



Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus

B.Tech. Computer Science & Engineering (Artificial Intelligence and Machine Learning)

With Effect from Academic Year 2026-27

Prepared by: - Board of Studies in CSE(AIML)

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Chairman – BOS



Chairman – Academic Board

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Vision of the Institution

"To be a globally acclaimed Institute in Technical Education and Research for holistic Socio-economic development".

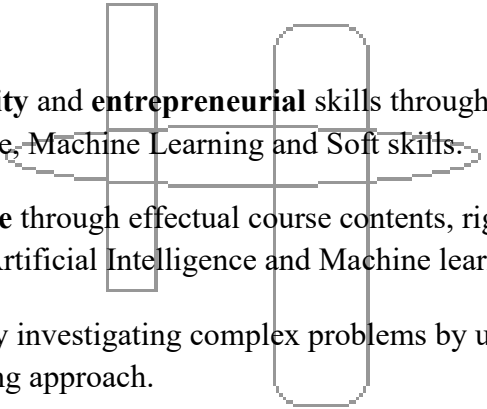
Mission of the Institution

- To ensure that 100% students are employable and employed in Industry, Higher Studies, become Entrepreneurs, Civil / Defense Services / Govt. Jobs and other areas like Sports and Theatre.
- To strengthen Academic Practices in terms of Curriculum, Pedagogy, Assessment and Faculty Competence.
- Promote Research Culture among Students and Faculty through Projects and Consultancy.
- To make students Socially Responsible Citizens.

Vision of the Department

“To be an academic excellence center for developing globally competent engineers and researchers for holistic Socio-economic development”.

Mission of the Department

- 
- To ensure students' **employability** and **entrepreneurial** skills through knowledge of principles of computing, Artificial Intelligence, Machine Learning and Soft skills.
 - To enhance **academic excellence** through effectual course contents, rigorous hands-on and active participation of industry in the Artificial Intelligence and Machine learning domain.
 - To cultivate **research culture** by investigating complex problems by using computing, Artificial Intelligence and Machine learning approach.
 - To develop a sense of responsibility and ethics among students to make them **responsible citizens**.

Board of Studies Computer Department AY 2026-27

Sr. No	Name	Affiliation in Committee	Designation
1	Prof. (Dr.) Premanand Ghadekar	Head of Department (Chairman)	Head & Professor, CSE(AI&ML)
2	Prof. (Dr.) Gitanjali Shinde	Entire Faculty of Each Specialization Representative	Associate Professor
3	Dr. Sanjeevkumar Angadi	Entire Faculty of Each Specialization Representative	Associate Professor
4	Dr. Jyoti Kanjalkar	Entire Faculty of Each Specialization Representative	Assistant Professor
5	Dr. Varsha Dange	Entire Faculty of Each Specialization Representative	Assistant Professor
6	Ms. Kalyani Ghuge	Entire Faculty of Each Specialization Representative	Assistant Professor
7	Prof. (Dr.) Ramakrishna Upadrasta	Subject Expert from Outside University nominated by Academic Council	Associate Professor, Department of CSE,IIT Hyderabad
8	Prof. (Dr.) Y. V. Haribhakta	Subject Expert from Outside University nominated by Academic Council	Associate Professor, Department of CSE,COEP Technological University
9	Prof.(Dr.) Nilesh Uke	VC Nominee	Professor, Principal, Indira College of Engineering and Management, Pune.
10	Mr.Prashant Kamble	Industry Representative	Executive Director - AI and Data Team MSCI Inc. ,Ex-Microsoft MBA, AI/ML/GenAI Mentor
11	Mr.Girish Bharambe	Meritorious Alumnus Nominated by Director	NvidiaSenior Manager GPU Compilers at NVIDIA

Program Educational Objectives (PEOs)

PEO	PEO Focus	PEO Statements
PEO1	Core competence	Demonstrate core competence in principles of computing and AIML based Technologies.
PEO2	Breadth	Apply engineering knowledge to solve industry problems with creative and innovative design , development tools and AIML techniques.
PEO3	Professionalism	Develop ethical and professional practices effectively to gain desired soft skills in social and global context.
PEO4	Learning Environment	Aim for continuing education and entrepreneurship in emerging areas of computing and AIML.

