic AI, Data-driven AI and Machine Learning, Introduction to Machine Learning and Deep Learning based AI, some applications of symbolic and data driven AI, Interpretable and Explainable AI, Ethics of AI: benefits and risks of AI.		

Text Books	
1	S. Russel, P. Norvig, "Artifical Intelligence- A Modern Approach", Third Edition, Persona Education, 2015.
2	Russell, Stuart, J. and Norvig, Peter, Artificial Intelligence - A Modern Approach, Pearson, 4th edition, 2020.
3	Bratko, Ivan, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 4th edition, 2012
Reference Books	
1	Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Third Edition, McGraw Hill, 2017.
2	Introduction to AI & Expert System: Dan W. Patterson PHI.
3	Ivan Bratko: "Prolog Programing For Artificial Intelligence", 2nd Edition Addison Wesley.
4	Rich, Elaine and Knight, Kelvin, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2010 Relevant
E- Books	
1	http://courses.csail.mit.edu/6.034f/ai3/rest.pdf
MOOC	
1	https://onlinecourses.nptel.ac.in/noc22_cs56/preview -Course (nptel.ac.in)
2	https://nptel.ac.in/courses/106106226

CO-PO Mapping Table

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	1	-
CO2	3	3	2	-	2	-	-	-	-	-	1
CO3	3	3	2	2	2	-	-	-	-	1	-
CO4	3	3	3	2	2	-	-	-	-	-	1
CO5	3	2	-	-	-	-	-	-	-	-	1

Second Year Artificial Intelligence and Machine Learning (2025 Course)

Data Structures using Artificial Intelligence Laboratory

Course Code	AMPCC204P	**Credit**	02
Contact Hours	**PR:** 4 Hrs./Weeks(P)	**Type of Course**	Practical
Examination Scheme	**TW:** 25 Marks **PR:** 50 Marks **OR:** 25 Marks	**Total Marks**	100$

TOP

Pre-requisites: Data Structures & Artificial Intelligence

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Term Work Evaluation (TW)	Internal	25$
2.	Practical Evaluation (PR)	External	50$
3.	Oral Evaluation (OR)	External	25$

Course Objectives	
1	To develop problem-solving skills by implementing linear and non-linear data structures such as arrays, linked lists, stacks, and queues for real-world applications like job scheduling and appointment systems.
2	To analyze and apply different sorting and searching algorithms, and evaluate their time complexity for efficient data organization and processing.
3	To understand and implement fundamental AI search algorithms such as BFS and DFS for solving state-space problems like 8-puzzle and water jug problem.
4	To design intelligent systems using AI techniques such as game playing, optimization, and decision-making algorithms including Alpha-Beta pruning and TSP.

Course Outcomes	
CO1	**Apply** sorting and searching techniques and analyze their performance using appropriate data structures.
CO2	**Implement** linear data structures such as arrays, linked lists, stacks, and queues to solve computational problems.
CO3	**Apply** search algorithms like BFS, DFS, and heuristic techniques to solve AI problems.
CO4	**Develop** AI-based solutions for classical problems such as games, puzzles, and optimization problems.
CO5	**Design and develop** real-world applications using data structures and AI concepts with consideration of efficiency and problem-solving.

Guidelines

Course Design and Assessment:

- The assignments are divided into groups (A, B, and C), with specific implementation requirements.
- Group A and B assignments are to be implemented using Python, focusing on fundamental operations without using built-in methods for core functionalities.
- A minimum of 10 assignments must be completed (Group A & Group B), covering at least 5 assignments from group A, 5 assignments from Group B & 2 Mini Project from group C respectively.

Operating System Recommended: - 64-bit Open source Linux or its derivative Programming tools recommended: - C++/Python

Laboratory Journal Submission:

Students must maintain a laboratory journal with a structured format:

- Title, Objective, Problem Statement, and Outcomes.
- Theory (Concepts and Algorithms), Flowchart, and Test Cases.
- Program Code, Sample Output, Conclusion, and Analysis.
- Journals must be handwritten for problem-solving write-ups but may include soft copies of code and outputs to reduce paper usage.

Evaluation and Assessment:

Continuous evaluation based on:

- Timely submission of assignments.
- Code efficiency and innovation.
- Problem-solving and debugging skills.
- Punctuality and active participation.
- Practical examination must include problem-solving demonstrations, viva voce, and code walkthroughs to assess conceptual clarity.

Sr. No.	List of Laboratory Assignments: Group A (*Any Five)
LA 1	Write a **Python** program to store first year percentage of students in array. Write function for sorting array of floating-point numbers in ascending order using i. Selection Sort ii. Bubble sort and display top five scores
LA 2	Write Python program to store 10th class percentage of students in array. Write function for sorting array of floating-point numbers in ascending order using radix sort and display top five scores.
LA 3	Write a program to store the first year percentage of students in an array. Write function for sorting array of floating point numbers in ascending order using - Selection Sort - Bubble sort and display top five scores.
LA 4	Implement a program to perform insertion, deletion, traversal, and searching operations on a one-dimensional array. Analyze the time complexity of each operation.
LA 5	Write a program to implement doubly linked list: a) Display free slots b) Book appointment c) Sort list based on time d) Cancel appointment (check validity, time bounds, availability) e)Sort list based on time using pointer manipulation.
LA 6	Implement Stack using a linked list. Use this stack to perform evaluation of a postfix expression.
LA 7	A double-ended queue (deque) is a linear list in which additions and deletions may be made at either end. Obtain a data representation mapping a deque into a one-dimensional array. Write a program to simulate deque with functions to add and delete elements from either end of the deque.
LA 8	Pizza parlor accepting maximum M orders. Orders are served on a first come first served basis. Queues are frequently used in computer programming, and a typical example is the creation of a job queue by an operating system. If the operating system does not use priorities, then the jobs are processed in the order they enter the system. Write a program for simulating job queue. Write functions to add jobs and delete jobs from the queue.

List of Laboratory Assignments: Group B (*Any Five)	
LA 9	Write a Program to Implement Breadth First Search using Python.
LA 10	Write a Program to Implement Depth First Search using Python.
LA 11	Write a Program to Implement Tic-Tac-Toe game using Python.
LA 12	Write a Program to Implement 8-Puzzle problem using Python.
LA 13	Write a Program to Implement Water-Jug problem using Python.
LA 14	Write a Program to Implement Travelling Salesman Problem using Python.
LA 15	Write a Program to Implement Tower of Hanoi using Python.
LA 16	Write a Program to Implement Monkey Banana Problem using Python.
LA 17	Write a Program to Implement Alpha-Beta Pruning using Python.
Group C- Mini Project (*Any Two)	
MP 1	Design an Online Food Order Processing System that manages incoming customer orders using queue data structure. Orders must be processed in the order they are received. The system should allow order placement, order preparation status tracking, and order completion display.
MP 2	Develop a Hospital Emergency Management System that manages patients based on priority using a queue. Emergency cases should be handled first, while normal cases follow FIFO order. Patient records must be stored dynamically using a linked list. The system should allow patient registration, priority assignment, treatment completion, and record maintenance.
MP 3	Movie Recommendation System using Natural Language Processing and Python.
MP 4	Reinforcement Learning-Based Smart Traffic Signal Control System.

Reference Books	
1	"Think Python" by Allen B. Downey: A widely used textbook for learning Python programming concepts.
2	"Python for Data Analysis" by Wes McKinney: A comprehensive guide for data analysis using Python libraries like Pandas, NumPy, and IPython.
3	"Learn Python the Hard Way" by Zed A. Shaw: A more hands-on approach to learning Python.

E- Books	
1	https://artint.info/AIPython/aipython.pdf

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	1	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-
CO3	3	3	2	2	2	-	-	-	1	-	-
CO4	3	3	3	2	2	-	-	-	1	-	-
CO5	3	3	3	2	2				2		

Second Year Artificial Intelligence and Machine Learning (2025 Course) Social Well-being			
Course Code	AMVEC205W	**Credit**	02
Contact Hours	**Th:** 01 Hr./Weeks(L) **Tut:** 01 Hr./WeeksT)	**Type of Course**	Theory/Tutorial
Examination Scheme	**TW:** 25 Marks	**Total Marks**	25$

TOP

Pre-requisites: - Communication Skills, General Awareness of Societal Issues and Community Life, Basic Digital Literacy

- **Course assessment methods/tools:**

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Term Work Evaluation (TW)	Internal	25$

Course Objectives	
1	To develop awareness of social values, ethics, and responsible citizenship that directs towards social well being
2	To enhance communication, empathy, and interpersonal skills for better social interaction
3	To understand social issues and challenges in society and their impact
4	To promote teamwork, collaboration, and community engagement
5	To foster a sense of social responsibility and sustainable development

Course Outcomes	
CO1	Demonstrate **understanding** of social values, ethics, and responsible citizenship
CO2	**Apply** effective communication and interpersonal skills in social interactions
CO3	Identify and **analyze** key social issues and their impact on society
CO4	Work collaboratively in teams and participate in community-based activities
CO5	**Exhibit** a sense of social responsibility towards sustainable development

Topics covered:		
UNIT-I:	**Introduction to Social Well-Being**	**(2 Hrs.)**
Concept of social wellbeing, importance of social wellbeing, human values related to social wellbeing , ethics, and responsible citizenship, Indicators of Social Well-being.		