List of Programme Outcomes [PO]

PO	PO Statements
PO1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems..
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes [PSO]

Programme Specific Outcome Statements

- PSO1:** Demonstrate competence in programming with sound knowledge of principles of computing.
- PSO2:** Formulate coherent design, execute proficient implementation, and conduct testing to solve real world problems using software paradigms and AIML methodologies.
- PSO3:** Adapt and exhibit skills in emerging domains of computer science, engineering and technology.

Nomenclature for Teaching and Examination Assessment Scheme AY 2026-27

Sr No.	Category	Head of Teaching/ Assessment	Abbreviation used
1	Teaching	Theory	Th
2	Teaching	Laboratory	Lab
3	Teaching	Tutorial	Tut
4	Teaching	Open Elective	OE
5	Teaching	Multi-Disciplinary	MD
6	Teaching	Computer Science	CS
7	Teaching	Machine Learning	ML
8	Assessment	Laboratory Continuous Assessment	CA
9	Assessment	Mid Semester Assessment	MSA
10	Assessment	End Semester Assessment	ESE
11	Assessment	Home Assignment	HA
12	Assessment	Course Project	CP
13	Assessment	Group Discussion	GD
14	Assessment	PowerPoint Presentation	PPT
15	Assessment	Class Test –1	CT1
16	Assessment	Class Test –2	CT2
17	Assessment	Mid Semester Examination	MSE
18	Assessment	End Semester Examination	ESE
19	Assessment	Written Examination	WRT
20	Assessment	Multiple Choice Questions	MCQ
21	Assessment	Laboratory	LAB

Title: Course Structure

FF No. 653

Branch: Computer Science & Engineering (AIML)

Year: B.TECH

Academic Year.: 2026-27 Semester Module: VII

Pattern:26-27

Sub No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme											Credits
			Th	Lab	Tut	CVV	CP	LAB CA	GD/ PPT/ HA	MSE (W/O)	T1(W/O)	T2 (W/O)	ESE(R)	ESE (W/O)	PRACT /CVV	Total	
S1:OE1	LLP	LinkedIn Learning*	0										100			100	1
S2:OE2	ML4001	Generative AI	2	-	-	-	-	-	10	30		-		30(O)	30	100	2
S3:OE3	ML4003 Swayam	Deep Learning for Computer Vision	2	-	-	-	-	-	10	30		-		30(O)	30	100	2
S4:Major Project	ML4009	Major Project	0							30		-	70	-		100	10
S5	ML4007	Design Thinking-7														100	1
		Total	4	-	-		-	-	20	90	-		170	60	60	400	16

LinkedIn Learning Courses*

Subject Code	Bucket-I Subject Name	MD4281	Technical Program Management
MD4274	Large Language Models Skill Development	Subject Code	Bucket-II Subject Name
MD4275	Mastering Microsoft Power BI	MD4282	Natural Language Processing Skill Development
MD4276	Generative AI Skills for Developers	MD4283	Prompt Engineering Skills
MD4277	Career in Data Analysis	MD4284	Essentials in Generative AI
MD4278	Concepts of Data Visualization and Storytelling	MD4285	Python in Finance
MD4279	AWS Certified Solutions Architect	MD4286	Understanding Quantum Computing
MD4280	IT Security Specialist	MD4287	Foundational Maths for Machine Learning

Title: Course Structure

FF No. 653

Branch: Computer Science & Engineering (AIML)