UNIT-II:	**Communication and Interpersonal Skills**	**(2 Hrs.)**
Effective communication, empathy, active listening, relationship building.		
UNIT-III:	**Understanding Society and Social Issues**	**(2 Hrs.)**
Social structure, diversity, inclusion, key social challenges (poverty, education, environment).		
UNIT-IV:	**Teamwork and Community Engagement**	**(3 Hrs.)**
Team dynamics, collaboration, role of individuals in society, community participation.		
UNIT-V	**Ways of improving Social Wellbeing:**	**(3 Hrs.)**
Approaching friends and family for support, Treating others with respect, Balancing own social and personal time, Engaging in conflict resolution and softening barriers Social Responsibility and Sustainability related to social well-being Sustainable development goals for social well-being, environmental awareness, social responsibility practices.		

List of Assignments	
1.	**Write a short reflection**: "Role of Engineers in Society for maintaining social well-being" (300–400 words) **Case study discussion**: Analyze a real-life example of ethical/unethical engineering practice **Activity**: Identify 5 social responsibilities of an engineer
2.	**Communication and Interpersonal Skills** **Role play**: Effective vs ineffective communication in a team project **Activity**: Practice active listening and summarize partner's views Assignment: Write a professional email/report on a social issue
3.	**Understanding Society and Social Issues** **Mini-survey**: Collect data on a local social issue (e.g., waste management, traffic, water usage) **Data analysis**: Present findings using charts/graphs Discussion: Impact of technology on society (positive & negative)
4.	**Teamwork and Community Engagement** **Group activity**: Solve a community problem using engineering thinking **Task:** Plan a small social initiative (cleanliness drive, awareness campaign, etc.)

5.	**Social Responsibility and Sustainability** **Activity:** Conduct a simple sustainability audit (energy/water usage at home/college) **Task:** Propose an eco-friendly engineering solution Poster/Presentation: Sustainable development goals (SDGs)
6	**Ethics and Decision-Making** **Case study:** Analyze ethical dilemmas in engineering (e.g., safety vs cost) **Debate:** "Technology always improves quality of life – Agree/Disagree" Assignment: Suggest ethical solutions for a given scenario
Text Books	
1	Human Values and Professional Ethics – Suresh Jayshree
2	Textbook on Professional Ethics and Human Values – R. S. Naagarazan
3	Universal Human Values and Professional Ethics – Dr. Ritu Soryan
Reference Books	
1	Human Values and Professional Ethics – Subhash B. Gogate Vikas Publishing House Pvt. Ltd.
2	Ethics and Human Values in Engineering Practices – Dr. Subrata Das
3	Ethics in Engineering – Mike W. Martin & Roland Schinzinger Publisher: Tata McGraw-Hill

CO-PO Mapping Table

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	1	1	-	3	3	-	-	-	-
CO2	2	3	1	1	-	2	2	-	1	-	-
CO3	1	2	2	1	-	2	1	-	2	-	-
CO4	1	2	1	2	-	2	2	2	-	-	-
CO5	-	1	2	1	-	2	2	1	2	1	1

Second Year Artificial Intelligence and Machine Learning (2025 Course) Community Engagement - Field Project			
Course Code	AMCEP206O	**Credit**	02
Contact Hours	**PR:** 04 Hrs./Weeks(P)	**Type of Course**	Practical
Examination Scheme	**TW:** 25 Marks **OR:** 50 Marks	**Total Marks**	75$

TOP

Pre-requisites: - Students should have prior knowledge of

- Basic understanding of core engineering concepts relevant to the chosen field of work.
- Knowledge of teamwork, communication, and project planning.
- Awareness of safety protocols and ethical considerations for fieldwork

Course assessment methods/tools:

Sr. No.	Course Assessment Methods/ Tools	External/ Internal	Marks
1.	Term Work Evaluation (TW)	Internal	25$
2.	Oral Evaluation (OR)	External	50$

Course Objectives	
1	To develop problem-solving skills by identifying real-world community challenges and applying AI & data science techniques for effective solutions.
2	To enhance interdisciplinary collaboration by integrating AI, data analytics, and software development with societal needs in community projects.
3	To promote research, innovation, and ethical AI practices in field-based projects, ensuring social responsibility and sustainability.
4	To equip students with project management skills, including planning, execution, documentation, and presentation of AI-driven community solutions.

Course Outcomes	
CO1	**List and identify** community-based problems related to AI and data science applications
CO2	**Explain and describe** AI-driven models or applications used to address real-world issues in a structured and ethical manner.
CO3	**Apply** teamwork, communication, and project management skills while working effectively in multidisciplinary teams
CO4	**Examine and analyze** the societal, economic, and environmental impacts of AI solutions to determine areas for sustainable improvement.

Course Guidelines

Community Problem Identification & Data Collection: Introduction to Community Engineering and its role in AI & Data Science. Identifying real-world challenges in society, healthcare, education, environment, agriculture, etc. Field visits / Data collection techniques (surveys, interviews, IoT sensors, open datasets). Understanding ethical AI practices and data privacy regulations. Case studies on AI applications in social good.

AI Model Development & Solution Design: AI techniques suitable for community-driven projects (ML, NLP, Data Analytics). Data preprocessing, feature engineering, and model selection. Model training, validation, and performance evaluation. AI tools and frameworks (TensorFlow, PyTorch, Scikit-learn). Prototyping AI solutions (web, mobile, IoT, cloud deployment).

Project Implementation, Teamwork & Communication: Agile project management and teamwork in AI-driven projects. Collaborative software development using Git, JIRA, and cloud platforms. Integration of AI models into applications. Testing, debugging, and optimization of AI-based solutions. Communicating technical findings through reports, presentations, and demos.

Social Impact, Deployment & Final Evaluation: Field testing and validation of AI solutions in real-world scenarios. Assessing economic, environmental, and societal impacts of AI models.

Ethical concerns in AI: Bias, fairness, and responsible AI development. Sustainable AI solutions aligned with UN SDGs (Sustainable Development Goals). Final project presentation, demonstration, and documentation submission.

Implementation Guidelines

Project Execution Guidelines:

1. **Team Formation:**
   - Students shall work in teams of 3-4 members.
   - Each team will identify a real-world community problem **(Village/habitation/municipal ward etc.)** and propose an AI-based solution.
   - Topics must be approved by faculty within the first 2 weeks.
2. **Mentorship**
   - Each project group/batch shall be assigned a **faculty mentor** for academic guidance and support.
   - The mentor will regularly monitor the progress of the project, provide technical and professional guidance, and evaluate the work carried out by the students throughout the project duration.
3. **Batch Structure**
   - A class of **60 students** may be divided into **3 batches (20 students each)**
   - Each batch shall be allotted practical session of **4-hour weekly** for project-related activities and guidance.

4. External Association

Students shall collaborate with:

- Government officials
- Village authorities
- NGOs / local bodies

The allocation of villages, organizations, or fieldwork areas may be facilitated by the district or local administration.

5. Nature of the Project

- The project must be **independent of NSS/NCC/Clubs activities**
- The project should address **real-world, localized community** issues and aim to provide practical and sustainable solutions.

6. Documentation

- Each student shall maintain an **Activity Log Book** throughout the project duration.
- The log book must include: **daily/weekly activities, observations, and learning outcomes** achieved during the project work.
- The **Activity Log Book** must be duly verified and signed by the Faculty Mentor and Head of Department (HoD).

7. Proposal Submission:

CEP Group Should Submit a two-page project proposal, preferably prior to the term commencement outlining the following:

- Title of the project
- Aim, Objective and expected outcome
- Plan of execution (timeline and activities).
- Place of the CEP and involvement of any local authority, NGP
- Required resources (if any).

Get approval from the designated faculty mentor.

7. Project Report

- Each group shall submit a detailed **project report** at the end of the project work.
- The report should include:
  - Community profile,
  - Problem statement,
  - Methodology,
  - Implementation details,
  - Results, and overall impact of the project.

8. Internal Evaluation

- The internal evaluation shall be conducted by a committee constituted by the **Head of Department (HoD).**
- The evaluation shall be based on students' participation, field work, innovation, quality of documentation, and overall project performance.
- Marks shall be awarded based on the assessment and recommendations of the **Faculty Mentor and HoD.**

9. Awareness Activities

Students may conduct awareness programs in areas such as:

- Health and Hygiene,
- Organic Farming,
- Renewable Energy,
- E-waste Management,
- De-addiction awareness, and other relevant domains based on students' expertise and community needs.

10. Final Evaluation

- The final evaluation shall be conducted through an **Oral Examination (Viva Voce).**
- The evaluation shall include project presentation, demonstration of outcomes, and assessment of the overall impact and learning achieved through the project work.

Assessment Scheme

Component	Weightage
Survey & Activity Log Book	15%
Problem Identification & Proposal	15%
Field Implementation	30%
Final Report	20%
Presentation, Demonstration of outcomes & Viva Voce	20%

Reference Books	
1	Bansal, V. (2019). Hands-On Artificial Intelligence for Healthcare: A Practical Guide to Building AI Models in Healthcare and Life Sciences. BPB Publications.
2	Bose, I., & Pal, A. (2020). Data Science for Engineers. Springer.
3	Chaudhury, S., & Mitra, P. (2018). AI for Social Good: Use Cases in Emerging Economies. Springer.
4	Patel, N., & Agrawal, R. (2020). Artificial Intelligence: A Modern Approach. Pearson India.

MOOC Courses	
1	https://www.nasscom.in/
2	https://meity.gov.in/
3	https://niti.gov.in/.

CO-PO Mapping Table

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CO1	2	3	1	1	1	3	2	1	-	-	-
CO2	3	2	2	2	3	2	1	3	1	1	-
CO3	1	1	2	-	1	1	-	2	3	3	3
CO4	2	3	2	2	1	3	3	2	1	1	1

Second Year Artificial Intelligence and Machine Learning (2025 Course) Entrepreneurship and Startup Ecosystem			
Course Code	AMEMC207W	**Credit**	02
Contact Hours	**TH:** 01 Hrs./Weeks(L) **TUT:** 01 Hrs./Weeks(L)	**Type of Course**	Lecture/Tutorial
Examination Scheme	**TW:** 25 Marks	**Total Marks**	25$

TOP

Pre-requisites: - Completion of foundational engineering courses like Engineering Mathematics or Introduction to Computers for better context in tech startups.

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Term Work (TW)	Internal	25$

Course Objectives	
1	To understand the basic concepts, characteristics, and importance of entrepreneurship.
2	To study the startup ecosystem and its support and incubation mechanisms.
3	To identify business opportunities through market analysis and demand-supply gap assessment.
4	To develop preliminary startup ideas and feasibility-based concept notes.

Course Outcomes	
CO1	Ability to **Explain** entrepreneurship concepts, traits, and business ownership forms.
CO2	Ability to **Describe** the startup ecosystem and institutional support available to entrepreneurs.
CO3	Ability to **Analyze** market problems and identify viable business opportunities.
CO4	Ability to **Prepare** a preliminary startup concept note with basic feasibility inputs.
CO5	Ability to **Evaluate** a startup idea for innovation, scalability, risk, and incubation readiness.

Topics covered:		
UNIT-I:	**Entrepreneurship Basics**	**(2 Hrs.)**
Concept, need, characteristics, qualities, functions, types of entrepreneurs; barriers.		
UNIT-II:	**Ownership and Roles**	**(2 Hrs.)**
Entrepreneur vs. manager; forms of business ownership (sole proprietorship, partnership); types of industries.		

UNIT-III:	**Startup Ecosystem**	**(2 Hrs.)**
Concept of startups; support agencies (DIC, NSIC, SIDBI, NABARD, KVIC, banks).		
UNIT-IV:	**Incubation Support**	**(3 Hrs.)**
Role of Technology Business Incubators (TBI) and Science & Technology Entrepreneur Parks (STEP).		
UNIT-V	**Opportunity Identification**	**(3 Hrs.)**
Business opportunity spotting; SSI, ancillary, tiny units; demand-supply assessment.		

Tutorial Assignment	
1	Prepare a profile of an entrepreneur and compare the role of an entrepreneur with that of a manager
2	Map the startup ecosystem for a chosen sector and identify the key support agencies, incubators, and funding sources available in India.
3	Identify a real local market problem and analyze whether it can become a viable startup opportunity based on demand-supply gaps.
4	Develop a preliminary startup concept note for an identified idea, including the problem, solution, target customer, and basic feasibility.
5	Evaluate a startup idea for innovation, scalability, risks, and incubation readiness using ecosystem support parameters.

Textbooks:	
1.	Entrepreneurship Development and Management by R. K. Singhal, Katson Books.
2.	Entrepreneurship Development and Management by Vasant Desai, Himalaya Publishing House.
Reference Books:	
1.	The Lean Startup, Author name: Eric Ries, ISBN: 978-0307887894 Publisher: Crown Business
2.	Zero to One, Author name: Peter Thiel with Blake Masters, ISBN: 978-0753555194, Publisher: Virgin Books
3.	The Startup Owner's Manual, Author name: Steve Blank and Bob Dorf, ISBN: 978-0984999309, Publisher: K&S Ranch

4.	Startup Ecosystem in India: Text & Cases, Author name: Rajeeb Mishra, ISBN: 978-9356737153, Publisher: Himalaya Publishing House
5.	The $100 Startup, Author name: Chris Guillebeau, ISBN: 978-0307951526, Publisher: Crown Business
E- Books:	
1	Entrepreneurship, Michael Laverty and Chris Littel, Colorado State University Global / Pressbooks, Free PDF from freebookcentre.net
2	Introduction to Entrepreneurship, Sathyabama Institute of Science and Technology, Sathyabama Institute, Free PDF from freebookcentre.net
3	The Entrepreneur's Guide to Building a Successful Business, Jonathan T. Scott, Free PDF from efmdglobal.org
4	Entrepreneurship and Small Business Management, Hitesh Jhanji (Editor), Lovely Professional University / Excel Books, Free PDF from ebooks.lpude.in
MOOC:	
1	"Entrepreneurship 101: Who is your customer?" by MIT on edX.
2	"How to Build a Startup" by Steve Blank on Coursera.
3	"Startup Ecosystem" by Startup School on Udacity.

CO-PO Mapping Table

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CO1	2	1	-	-	-	1	-	-	-	-	-
CO2	1	2	-	-	1	1	-	1	-	-	2
CO3	1	2	2	2	1	-	-	-	1	-	-
CO4	-	1	3	2	2	-	-	-	1	2	1
CO5	-	2	2	2	2	-	-	2	1	1	2

Artificial Intelligence and Machine Learning

Second Year (Semester – IV)

Syllabus

Second Year Artificial Intelligence and Machine Learning (2025 Course) Operating Systems			
Course Code	AMPCC208T	**Credit**	02
Contact Hours	**TH:** 02 Hrs./Weeks(L)	**Type of Course**	Lecture
Examination Scheme	**CCE:** 50 Marks **SEE:** 50 Marks	**Total Marks**	100

TOP

Pre-requisites: Fundamental of Programming Languages

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Comprehensive Continuous Evaluation (CCE)	Internal	50*
2.	Semester End Evaluation (SEE)	Internal	50#

Course Objectives	
1	To understand the basic concepts, structure, and functions of operating systems.
2	To learn process management, scheduling techniques, and synchronization mechanisms.
3	To understand deadlock handling techniques and system protection mechanisms.
4	To study memory management and file system organization in operating systems.
5	To analyze OS algorithms and evaluate system performance.

Course Outcomes	
CO1	**Recall** the basic concepts of operating systems, including their evolution, services, and system calls.
CO2	**Describe** process management concepts, scheduling algorithms, and multithreading models.
CO3	**Apply** synchronization techniques to solve concurrency problems in operating systems.
CO4	**Analyze** and handle deadlock situations using prevention, avoidance, detection, and recovery techniques.
CO5	**Evaluate** the effectiveness of memory management and file system techniques for system performance optimization.

Topics covered:		
UNIT-I:	**Introduction**	**(5 Hrs.)**
Evolution of OS, Types of OS, Basic h/w support necessary for modern operating systems, services provided by OS, system programs and system calls, system design and implementation.		

UNIT-II:	Process & Its Scheduling	(5 Hrs.)
Process & Its Scheduling Process concept, process control block, Types of scheduler, context switch, threads, multithreading model, goals of scheduling and different scheduling algorithms.		
UNIT-III:	**Process management and Synchronization**	**(5 Hrs.)**
Process management and synchronization: Concurrency conditions, Critical section problem, software and hardware solution, semaphores, conditional critical regions and monitors, classical inter process communication problems.		
UNIT-IV:	**Deadlock**	**(5 Hrs.)**
Deadlock definitions, Prevention, Avoidance, detection and Recovery, Goals of Protection, access matrix, Deadlock implementation.		
UNIT-V	**Memory Management & File Handling**	**(6 Hrs.)**
File systems: File concept, Access methods space allocation strategies, disk arm scheduling strategies. Contiguous allocation, Relocation, Paging, Segmentation, Segmentation with paging, demand paging, Virtual Memory Concepts, page faults and instruction restart , page replacement algorithms, working sets, Locality of reference, Thrashing, Garbage Collection.		

Text Books	
1	Operating System concepts – Silberchatz; Galvin, Addison Wesley, 8th Edition
2	Modern Operating Systems – Tanenbaum, Pearson Edn. 3rd Edition Referenc e Books
3	Operating Systems: Internals and Design Principles -- William Stallings
Reference Books	
1	Operating Systems – S R Sathe, Macmillan Publishers, India, 2008
2	Operating System –Milan Milenkovik, McGraw-Hill, 1987
3	Operating Systems - 3 rd Edition by Gary Nutt, Pearson Education.

CO-PO Mapping Table

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	2
CO2	3	3	2	-	2	-	-	-	-	-	2
CO3	3	3	2	2	2	-	-	-	-	-	2
CO4	3	3	2	2	-	-	-	-	-	-	2
CO5	3	3	2	2	2	-	-	-	-	-	2

Second Year Artificial Intelligence and Machine Learning (2025 Course) Data Structures and Algorithms			
Course Code	AMPCC209T	**Credit**	02
Contact Hours	**TH:** 02 Hrs./Weeks(L)	**Type of Course**	Lecture
Examination Scheme	**CCE:** 50 Marks **SEE:** 50 Marks	**Total Marks**	100

TOP

Pre-requisites: Programming and Problem Solving, Data Structures

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Comprehensive Continuous Evaluation (CCE)	Internal	50*
2.	Semester End Evaluation (SEE)	Internal	50#

Course Objectives	
1	To understand the standard and abstract data representation Method and develop logical ability to solve the problem in time efficient way.
2	To expose students to career opportunities in the fields of data structure design, data handling implementation, and the development of efficient sorting and searching techniques.
3	To enable students to select and apply appropriate data structures and algorithms for efficient problem solving.
4	To understand and apply various algorithmic strategies for effective problem solving using appropriate data structures.

Course Outcomes	
CO1	**Recall** the concepts of tree and binary tree, including basic definitions, types, traversal methods, and binary search tree operations.
CO2	**Explain** the concept of multi-way search trees and B/B+ trees for efficient data storage and retrieval.
CO3	**Apply** graph representations and use graph algorithms to solve real-world problems.
CO4	**Analyze** the suitability and performance of heap and balanced tree structures (such as AVL Trees and Red-Black Trees) for implementing efficient priority-based operations.
CO5	**Evaluate** the efficiency and suitability of heap and balanced tree structures (AVL and Red-Black Trees) for implementing priority-based operations by comparing their performance in different computational scenarios.