Year: B.TECH Academic Year.: 2026-27 Semester Module: VII Pattern:26-27

Sub No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme										Total	Credits
			Th	Lab	Tut	CVV	CP	LAB CA	GD/ PPT/ HA	MSE (W/O)	T1(W/O)	T2 (W/O)	ESE(R)	ESE (W/O)	PRACT /CVV		
S1	ML4011	Industry Internship	-	32	-	-	-		-	30	-	-		70		100	15
	ML4012																
S1	ML4013	Research Internship	-	32	-	-	-		-	30	-	-		70		100	15
S2	ML4008	Design Thinking-7	-	-	-	-	-		-	-	-	-		100		100	1
		Total		32	-	-	-		-	30	-			170		300	16

Title: Course Structure

FF No. 653

Branch: Computer Science & Engineering (AIML)

Year: B.TECH Academic Year.: 2026-27 Semester Module: VIII Pattern:26-27

Sub No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme										Total	Credits
			Th	Lab	Tut	CVV	CP	LAB CA	GD/PPT/HA	MSE (W/O)	T1(W/O)	T2 (W/O)	ESE(R)	ESE (W/O)	PRACT /CVV		
OE1	-	LinkedIn Learning*	0										100				2
	ML4016	Agentic AI	2		-		-	30	10	30	-			30		100	2
OE3	ML4017*(S wayam)	Parallel Computer Architecture	2	-	-		-	30	10	30	-			30		100	2
Major Project	ML4018	Major Project	0	20	-		-	30	-	90	-		70	-		100	10
		Total	4	20	-		-	90	20	30	-		70	60		300	16

Title: Course Structure

Branch: Computer Science & Engineering (AIML)

FF No. 653

Year: B.TECH Academic Year.: 2026-27 Semester Module: VIII Pattern:26-27

Course Work- Internship)

Sub No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme										Total	Credits
			Th	Lab	Tut	CVV	CP	LAB CA	GD/ PPT/ HA	MSE (W/O)	T1(W/O)	T2 (W/O)	ESE(R)	ESE (W/O)	PRACT /CVV		
S1	ML4232	Industry Internship	-	32	-	-	-	-	-	30	-	-	-	70	-	100	16
S1	ML4234	International Internship	-	32	-	-	-	-	-	30	-	-	-	70	-	100	16
S1	ML4202	Research Internship	-	32	-	-	-	-	-	30	-	-	-	70	-	100	16
		Total	-	32	-	-	-	-	-	30	-	-	-	70	-	100	16

Title: Course Structure

FF No. 653

Branch: Computer Science & Engineering (AIML)

Year: B.TECH **Academic Year.:** 2026-27 **Semester Module: VIII Pattern:26-27**

Internship-Course Work

Sub No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme										Total	Credits
			Th	Lab	Tut	CVV	CP	LAB CA	GD/PPT/HA	MSE (W/O)	T1(W/O)	T2 (W/O)	ESE(R)	ESE (W/O)	PRACT /CVV		
S1	ML4232	Industry Internship	-	32	-	-	-	-	-	30	-	-	-	70		100	15
S1	ML4202	Research Internship	-	32	-	-	-	-	-	30	-	-	-	70		100	15
S2	----- -	Design Thinking-7	-	-	-	-	-	-	-	-	-	-	-	100		100	1
		Total	-	32	-	-	-	-	-	30	-	-	-	170		100	16

Title: Course Structure

Branch: Computer Science & Engineering (AIML)

FF No. 653

Year: B.TECH Academic Year.: 2026-27 Semester Module: VIII Pattern:26-27

Internship-Course Work

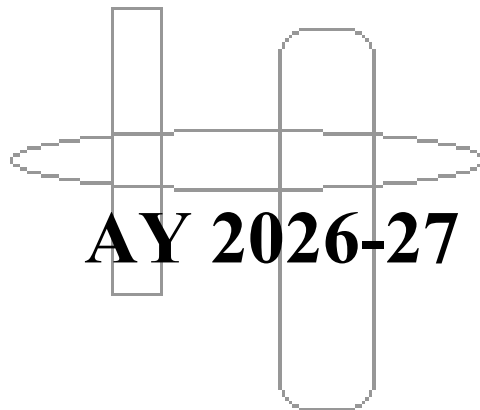
Sub No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme										Total	Credits
			Th	Lab	Tut	CVV	CP	LAB CA	GD/PPT/HA	MSE (W/O)	T1(W/O)	T2 (W/O)	ESE(R)	ESE (W/O)	PRACT /CVV		
OE1		LinkedIn Learning	0		-	-	-	-	-		-	-	-	100		100	2
OE2		Coursera	0	-	-	-	-	-	-		-	-	-	100		100	4
Major Project	ML4006	Major Project	0	20	-	-	-	-	-	30	-	-	-	70		100	10
		Total	3	20	-	-	-	-	-	30	-	-	-	270		300	16