Topics covered:		
UNIT-I:	**Tree**	**(5 Hrs.)**
Trees and Binary Trees: Introduction of Tree, Basic terminology and Representation of Tree**,** Binary Trees Representation, Convert Tree into Binary Tree, Operations: Insert, Delete, Traversal: Preorder, In-order, Post-order, Traversal Algorithms Using Stacks, Header Nodes; Threads, Threaded Binary Trees, **Binary Search Trees:** Searching and Inserting in Binary Search Trees, Deleting in a Binary Search Tree,		
UNIT-II:	**Multi-way Search Tree**	**(5 Hrs.)**
M-way Search Trees: Searching, Insertion and Deletion in an m-way Search tree, B-Trees ,Searching, Insertion and Deletion in a B-tree, B+-Trees Graph Algorithms.		
UNIT-III:	**Graph**	**(6 Hrs.)**
Graphs and their Applications - Introduction, Graph Theory Terminology, Sequential Representation of Graphs, Adjacency Matrix; Path Matrix, Linked Representation of a Graph, Operations on Graphs, Topological Sorting, **Implementation of algorithms for Traversal:** Kruskal's, Prim's and Single source shortest path Algorithms, Application of graph for problems like shortest path on a map.		
UNIT-IV:	**Heaps**	**(6 Hrs.)**
Priority Queue and Heap: Priority Queue, Max. and Min Heap, Operation on Heap, Heapsort, application of Trees. **AVL Tree:** Introduction, Properties, Balance Factor, Operation-Insert, delete and Rotate, **Red black Tress:** Properties, Operations Like Insert, Delete, and Rotate.		
UNIT-V:	**Hashing and File Organization**	**(6 Hrs.)**
Hashing: Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, Different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining with and without replacement. **File:** Concept of File, File types and file organization (sequential, index sequential and Direct Access), Comparison of different file organizations.		

Text Books	
1	A. VAho, J Hopcroft, JD Ullman, Data Structures and Algorithms, Addison- Wesley, 1983.
2	THCormen, CF Leiserson, RL Rivest, C Stein, Introduction to Algorithms, 3rd Ed., MIT Press, 2009.
3	Sahni, S., "Data Structures, Algorithms, and Applications in C++", WCB/McGraw-Hill.

Reference Books	
1	Data Structures & Algorithms, 1e, Alfred V.Aho, Jeffery D. Ullman , Person.
2	MT Goodrich, R Tamassia, DM Mount, Data Structures and Algorithms in Java, 5th Ed., Wiley, 2010. (Equivalent book in C also exists.)
3	Wirth, N., "Algorithms and Data Structures", Prentice-Hall of India.
E- Books	
1	https://apps2.mdp.ac.id/perpustakaan/ebook/Karya%20Umum/Dsa.pdf
2	MT Goodrich, R Tamassia, DM Mount, Data Structures and Algorithms in Java, 5th Ed., Wiley, 2010. (Equivalent book in C also exists.)
3	Wirth, N., "Algorithms and Data Structures", Prentice-Hall of India.
4	https://people.inf.ethz.ch/wirth/AD.pdf

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	1	-
CO2	3	2	-	-	-	-	-	-	-	1	-
CO3	3	3	3	2	2	-	-	-	-	1	1
CO4	3	3	2	-	2	-	-	-	-	1	-
CO5	3	3	2	2	2	-	-	-	-	2	1

Second Year Artificial Intelligence and Machine Learning (2025 Course) Machine Learning Algorithms			
Course Code	AMPCC210T	**Credit**	02
Contact Hours	**TH:** 02 Hrs./Weeks(L)	**Type of Course**	Theory
Examination Scheme	**CCE:** 50 Marks **SEE:** 50 Marks	**Total Marks**	100

TOP

Pre-requisites: Transforms and Numerical Methods, Artificial Intelligence

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Comprehensive Continuous Evaluation (CCE)	Internal	50*
2.	Semester End Evaluation (SEE)	Internal	50#

Course Objectives	
1	To introduce fundamental concepts and types of Machine Learning.
2	To understand regression and classification techniques for predictive modeling.
3	To explore unsupervised learning and clustering methods.
4	To analyze model performance using appropriate evaluation metrics.
5	To study recommendation systems and their applications.

Course Outcomes	
CO1	**Recall** the fundamentals of Machine Learning, types of learning, and different ML models.
CO2	**Describe** regression techniques and interpret the performance of models using suitable evaluation metrics.
CO3	**Apply** classification techniques and evaluate models for binary and multiclass problems.
CO4	**Analyze** unsupervised learning methods and clustering algorithms for data analysis.
CO5	**Critically evaluate** recommendation system techniques and recommend appropriate approaches for personalized applications.

Topics covered:		
UNIT-I:	**Introduction to Machine Learning**	**(6 Hrs.)**
Introduction to Machine Learning: History of ML, Comparison of Machine Learning with Traditional Programming, ML vs AI vs Data Science. Basic definitions, Examples of Machine Learning applications, **Types of Learning:** Supervised, Unsupervised and Semi Supervised Learning, **Models of Machine learning:** Geometric model, Probabilistic Models, Logical Models, Grouping and grading models, Parametric and non-parametric models.		
UNIT-II:	**Regression**	**(6 Hrs.)**
Regression: Regression, Need of Regression, Difference between Regression and Correlation, Types of Regression: Univariate vs. Multivariate, Linear vs. Nonlinear, Simple Linear vs. Multiple Linear, Bias-Variance tradeoff, Overfitting and Underfitting. **Regression Techniques:** Lasso regression, Ridge regression, ElasticNet Regression, Gradient descent algorithm. **Evaluation Metrics:** Mean Squared Error (MSE), Mean Absolute Error (MAE), Root Mean Squared Error (RMSE),R-squared ,Adjusted R-squared.		
UNIT-III:	**Classification**	**(6 Hrs.)**
Introduction: Need of Classification, Types of Classification (Binary and Multiclass), Binary-vs-Multiclass Classification, Balanced and Imbalanced Classification Problems. **Binary Classification:** Linear Classification model, Performance Evaluation- Confusion Matrix, Accuracy, Precision, Recall, F measures. **Multiclass Classification:** One-vs-One and One-vs-All classification techniques, Performance Evaluation- Confusion Matrix, Per Class Precision, Per Class Recall **Classification Algorithms:** K Nearest Neighbor, Linear Support Vector Machines (SVM).		
UNIT-IV:	**Unsupervised Learning**	**(5 Hrs.)**
Distance Based Models: Neighbors and Examples, Nearest Neighbor Classification. **Distance based clustering algorithms**: K-means and K-medoids, Hierarchical clustering. **Tree Based Models:** Decision Trees, Minority Class, Impurity Measures – Gini Index and Entropy, Best Split. **Evaluation metrics and score:** elbow method, extrinsic and intrinsic methods.		
UNIT-V:	**Introduction to Recommendation Systems**	**(5 Hrs.)**
Introduction to Recommendation Systems- Naïve User based systems, Content based Systems, Model free collaborative filtering-singular value decomposition, alternating least squares.		

Text Books	
1	Mitchell Tom, Machine Learning. McGraw Hill, 1997.
2	Introduction to machine learning, Ethem Alpaydin. —2nd ed., The MIT Press, Cambridge, Massachusetts, London, England.
3	Chris Bishop, Pattern Recognition and Machine Learning
4	Shalev-Shwartz, Shai, and Shai Ben-David, "Understanding machine learning: From theory toalgorithms", Cambridge university press, 2014.
5	Ethem Alpaydin, "Introduction to Machine Learning", Publisher: The MIT Press,2014
Reference Books	
1	Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning Data Mining, Inference and Prediction.
2	Ian H Witten, Eibe Frank, Mark A Hall, "Data Mining, Practical Machine Learning Tools and Techniques", Elsevier, 3rd Edition.
3	Shalev-Shwartz, Shai, and Shai Ben-David, "Understanding machine learning: From theory toalgorithms", Cambridge university press, 2014.
E- Books	
1	A brief introduction to machine learning for Engineers: https://arxiv.org/pdf/1709.02840.pdf
2	Introductory Machine Learning Nodes: http://lcsl.mit.edu/courses/ml/1718/MLNotes.pdf
3	Foundation of Machine Learning: https://cs.nyu.edu/~mohri/mlbook/

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-
CO3	3	3	3	2	3	-	-	-	1	-	-
CO4	3	3	2	3	3	-	-	-	1	-	-
CO5	3	3	2	3	3	-	-	-	2	-	-

Second Year Artificial Intelligence and Machine Learning (2025 Course)			
Data Structures and Algorithms using Machine Learning Laboratory			
Course Code	AMPCC212P	**Credit**	02
Contact Hours	**PR:** 4Hrs./Weeks(P)	**Type of Course**	Practical
Examination Scheme	**TW:** 25 Marks **PR:** 50 Marks	**Total Marks**	75$

TOP

Pre-requisites: Data Structures & Artificial Intelligence

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Term Work Evaluation (TW)	Internal	25$
2.	Practical Evaluation (PR)	External	50$

Course Objectives	
1	To understand and implement fundamental data structures such as trees, hashing, heaps, and graphs for efficient data storage and retrieval.
2	To analyze and apply algorithmic techniques for solving real-world problems such as searching, sorting, and network optimization.
3	To understand core machine learning concepts including supervised, unsupervised, and reinforcement learning techniques.
4	To develop and evaluate machine learning models using real-world datasets and performance metrics.

Course Outcomes	
CO1	**Apply** advanced data structures such as trees, graphs, hashing, and files to design efficient solutions for real-world problems.
CO2	**Analyze and evaluate** the performance of data structure operations using time and space complexity.
CO3	**Apply** machine learning algorithms such as regression, classification, and clustering on real-world datasets.
CO4	**Evaluate** machine learning models using appropriate performance metrics and optimize their accuracy.
CO5	**Design and develop** real-world applications using data structures and machine learning techniques, demonstrating problem-solving and innovation skills.

Guidelines

Course Design and Assessment:

- The assignments are divided into groups (A, B, and C), with specific implementation requirements.
- Group A (Data Structures and Algorithms) and Group B (Machine Learning and Algorithms) assignments are to be implemented using Python, focusing on fundamental operations without using built-in methods for core functionalities.
- A minimum of 10 assignments must be completed (Group A & Group B), covering at least 5 assignments from group A, 5 assignments from Group B & 2 Mini Project from group C respectively.

Operating System recommended: - 64-bit Open source Linux or its derivative Programming tools recommended: - C++/Python

Laboratory Journal Submission:

Students must maintain a laboratory journal with a structured format:

- Title, Objective, Problem Statement, and Outcomes.
- Theory (Concepts and Algorithms), Flowchart, and Test Cases.
- Program Code, Sample Output, Conclusion, and Analysis.
- Journals must be handwritten for problem-solving write-ups but may include soft copies of code and outputs to reduce paper usage.

Evaluation and Assessment:

Continuous evaluation based on:

- Timely submission of assignments.
- Code efficiency and innovation.
- Problem-solving and debugging skills.
- Punctuality and active participation.

Practical examination must include problem-solving demonstrations, viva voce, and code walkthroughs to assess conceptual clarity.

Sr. No.	List of Laboratory Assignments: Group A (*Any 5)
LA 1	Write a program to construct a Binary Search Tree and find the post order predecessor of given key with a guarantee of preserving the worst-case running time O(log n)
LA 2	A Dictionary stores keywords and its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide a facility to display whole data sorted in ascending/Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Binary Search Tree for implementation.
LA 3	Design a B-Tree-based application to manage student records using student IDs as keys. Support insertion of new records, deletion, and searching for student details efficiently.
LA 4	You have a business with several offices; you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost. Solve the problem by suggesting appropriate data structures.
LA 5	Implement a Hash Table for Storing and Retrieving Employee Information with Efficient Collision Handling.
LA 6	Design a network of pipes for drinking water for small outlying villages. Find the minimum cost spanning tree or path of a given undirected graph of villages using Kruskal's algorithm
LA 7	Design and implement a dictionary using a height-balanced tree (e.g., AVL Tree) to store keywords along with their meanings. The application should support operations such as insertion of new keywords, deletion, updating existing entries, and displaying the dictionary contents in ascending or descending order. Additionally, determine the maximum number of comparisons required to search for a keyword and analyze the time complexity of the search operation.
LA 8	Develop a program to read the marks obtained by second-year students in an online examination for a particular subject. Utilize heap data structures to efficiently determine the maximum and minimum marks. Analyze the time and space complexity of the implemented algorithm.
LA 9	Company maintains employee information as employee ID, name, designation and salary. Allow user to add, delete information of employee. Display information of particular employee. If employee does not exist an appropriate message is displayed. If

	it is, then the system displays the employee details. Use index sequential file to maintain the data.
LA10	Implement all the functions of a dictionary (ADT) using hashing and handle collisions using chaining with / without replacement. Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique. Standard Operations: Insert(key, value), Find(key), Delete(key)
List of Laboratory Assignments: Group B (*Any 5	
LA 11	Predict the price of the Uber ride from a given pickup point to the agreed drop-off location. Perform following tasks: 1. Pre-process the dataset. 2. Identify outliers. 3. Check the correlation. 4. Implement linear regression and ridge, Lasso regression models. 5. Evaluate the models and compare their respective scores like R2, RMSE, etc. Dataset link: https://www.kaggle.com/datasets/yasserh/uber-fares-dataset
LA 12	Classify the email using the binary classification method. Email Spam detection has two states: a) Normal State – Not Spam, b) Abnormal State – Spam. Use K-Nearest Neighbors and Support Vector Machine for classification. Analyze their performance. Dataset link: The emails.csv dataset on the Kaggle https://www.kaggle.com/datasets/balaka18/email-spam-classification-dataset-csv
LA 13	Implement Gradient Descent Algorithm to find the local minima of a function. For example, find the local minima of the function $y=(x+3)^2$ starting from the point x=2.
LA 14	Implement K-Nearest Neighbors algorithm on diabetes.csv dataset. Compute confusion matrix, accuracy, error rate, precision and recall on the given dataset. Dataset link : https://www.kaggle.com/datasets/abdallamahgoub/diabetes
LA 15	Implement K-Means clustering on Iris.csv dataset. Determine the number of clusters using the elbow method. Dataset Link: https://www.kaggle.com/datasets/uciml/iris
LA 16	Implementation of Support Vector Machines (SVM) for classifying images of handwritten digits into their respective numerical classes (0 to 9).
LA 17	Implement K-Mediod Algorithm on a credit card dataset. Determine the number of clusters using the Silhouette Method. Dataset link: https://www.kaggle.com/datasets/arjunbhasin2013/ccdata
LA 18	Build a Tic-Tac-Toe game using reinforcement learning in Python by using following tasks

	a. Setting up the environment b. Defining the Tic-Tac-Toe game c. Building the reinforcement learning model d. Training the model e. Testing the model
Group C – Mini Project (*Any 2)	
MP 1	Design a mini project using C++ which will use the different data structure with or without C++ library and show the use of specific data structure on the efficiency (performance) of the code.
MP 2	Design a mini project for automated Term work assessment of student based on parameters like daily attendance, Unit Test / Prelim performance, Students achievements if any, Mock Practical
MP 3	Use the following dataset to analyze ups and downs in the market and predict future stock price returns based on Indian Market data from 2000 to 2020. Dataset Link: https://www.kaggle.com/datasets/sagara9595/stock-data
MP 4	Build a machine learning model that predicts the type of people who survived the Titanic shipwreck using passenger data (i.e. name, age, gender, socio-economic class, etc.). Dataset Link: https://www.kaggle.com/competitions/titanic/data

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	2	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-
CO3	3	3	2	2	3	-	-	-	-	-	-
CO4	3	3	3	2	3	-	-	-	-	-	-
CO5	3	3	3	2	3						

Second Year Artificial Intelligence and Machine Learning (2025 Course) Power BI for Beginners Laboratory			
Course Code	AMVSE212P	**Credit**	02
Contact Hours	**PR:** 04 Hrs./Weeks(P)	**Type of Course**	Practical
Examination Scheme	**PR:** 50 Marks	**Total Marks**	50

TOP

Pre-requisites: Artificial Intelligence

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Practical Evaluation (PR)	External	50$

Course Objectives	
1	Understand the basic setup, navigation, and initial configuration of Power BI, including signing in, workspace creation, and database updates.
2	Learn how to import and prepare data from multiple sources for analysis in Power BI Desktop.
3	Develop skills to load and configure multiple queries for building structured datasets in Power BI Desktop
4	Gain expertise in creating and managing data models by defining relationships, configuring tables, and using quick measures in Power BI.

Course Outcomes	
CO1	**Define** data preparation techniques used in Power BI, including data import, transformation, and query configuration.
CO2	**Explain and describe** data models in Power BI, including relationships, measures, and security features.
CO3	**Apply** DAX functions to create calculated columns, measures, and perform advanced data analysis.
CO4	**Analyze and interpret** interactive dashboards and reports to assess data visualization effectiveness for decision-making.
CO5	**Evaluate** the effectiveness of real-world dashboards developed using Power BI for analyzing and visualizing domain-specific data, and justify their suitability in deriving actionable insights for decision-making.

Guidelines

Course Design and Assessment:

- The assignments are divided into groups (A, B, and C), with specific implementation requirements. A minimum of 7 assignments must be completed (Group A & Group B), covering at least 5 assignments from group A, 2 assignments from Group B & 1 Mini Project from group C respectively.

Operating System recommended: - 64-bit Open source Linux or its derivative

Programming tools recommended: - Power BI Desktop

Laboratory Journal Submission:

Students must maintain a laboratory journal with a structured format:

- Title, Objective, Problem Statement, and Outcomes.
- Theory (Concepts and Algorithms), Flowchart, and Test Cases.
- Program Code, Sample Output, Conclusion, and Analysis.
- Journals must be handwritten for problem-solving write-ups but may include soft copies of code and outputs to reduce paper usage.

Evaluation and Assessment:

Continuous evaluation based on:

- Timely submission of assignments.
- Code efficiency and innovation.
- Problem-solving and debugging skills.
- Punctuality and active participation.

Practical examination must include problem-solving demonstrations, viva voce, and code walkthroughs to assess conceptual clarity.

Sr. No.	List of Laboratory Assignments: Group A(All Compulsory)
1.	Basic setup and navigation of Power BI by completing initial tasks including signing in, creating a workspace, and updating the lab database.
2.	To learn how to prepare and import data from multiple sources into Power BI Desktop for further analysis and visualization.
3.	To load and configure multiple queries in Power BI Desktop to prepare a structured dataset for analysis.