LinkedIn Learning Courses*

Subject Code	Subject Name	Subject Code	Subject Name
MD4274	Large Language Models Skill Development	MD4282	Natural Language Processing Skill Development
MD4275	Mastering Microsoft Power BI	MD4283	Prompt Engineering Skills
MD4276	Generative AI Skills for Developers	MD4284	Essentials in Generative AI
MD4277	Career in Data Analysis	MD4285	Python in Finance
MD4278	Concepts of Data Visualization and Storytelling	MD4286	Understanding Quantum Computing
MD4279	AWS Certified Solutions Architect	MD4287	Foundational Maths for Machine Learning
MD4280	IT Security Specialist		
MD4281	Technical Program Management		

Syllabus Of
Computer Science and Engineering (Artificial Intelligence
& Machine Learning)
(AY 2026-27)

B.TECH. Computer Science and Engineering (Artificial Intelligence & Machine Learning)



Module VII Course Content

FF No.: 654-A**ML4001: Generative AI**

Teaching Scheme	Examination Scheme
Credits : 2	CVV: 30 Marks
Lectures : 2 Hrs/week	HA: 10 Marks
Practical : 0 Hrs/week	MSE: 30 Marks
Tutorial : 0 Hrs/week	ESE(O): 30 Marks

Prerequisites:	
•	AI, ML, DL.
Course Objectives:	
•	The course introduces the students with the basic concepts of Generative AI.
•	The objective is to understand the applications of Generative AI in various business areas and to leverage Generative AI technologies
•	to increase productivity and workflow in the evolving business landscape..
•	Developing practical skills in prompt engineering, model interaction, evaluation, and responsible use of AI technologies
Course Outcomes:	
	After completion of the course, student will be able to
1.	Understand the necessary steps for successful implementation of Generative AI in various business areas.
2.	Describe the working principles and architectures of major generative models, including Large Language Models (LLMs), Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and diffusion models.
3.	Design and apply effective prompt engineering techniques to obtain reliable and relevant outputs from generative AI systems.
4.	Develop and evaluate applications using Generative AI for text, image, code, and other content-generation tasks.
5.	Analyze the limitations, risks, biases, privacy concerns, security issues, and ethical implications associated with Generative AI.
6.	Apply Generative AI tools responsibly to solve real-world problems and demonstrate awareness of emerging trends and developments in the field.

Section1:	
Unit1: Introduction to Artificial Intelligence	(4 Hours)
Definition and history of AI, Different types of AI (narrow, general, super) AI vs. Machine Learning vs. Deep Learning, Supervised, unsupervised, and reinforcement learning, Applications of AI in various fields	

Unit 2: Foundations of Generative AI		(4 Hours)
Introduction to deep learning and neural networks, Key concepts: activation functions, backpropagation, gradient descent, Different types of neural networks (CNNs, RNNs, transformers), Generative vs. discriminative models		
Unit 3: Generative Adversarial Networks (GANs)		(4 Hours)
Core concepts of GANs: generator and discriminator, Training process and challenges, Applications of GANs: image generation, style transfer, data augmentation		
Section :2		
Unit 4: Variational Autoencoders (VAEs)		(4 Hours)
Introduction to VAEs and their architecture, Encoding and decoding process, Applications of VAEs: anomaly detection, dimensionality reduction, data generation		
Unit 5: Diffusion Models		(4 Hours)
Understanding the diffusion process, Forward and reverse diffusion, Applications of diffusion models: image generation, text generation, audio synthesis		
Unit 6: Applications of Generative AI		(4 Hours)
Image generation and manipulation, Natural language processing (text generation, translation, summarization), Music composition and audio generation, Drug discovery and materials science, Other emerging applications		
Unit No 7: Ethical Considerations and Future Directions		
Ethical implications of Generative AI: bias, misinformation, job displacement, Responsible AI development and deployment, Future trends and research directions in Generative AI		
Text Books: <i>(As per IEEE format)</i>		
1	Build a Large Language Model (From Scratch) by Sebastian Raschka	
2	Natural Language Processing with Transformers (by Lewis Tunstall, Leandro von Werra, & Thomas Wolf)	

Reference Books: <i>(As per IEEE format)</i>	
1.	Building LLM Powered Applications (by Valentina Alto)
2.	4. Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play (by David Foster)

CO-PO Mapping

CO	Program Outcomes (PO)												PSO		
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	2	1	1	2	2	3	3	2	2	2
CO2	3	2	2	2	2	1	1	1	1	1	2	3	3	2	2
CO3	2	3	3	2	3	1	1	1	1	2	2	3	3	3	2
CO4	3	3	3	3	3	2	1	1	2	2	2	3	3	3	3
CO5	2	3	2	3	2	2	2	3	2	2	1	3	2	2	3
CO6	2	3	3	3	3	3	2	3	3	3	3	3	3	3	3
Average	2.33	2.67	2.5	2.33	2.5	1.83	1.33	1.67	1.83	2	2.17	3	2.67	2.5	2.5

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FF No.: 654

ML4006 & ML4007: Major Project

Teaching Scheme Theory: ...26... Hours/Week

Course Prerequisites: Project Based Learning

Aim

This course addresses the issues associated with the successful management of a project. The course emphasizes project life cycle phases requirement engineering, system analysis and system design. A further aim is for students to heighten personal awareness of the importance of developing strategies for themselves and working with peers to create desired outcomes. Project Work can lead to:

- Transform existing Ideas into conceptual models.
- Transform conceptual models into determinable models.
- Use determinable models to obtain system specifications.
- Select optimum specifications and create physical models.
- Apply the results from physical models to create real target systems.

Project Group and Topic Selection and Synopsis:

The project work needs to be undertaken by a group of maximum FOUR and minimum of THREE students. The Project work will be jointly performed by the project team members. The student needs to identify a technological problem in the area of Computer Engineering or Information Technology of their choice and address the problem by formulating a solution for the identified problem. The Project Group will prepare a synopsis of the project work which will be approved by the concerned faculty member. The project should not be a reengineering or reverse engineering project. In some cases, reverse engineering projects will be permissible based on the research component involved in it. The project work aims at solving a real world technical problem. Hence ample literature survey is required to be done by the students. Application-oriented projects will not be acceptable. Low-level custom User Interface development and its allied mapping with a particular technology will not be accepted.

Overview of the Course:

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1. The Student Project Group is expected to make a survey of situation for identifying the requirements of selected Technological Problem. The Student Project Group will be monitored by Internal Guides and External Guides (if any).
2. The project requires the students to conceive, design, implement and operate a mechanism (the design problem). The mechanism may be entirely of the student's own design, or it may incorporate off-the-shelf parts. If the mechanism incorporates off-the-shelf parts, the students must perform appropriate analysis to show that the parts are suitable for their intended purpose in the mechanism.
3. The project must be based on a Fresh Idea or Implementation of a Theoretical Problem – meaning that there is not a known Solution to the design problem Or Create a Better Solution.
4. The project must have an experimental component. Students must conceive, design, implement and operate an appropriate experiment as part of the project. The experiment might be to collect data about some aspect of the design (i.e., to verify that the design will work as expected). Alternatively, the experiment could be to verify that the final mechanism performs as expected.
5. Upon receiving the approval, the Student Project Group will prepare a preliminary project report consisting, Feasibility Study Document, System Requirement Specification, System Analysis Document, Preliminary System Design Document. All the documents indicated will have a prescribed format.
6. Upon project completion, the Student Project Group will prepare a detailed Project Report consisting of Semester I Preliminary Project document along with Detailed System Design Document, Implementation and Testing Document with conclusion and future scope of the Project Work. All the documents indicated will have a prescribed format. The Project Report ideally should consist of following documents: (Exceptions may be there based on the nature of the project, especially if some of the following documents are not applicable to a particular project as determined by the project guide, coordinator and head of department).