4.	To develop and configure a robust data model in Power BI Desktop by creating relationships, organizing tables, and using quick measures.
5.	To apply advanced data modeling techniques in Power BI Desktop by implementing many-to-many relationships and enforcing row-level security.
List of Laboratory Assignments: Group B (*Any 2)	
6.	To introduce the use of Data Analysis Expressions (DAX) in Power BI Desktop by creating calculated tables, columns, and measures for enhanced data modeling and analysis.
7.	To enhance analytical capabilities in Power BI Desktop by applying advanced DAX concepts, including filter context manipulation and time intelligence functions.
8.	To develop and publish a multi-page interactive report in Power BI Desktop using a live data connection, demonstrating effective report design and navigation.
Group C – Mini Project (*Any 1)	
MP 1	**Hospital Management Dashboard** **Problem Statement:** Hospitals manage large amounts of patient and operational data without proper visualization. This project aims to monitor patient records, doctor availability, and treatment statistics.
MP 2	**HR Analytics Dashboard for Employee Attrition** **Problem Statement:** Organizations struggle to identify reasons behind employee attrition. This project analyzes HR data to detect patterns and reduce employee turnover.
MP 3	**Customer Segmentation Analysis using Power BI** **Problem Statement:** Businesses lack clear insights into different customer groups and their behaviors. This project segments customers based on purchasing patterns to improve marketing strategies.

Text Books	
1	"Introducing Microsoft Power BI" by Alberto Ferrari and Marco Russo.
2	"Learn Power BI: A Beginner's Guide to Developing Interactive Business Intelligence Solutions Using Microsoft Power BI" by Greg Deckler.
3	"Beginning Microsoft Power BI" by Dan Clark.

Reference Books	
1	"Microsoft Power BI Quick Start Guide" by Devin Knight, Brian Knight, and Mitchell Pearson
E- Books	
1	https://www.bconcepts.pt/wp-content/uploads/2021/04/PowerBI.pdf
2	https://monashdatafluency.github.io/Power_BI/powerbi-intro.pdf
3	https://www.data-action-lab.com/wp-content/uploads/2024/01/Power-BI-for-Beginners.pdf

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	1	3	1	-	-	-	-	1
CO2	3	2	2	1	3	1	-	-	-	-	1
CO3	2	3	3	2	3	1	-	-	-	-	1
CO4	2	3	2	3	3	2	-	-	-	-	1
CO5	2	3	2	3	3	-	-	-	-	-	1

Second Year Artificial Intelligence and Machine Learning (2025 Course) Internship			
Course Code	AMIAP213W	**Credit**	02
Contact Hours	**PR:** 04 Hrs./Weeks(PR)	**Type of Course**	Practical
Examination Scheme	**TW:** 25 Marks	**Total Marks**	25

TOP

Pre-requisites: -

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Term Work Evaluation (TW)	Internal	25*

Course Objectives	
1	To provide the work experience that can help students to put their education into practice.
2	To encourage and provide opportunities for students to get professional experience through internships.
3	To learn and apply knowledge gained through academics to real life/industrial situations.
4	To get familiar with various technologies and tools used in industries for development of their applications.

Course Outcomes	
CO1	**Recall** the concepts and requirements of professional competence through industry internship.
CO2	**Interpret** the relationship between academic learning and professional practices during internship
CO3	**Implement** suitable technologies and tools for solving real-time problems
CO4	**Analyze** professional responsibilities and assess the application of ethical practices in day-to-day life situations.
CO5	**Evaluate and justify** strategies for building professional and social networks, fostering industry relationships, and leveraging them for career opportunities and future employment exposure.

Guidelines:

Internships are skill development, making students aware about the industrial environment, professional ethics, and career development opportunities. Students with well-identified internship goals make better utilization of practical experience in a field/broad area chosen. The well-skilled and properly groomed interns are always in demand for industries/organizations. Industrial internships are like learning in the supervised mode and shaping one's career with pre identified goals. It's an important aspect as employers are looking for employees who are skilled and aware of the industry environment, practices, procedures, and culture. The intern will focus on particular task or part of the project concisely as it is structured, short-term, and supervised. a The engineering undergraduate can be exposed to the procedures and practices followed in the industry through the traditional teaching-learning process but it is always restricted by the simulation horizons so it is being placed on the actual background to gear up the skills. An opportunity, engineering internships, will help interns to gear up and affirm conceptual learning in academics.

Duration

Internship is to be completed after semester 3 and before commencement of semester 4 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 4.

Internship Work Identification

The student may choose to undergo an Internship in Industry/Government Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. The student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO/Government organization/Micro/Small/Medium enterprises to make themselves ready for the industry [1].

Students must register at Internshala[2]. Students must get Internship proposals sanctioned by the college authorities well in advance. The internship work identification process should be initiated in the semester-5 in coordination with the training and placement cell/ industry-institute cell/ internship cell. This will help students to start their internship work on time. Internship is to be completed aftersemester-5 and before commencement of semester-6 of at least 4 to 6 weeks and it is to be assessed and evaluated in semester-6.

Students can take internship work in the form of the following but not limited to:

- Working for a consultancy/ research project
- Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation
- Council/ startups cells of institute

- Learning at the Departmental Lab/Tinkering Lab/ Institutional workshop,
- Development of new product/ Business Plan/ registration of start-up
- Industry / Government Organization Internship
- Internship through Internshala
- In-house product development, intercollegiate, inter-department research internship under research lab/group, micro/small/medium enterprise/online internship
- Research internship under professors, IISC, IIT's, Research organizations
- NGOs or Social Internships, rural internships Participate in open-source development.

Internship Diary/Internship Workbook

Students must maintain an Internship Diary/ Internship Workbook. The main purpose of maintaining a diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered, and suggestions given if any. The training diary/workbook should be signed every day by the supervisor. Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry supervisor to the Institute immediately after the completion of the training.

Internship Work Evaluation

Every student needs to prepare and maintain the documents with valid evidence of the activities done by him/her in the form of an internship diary or an internship workbook. The evaluation of these activities will be carried out by the Programme Head/Internship In-charge/Project Head/ Faculty mentor or Industry supervisor based on a satisfactory compilation of internship activities /sub activities, effective practical work, domain knowledge, well understanding of concepts, the level of achievement expected, the evidence needed to assign the points and the duration for certain activities. Assessment and evaluation are to be done in consultation with the internship supervisor (Internal and External supervisors from the place of internship) Recommended evaluation parameters: Post Internship, Internal Evaluation Term work (Internship Diary/Workbook and Internship Report) -50 Marks and Oral/Seminar Presentation 50 Marks Evaluation through seminar presentation at the Institute The student will give a seminar based on his internship report/workbook before the panel of experts constituted by the concerned department as per the norms of the institute.

The evaluation will be based on the following criteria:

- Domain Knowledge and Skil
- Presentation/communication skill
- Teamwork
- Innovation/Creativity
- Planning and Organizational Skill
- Adaptability
- Analytical Skill
- Attitude and Behaviour at work
- Societal understanding
- Ethics
- Regularity and Punctuality
- Attendance Record
- Dairy/Workbook

After completion of the Internship, the student should prepare a comprehensive report that includes what he/she has observed, monitored and learnt during the training period.

The internship Diary/workbook may be evaluated on the basis of following parameters:

- Proper and timely documented entries
- Time to time maintaining the internship diary
- Adequacy & quality of information recorded
- Relevant information gathered and analyzed
- Thought process and recording tools and techniques used
- Structuring the information

Internship Report

The report shall be prepared and presented covering the following recommended fields but limited to,

- Title/Cover Page
- Internship completion certificate
- Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details
- Index/Table of Contents
- Introduction

- Title/Problem statement/objectives
- Motivation/Scope and rationale of the study Methodological details (tools and techniques used)
- Results / Analysis /Inferences
- Conclusion and future scope
- Suggestions / Recommendations for improvement to industry (if any)
- Attendance Record
- Acknowledgement
- List of references (Library books, magazines, web references and other sources)

Reference Books	
1	https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf
2	https://internship.aicte-india.org/

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	1	-	-	-	1	1
CO2	2	2	-	-	-	1	-	-	-	2	1
CO3	2	2	3	1	3	-	-	-	1	-	1
CO4	-	2	-	2	-	2	1	3	1	1	2
CO5	-	1	-	-	-	2	-	2	3	3	2

Second Year Artificial Intelligence and Machine Learning (2025 Course) Sustainable Development			
Course Code	AMVEC214W	**Credit**	02
Contact Hours	**TH:** 02Hr./Weeks(L)	**Type of Course**	Theory
Examination Scheme	**TW:** 25 Marks	**Total Marks**	25*

TOP

Pre-requisites: Universal Human Values

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Term Work Evaluation (TW)	Internal	25*

Course Objectives	
1	**Identify** principles of sustainable development and environmental impacts of computing systems.
2	**Analyze** lifecycle sustainability and circular economy in computing infrastructure.
3	**Apply** green software engineering and sustainable AI techniques.
4	**Evaluate** sustainability strategies, carbon metrics, and ESG frameworks in IT systems.

Course Outcomes	
CO1	**Identify** sustainability concepts and environmental impacts of AI and computing systems.
CO2	**Analyze** lifecycle impacts and circular economy practices in IT systems.
CO3	**Apply** energy-efficient software and sustainable AI design techniques.
CO4	**Evaluate** sustainable infrastructure, carbon metrics, and reporting frameworks.

Topics covered:

UNIT-I: Foundations of Sustainable Development and Green Computing (6 Hrs.)

Sustainable development concepts, SDGs, Role of digital technologies (AI, IoT, Cloud, Data Analytics), Green IT concepts and evolution, Environmental impact of computing systems, Digital carbon footprint, AI/ML energy consumption & Sustainable AI principles, Stakeholders: government, industry, academia.