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Sr.	Project Item
1	Project Cover Front Page
2	Project Completion Certificate [Institute]
3	Project Completion Letter [In case of Sponsored Projects]
4	Acknowledgments
5	Table of Contents
6	List of Figures
7	List of Tables
8	Project Synopsis [Problem Background, Existing System Details, Proposed Solution]
9	Feasibility Study Report
10	Project Plan
11	System Requirement Specification
12	System Analysis Document: UML Use Case Diagrams
13	System Analysis Document: UML Sequence Diagrams
14	System Analysis Document: UML State Diagrams
15	System Design Document with Module Specifications
16	System Implementation
17	System Testing and Experimental Findings
18	Conclusion
19	References

7. The Project Work will be assessed jointly by a panel of examiners consisting faculty and industry experts. The Project Groups will deliver the presentation and demonstration of the Project Work which will be assessed by the panel.
8. The Student Project Group needs to actively participate in the presentation. The panel of examiners will evaluate the candidate's performance based on presentation skills, questions based on the Project Work and overall development effort taken by the candidates.

Note:

The student needs to design and develop solution for the identified technological problem in the area of Computer Engineering or Information Technology of their choice. The Project Implementation needs to be completed using best possible use of available technologies as applicable to deal with the complexity of the project. The Project Group will prepare a detailed report of the project work which

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will be approved by the concerned faculty member. The Project Report need to be submitted both in Hard form and Soft form in CD. The Soft Copy of the Project Report must accompany other project deliverables as well.

Assessment: MSE and ESE

1. Mid Semester Assessment – 50 Marks to be converted to 30 Marks.
2. End Semester Assessment – 100 Marks to be converted to 70 Marks.

Mid-Semester Assessment

Sr. No.	Parameter	Marks
1	Problem Statement	10
2	Literature Review	10
3	Group formation and identification of individual responsibility	10
4	Objective of Project activity	10
5	Knowledge of domain, latest technology and modern tools used /to be used	10
TOTAL		50

End Semester Assessment

Sr. No.	Parameter	Marks
1	Realization of project as per problem statement	10
2	Design, Testing / Experimentation, Analysis / Validation	30
3	Documentation and Report Writing	20
4	Quality of Work	15
5	Performance in Question & Answers Session	15
6	Regular interaction with guide	10
TOTAL		100

Course Outcomes:

Upon completion of the course, graduates will be able to -

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CO1: Identify the real life problem from societal need point of view

CO2: Prepare the requirement engineering, feasibility analysis documents

CO3: Form the teams and share responsibilities according to individual skill strengths

CO4: Create design documents to build software solutions

CO5: Develop software solutions based on standard engineering specifications

CO6: Perform the verification and validation up to the mark

CO PO Map

	Program Outcomes (PO)											PSO		
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3		2					3					
CO2	2	3	3	2	2				3	3	2	3		3
CO3	2	-	-	-	-				3		2	3		
CO4	2	3	3	2	2	3	3.0	2.0	3	3	2	3	3	3
CO5	2	3	3	2	2				3	3	2	3	3	3
CO6	2	2	2	3	2				3	2	2	3	2	3
Average	2.0	2.8	2.75	2.83	2.0	3.0	3.0	2.0	3.0	2.75	2.0	3.0	1.75	3.0

CO attainment levels

CO1 -4 CO2 -2 CO3-4 CO4-5 CO5 -1 CO6-3