Case Study: AI Model Carbon Footprint Analysis

UNIT-II: Lifecycle Sustainability of Computing Systems (6 Hrs.)
Lifecycle of computing systems (manufacturing usage disposal), Energy consumption (CPU, GPU, IoT, edge devices), Embodied energy in hardware, E-waste management, Circular economy (Reduce, Reuse, Recycle), Sustainable supply chains, Life Cycle Assessment (LCA) methodology, ISO 14040 & ISO 14044. **Case Study:** Circular Economy and Lifecycle Analysis of a Computing Device.
UNIT-III:Green Software Engineering and Sustainable Artificial Intelligence (6 Hrs.)
Energy consumption of software systems, Green software principles (efficient algorithms, optimized coding),Sustainable architectures, Green AI (model compression, pruning, efficient training), Carbon aware computing & scheduling, Energy-aware data science workflows, Generative AI environmental impact , AI for sustainability (analytics, decision support tools), **Case Study:** Energy-Efficient Machine Learning Algorithms and Sustainable AI Model Design.
UNIT-IV: Sustainable Data Centers, Cloud Infrastructure and Carbon Management (6 Hrs.)
Sustainable Infrastructure: Green data center design, Cooling technologies & power management, Renewable energy integration, Sustainable cloud computing (virtualization, workload optimization), AI infrastructure optimization (GPU clusters, training pipelines) **Sustainability Metrics & Carbon Accounting:** Carbon footprint, CO2e, GHG- Scope 1, Scope 2, Scope 3 emissions, PUE, CUE, WUE, Energy intensity. **Governance & Reporting:** ESG frameworks, BRSR reporting, Carbon credits & carbon markets, MRV (Measurement, Reporting, Verification) Learning Resources **Future Trends:** Carbon-neutral data centers, Climate-aware computing, AI-enabled sustainability monitoring **Case Study:** Green Cloud Data Center Architecture and Carbon Accounting Practices.

Text Books	
1	S. Murugesan and G. R. Gangadharan, Harnessing Green IT: Principles and Practices. Hoboken, NJ, USA: Wiley, 2012.
2	L. M. Hilty and B. Aebischer, ICT Innovations for Sustainability. Cham, Switzerland: Springer, 2015.
Reference Books	
1	B. Tomlinson, Greening through IT. Cambridge, MA, USA: MIT Press.

2	World Resources Institute and World Business Council for Sustainable Development, GHG Protocol: Corporate Accounting and Reporting Standard. Washington, DC, USA: WRI, 2004.
3	D. J. C. MacKay, Sustainable Energy—Without the Hot Air. Cambridge, UK: UIT Cambridge, 2009.
4	M. Berners-Lee, How Bad Are Bananas? The Carbon Footprint of Everything. London, UK: Profile Books, 2010.
5	E. Masanet et al., "Energy Efficient Computing Systems," Annual Review of Environment and Resources, vol. 45, pp. 457–484, 2020.
6	T. Wiedmann and M. Lenzen, Environmental and Sustainability Accounting. Cham, Switzerland: Springer, 2018.A. Bahga and V. Madisetti, Cloud Computing: A Hands-On Approach. Vijay Madisetti and Arshdeep Bahga, 2014.
Web Links:	
1	Green Software Foundation: https://greensoftware.foundation
2	Climate Change AI: https://www.climatechange.ai
3	Google Sustainability: https://sustainability.google
4	AWS Sustainability: https://sustainability.aboutamazon.com

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	2	-	-	-	-	2
CO2	2	2	2	2	-	2	-	-	-	-	2
CO3	2	3	2	2	-	2	-	-	-	-	2
CO4	2	2	1	2	-	3	-	-	-	-	2
CO5	2	2	1	-	-	3	-	-	-	-	2

Second Year Artificial Intelligence and Machine Learning (2025 Course) Reasoning and Aptitude Development			
Course Code	AMAEC215W	**Credit**	02
Contact Hours	**TH:** 01Hrs./Weeks(L) **TUT:** 01Hrs./Weeks(L)	**Type of Course**	Theory
Examination Scheme	**TW:** 25 Marks	**Total Marks**	25

TOP

Pre-requisites: Basic Mathematical Skills, Professional Communication Skills

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Term Work Evaluation	Internal	25$

Course Objectives	
1	To enhance students' quantitative, logical reasoning, and verbal communication skills essential for academic and professional success.
2	To equip learners with the skills to accurately analyze and interpret data for informed decision-making.
3	To develop and strengthen logical thinking abilities among learners for effective problem-solving and reasoning.
4	To enable students to effectively comprehend and interpret English texts.
5	To prepare students for aptitude tests, placements, and higher studies.

Course Outcomes	
CO1	**Define and recall** fundamental quantitative concepts such as number system, ratio, percentage, and averages.
CO2	**Explain and interpret** arithmetic concepts including profit and loss, interest, time and work, and geometry in the context of solving real-life problems.
CO3	**Apply** logical reasoning skills to solve problems involving number series and pattern recognition.
CO4	**Analyze** complex problems and data using appropriate reasoning techniques to interpret patterns and relationships for effective problem-solving.
CO5	**Evaluate** grammar, vocabulary, and reading comprehension to assess and improve communication effectiveness.

Topics covered:		
UNIT-I:	**Fundamental Quantitative Abilities**	**(2 Hrs.)**
Concepts and Problems on Number System, HCF and LCM, Average, Ratio and Proportion, Percentage, Year month days counting, SI units and measurements		
UNIT-II:	**Arithmetic Quantitative Abilities**	**(2 Hrs.)**
Concepts and Problems on Ages, Profit and loss, Simple and Compound interest, Time value of money, Time and distance, Time and Work, Geometry and Coordinate Geometry, logarithms.		
UNIT-III:	**Logical Reasoning Ability**	**(2 Hrs.)**
Number Series, Pattern recognition, Alpha Numerical, Letter & Symbol Series , Numerical and Alphabet Puzzles, Seating Arrangement		
UNIT-IV:	**Thinking and Reasoning**	**(3 Hrs.)**
Objective Reasoning, Graph and Plots, Data sufficiency, Blood Relation, Coding deductive logic, Logical word sequence		
UNIT-V:	**Verbal Ability**	**(3 Hrs.)**
Synonyms, Antonyms, Contextual Vocabulary, Error Identification, Sentence Correction, Sentence Improvement, Subject-Verb agreement, Tenses and Articles, Reading Comprehension, Preposition & Conjunction.		

Text Books	
1	Quantitative abilities by Arun Sharma, Motilal Uk Books Of India, 2012
2	Quantitative Aptitude for Competitive Examinations by R S Agrawal.
3	Verbal and Non-Verbal reasoning by R S Agrawal

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-
CO3	-	3	-	2	-	-	-	-	-	-	-
CO4	-	3	2	3	2	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	2

Second Year Artificial Intelligence and Machine Learning (2025 Course) Technology Commercialization and Start-up Development			
Course Code	AMEMC216O	**Credit**	02
Contact Hours	**TH:** 01 Hrs./Weeks(L) **TUT:** 01 Hrs./Weeks(L)	**Type of Course**	Lecture
Examination Scheme	**OR:** 25 Marks	**Total Marks**	25

TOP

Pre-requisites: Entrepreneurship and Start-up Ecosystem

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Oral Evaluation (OR)	External	25*

Course Objectives	
1	To importance of technology commercialization and startup.
2	To intellectual property rights for protecting invention with product ownership.
3	To requisite knowledge of Registration process of for start-up
4	To setup of cost & funding for start-up.
5	To Go-to-Market (GTM) strategy for business venture.

Course Outcomes	
CO1	**List** the concepts of technology commercialization for starting a new venture
CO2	**Explain** the process of protecting an invention through Intellectual Property Rights (IPR) and describe the steps involved in registering an invention.
CO3	**Apply** the registration process by utilizing relevant market knowledge, skills, and appropriate professional attitude in a given scenario.
CO4	**Analyze** various available funding resources and prepare a structured costing sheet for effective financial planning.
CO5	**Evaluate and justify** an appropriate Go-to-Market strategy for a business venture.

Topics covered:

UNIT-I: Introduction to Technology commercialization & Startup ecosystem (2 Hrs.)

Introduction, Need and importance of commercialization, role of start-up in technology and comer canalization, challenges in technology commercialization, support systems for start-ups, future trends in technology.

Case Studies : Electric car, Pharma company, Joint venture, Agriculture

UNIT-II:	**IPR & Legal compliance**	**(2 Hrs.)**
Invention and innovation: need, benefits, intellectual property rights protection, patent drafting, procedure of IPR filing, legal policies, IT act, GST and income tax, companies act, labor law, environmental protection act. **Case Study :** Google search algorithm, Pepsi ingredient		
UNIT-III:	**Registration process & Market research Graph**	**(2 Hrs.)**
Registration process: Steps to register start-up with start-up India, benefits of start-up registration, requisites documents & information, start-up eligibility criteria. Market research: Development of marketing plan, pricing concepts and pricing strategy, consumer behaviour, market intelligence, marketing communication and promotional strategies. **Case study:** Proprietary firm- Patnajali Ayurveda, Private Limited Company-TCS, Partnership-Khaitan & Co.		
UNIT-IV:	**Costing & Funding strategy**	**(3 Hrs.)**
One time cost: Need, financial components, business formation and registration, professional services , advertising, infrastructure, technology, recurring cost: rent, salaries, insurance, tax, loan, maintenance, travel and training, types of startup funding, stages of startups and source of funding, steps to startup fund raising, types of investors, investors look for in startups , investors mindset to invest in startups , startup India funding support, startup India investor connect, credit guarantee scheme for startups **Case study :** Rapido, Blinkit, OYO, Unacademy		
UNIT-V:	**Growth and scaling-Go to market strategy**	**(3 Hrs.)**
Growth and scaling: significance, difference, scaling key metrics, identifying target segments and personas, analyzing customer needs and competitive landscape, value propositions, unique selling points (USPs), choosing distribution channels, pricing strategies, marketing, positioning plans, ans off matrix, scaling frameworks, organic vs. inorganic growth strategies, leveraging technology, partnerships for scalability, key Performance indicators for GTM, Feedback loops and agile adaptation. **Case study:** Zomato's Expansion Strategy in Tier 2 and 3 Cities , Analyze how Zomato tailored its GTMstrategy to penetrate smaller markets, adjusted pricing, and adapted to local preferences.		

Practical Assignments (any *4)	
1	Choose the topic for technology commercialization for the prospect of start-up.
2	Design a market research plan for identified area.
3	Create a funding proposal based on overall costing of start-up
4	Creation of patent draft copy on invention.
5	Design a Go-to-Market strategy for a start-up launching.
Text Books	
1	Fundamentals of Information Technology Author: Shambhavi Roy, Clinton Daniel, and Manish Agrawal.
2	8 Steps To Innovation: Going FromJ ugaad To Excellence, Collins India, 2013. ISBN: 9789350293584
3	National Student and Faculty Startup Policy 2019. Government of India.
4	Pavan Soni, "Design Your Thinking- The Mindsets, Toolsets and Skill Sets For Creative Problem Solving", Penguin Random House India Pvt. Ltd. 2020, ISBN: 9780670094097.
5	Intellectual Property, A primer for academia, Prof. Rupinder Tiwari, Mamta Bharadwaj, Publication Bureau Panjab University Chandigarh. https://dst.gov.in/sites/default/files/E-BOOK%20IPR.pdf.
6	Law Relating to Intellectual Property Rights by V.K. Ahuja
7	Sangeeta Sharma, Raghu Raman, Entrepreneurship Development–Prentice Hall India, 2021,ISBN: 9390544254
Reference Books	
1	Information Technology Author: V.Rajaraman
2	Innovation and Entrepreneurship, Peter F. Drucker, Harper Business; Reprint, 2006, ISBN: 9780060851132.
3	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown Currency; Illustrated, 2011. ISBN: 9780307887894.
4	Innovator's DNA, Updated, with a New Preface: Mastering the Five Skills of Disruptive Innova tors, Harvard Business Review Press; Revised, 2019. ISBN: 1633697207
5	Wiley Innovation Black Book Enterprise 4.0, 2020.
6	Problem-Solving", Penguin Random House India Pvt. Ltd. 2020, ISBN: 9780670094097
7	Fundamentals of Intellectual Property Rights by Anil Kumar H S and B. Ramakrishna.
8	Philip Kotler, Kevin Lane Keller, Marketing Management– Pearson Education, 16e, 2022,ISBN 9356062668

E- Books	
1	Technology Laws Decoded Author N.S.Nappinai
2	IPR-eng-ebook by bharatidasan University
3	Fundamentals Of Intellectual Property Rights And Patents by Rashika Kapadiya.
4	Peter Thiel, Blake Masters ,Zero to One: Notes on Startups, or How to Build the Future Crown Publishing Group,2014, 978-0-8041-3930-4
Links to online SWAYAM/NPTEL Courses	
1	Innovation Business Model and Entrepreneurshipby prof.Rajat Agrawal,Prof.Vinay Sharma I2IT Rookee.
2	Innovation and Start-up Policy By Prof. Rahul K. Mishra IILM Institute for Higher Education
3	Innovation, Business Models and Entrepreneurship, By Prof . Rajat Agrawal and Prof. Vinay Sharma | IIT Roorkee
4	Innovation Driven Entrepreneurship https://onlinecourses.swayam2.ac.in/ntr24_ed05/preview
5	https://onlinecourses.nptel.ac.in/noc19_mg55/preview

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	3	2	2	1	1	3	2	2	2
CO2	2	2	2	2	1	1	3	2	2	2	1
CO3	2	2	2	1	2	1	3	2	2	2	1
CO4	2	3	3	2	2	1	1	3	2	3	1
CO5	2	2	3	2	3	2	3	2	3	3	2

Second Year Artificial Intelligence and Data Science (2025 Course) Co -Curricular Course - II			
Course Code	AMCCC217W	**Credit**	01
Contact Hours	**PR:** 02 Hrs./Weeks(L)	**Type of Course**	Practical
Examination Scheme	**TW:** 25 Marks	**Total Marks**	25

TOP

Pre-requisites: This course is open to all second-year engineering students interested in enhancing their personal and professional development through co-curricular activities.

Course assessment methods/tools:

Sr. No.	Course assessment methods/ tools	External/ Internal	Marks
1.	Term Work Evaluation (TW)	External	25*

Term work: Assessment is based on the student's participation in various Co-Curricular Activities and Guidelines given in "Rules for Assigning Activity Points: Activity – Event Grade Point Scheme" Policy Document.

Course Objectives	
1	To encourage students to showcase their intellectual and independent thinking skills.
2	To imbibe a sense of confidence and managerial capabilities among students.
3	To promote the ability to work in team, organize and analyse available resources.
4	To build responsiveness among students about the social and cultural responsibilities.

Course Outcomes	
CO1	**Define and list** relevant information required for decision-making within the given activity.
CO2	**Explain** principles of management and organizational skills for planning, coordinating, and executing co-curricular activities.
CO3	**Apply** collaborative skills to work effectively with peers in order to achieve common goals and objectives in co-curricular activities.
CO4	**Analyze** their roles and responsibilities as members of a diverse community by examining perspectives that promote empathy, inclusivity, and social responsibility.

Course Guidelines:

1. Students are entitled to gain academic knowledge in this fast-paced environment, but it is also necessary for them to develop their personalities in both internal and external situations.
2. Co-curricular activities help students grow and develop their personalities. These activities contribute to a student's total personality development.
3. Not every student is intellectually inclined. Similarly, not all pupils are interested in co-curricular activities. Therefore, there is a need to provide a solid balance of co-curricular and extra-curricular activities in order to achieve the course learning objectives.
4. It primarily refers to intellectual, physical, emotional, and social growth that can be attained by a careful mix of academic, co-curricular, and extra-curricular activities.
5. So, keeping the course learning objectives the "Rules for Assigning Activity Points: Activity – Event Grade Point Scheme" Policy Document is proposed.
6. Student participation is assessed and reflected in the final activity performance report in order to get most students involved in extra-curricular activities (Group A) and co-curricular activities (Group B) as shown in Table 1 in the Policy Document.
7. All undergraduate students must choose at least ONE activity/event from each group i.e. (Group A and B).
8. Students shall choose one activity/ event from Group A and One from Group B that take place on- campus or off-campus.
9. Freedom shall be given to the students to take part in more than one activity under the group.
10. Students are expected to actively participate in activities, participate in contests, and earn grade points.
11. One student in each group must earn up to 50 grades in one semester so that they can achieve up to 100 grades in one year.
12. Grades for each semester are awarded based on the points achieved by the student, as shown in Table 2 in the Policy Document.

Course Structure: ***(Refer Rules for Assigning Activity Points: Activity – Event Grade Point Scheme)***

Co-Curriculum Course II (CECCC417W) **Professional Self Initiatives and Social Activity**
• Technical Events/Quiz/Paper Contest/Project Contest / Model Making etc.
• MOOC/ NPTEL/ SWAYAM/ Coursera etc. related to Professional Development and Social Activity
• Competitions/ Events Conducted by Professional Societies (ISTE, IEI, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.)
• Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at IITs/ NITs/ Reputed Institutes/ Universities
• Attending Full time Conference/ Seminars/ Exhibitions/ Workshop/ STTP Conducted at DYPCOEI
• Paper Presentation in National/ International Conference of High Repute
• Poster Presentation in National/ International Conference of High Repute
• Paper Publication in National/ International Journal of High Repute
• Industrial Training/ Internship (at least for 04 Weeks)
• Participation in Institute Level Student Clubs
• Elected Student Representative of Student Council (University Representative, General Secretary, Cultural, Sports, NSS Secretary, Ladies Representative, Academic Toppers, Invitee Members)
• Office Bearer of Professional Society Chapter (ISTE, IEI, CSI, IEEE, IETE, SAE, ISRO-IIRS, SWE, ISHRAE, ASM, ISNT etc.)
• Office Bearer of Institute Level Student Club
• Office Bearer of Departmental Student Association
• Office Bearer of ECell, Digital Content Lab etc.
• Student Ambassador for Mayura AICTE IDEA Lab/ NIDHI iTBI etc.
• Editorial Board Member of Annual Magazine
• Editorial Board Member of E-Newsletter
• Member of Governance Committee/ Statutory Committee

Participation Levels:
1. Level: I College Level Events 2. Level: II District/ Central/ Zonal Level Events 3. Level: III State Level Events 4. Level: IV National Level Events 5. Level: V International Level Events

Approval Documents:
1. Certificates 2. Letter from Authorities 3. Appreciation recognition letter 4. Documentary evidence 5. Legal Proof

Grading Scheme:		
Grade Range	**Grade**	**Academic Performance**
90-100	O	Outstanding
71 to 90	A+	Excellent
68-71	A	Very Good
65-68	B+	Good
60-65	B	Average
55-60	C	Below Average
50-55	D	Marginal
< 50	F1	Fail due to Poor Performance

CO-PO Mapping Table:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	3	-	-	-	-	2	3	-
CO2	-	3	3	-	-	-	-	-	2	2	-
CO3	-	-	2	-	-	-	-	-	3	3	-
CO4	-	-	-	-	-	-	2	3	2	2	-