CO Attainment Computation

The CO Attainment Computation process begins with defining the Course Outcomes (COs). Once COs are defined, they are mapped to Program Outcomes (POs) using an appropriate correlation strength. After this mapping, the attainment level for the course is set, followed by setting specific targets for each CO.

During course delivery, assessments are conducted to measure both direct and indirect CO attainments. The direct CO attainment is derived from the In-Semester Assessment and Semester End Examination. Likewise, the indirect CO attainment is evaluated based on Course Outcomes feedback from students.

These two components are combined to determine the overall CO attainment, calculated with a weightage distribution of 80% to direct CO attainment and the remaining 20% to indirect CO attainment.

After computing the overall CO attainment, it is compared with the target. If the target is attained, a root cause analysis is performed to identify any existing gaps, followed by creating an action plan for an incremental target for further improvement.

If the target is not attained, a root cause analysis is conducted to identify the reasons for the shortfall, and an action plan for improvement is developed. The revised plan leads to setting a new or the same target for the next cycle, ensuring continuous improvement in the course outcomes.

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Course-wise PO Attainment Computation

The computation of PO Attainment is done for each course of a program. The process begins with the CO–PO Mapping, wherein the COs are linked to POs using appropriate correlation strengths. Once this mapping is done, the target for each PO is set based on expected levels of student performance.

Next, the overall PO attainment for each course is calculated, representing how well students have achieved the defined program outcomes. This attainment is then compared with the predetermined target.

If the target is achieved, a root cause analysis is carried out to identify any potential gaps or areas of marginal improvement, followed by the creation of an action plan for an incremental target to further enhance performance.

If the target is not achieved, a root cause analysis is conducted to identify the reasons behind the shortfall. Based on the findings, an action plan for closing the gaps is developed. This plan may include implementation of corrective actions at various levels, such as revising course content, improving the articulation matrix, or restructuring the program framework.

After implementing these actions, the process continues with the same or adjusted targets, ensuring a continuous improvement cycle for achieving higher levels of PO attainment across courses.

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Batch-wise PO Attainment Computation

In another approach, the computation of PO Attainment is done for a given batch of outgoing students. The process begins with establishing the CO–PO Mapping using appropriate correlation strengths to identify how COs contribute to each PO. Based on this mapping, targets are set for each PO to define expected levels of student achievement.

The overall PO attainment for a batch is determined through two components: Direct PO Attainment and Indirect PO Attainment, with respective weightages of 80% and 20%.

The Direct PO Attainment is calculated from the Overall CO Attainment for each course in every semester. These values are then used to compute Direct PO Attainment for each course per semester, followed by averaging the direct PO attainments of all courses across all semesters to obtain the final direct PO attainment value.

The Indirect PO Attainment is assessed using feedback collected through Graduate Surveys, Alumni Surveys, and Employer Surveys, which reflect the perceived effectiveness of the program outcomes after graduation.

Once both direct and indirect components are computed, they are combined to determine the Overall PO Attainment for the batch. This result is compared with the predefined target to evaluate performance.

If the target is achieved, a Root Cause Analysis is performed to identify any potential gaps and to develop an Action Plan for Incremental Target to further enhance performance.

If the target is not achieved, a Root Cause Analysis is again conducted to determine the reasons for the shortfall. Based on the findings, an Action Plan for closing the gaps is formulated and implemented at various levels. This might include refinement of course content, improvement of the articulation matrix, or modification of the program structure. This process ensures continuous improvement and progressive enhancement of PO attainment across successive student batches.

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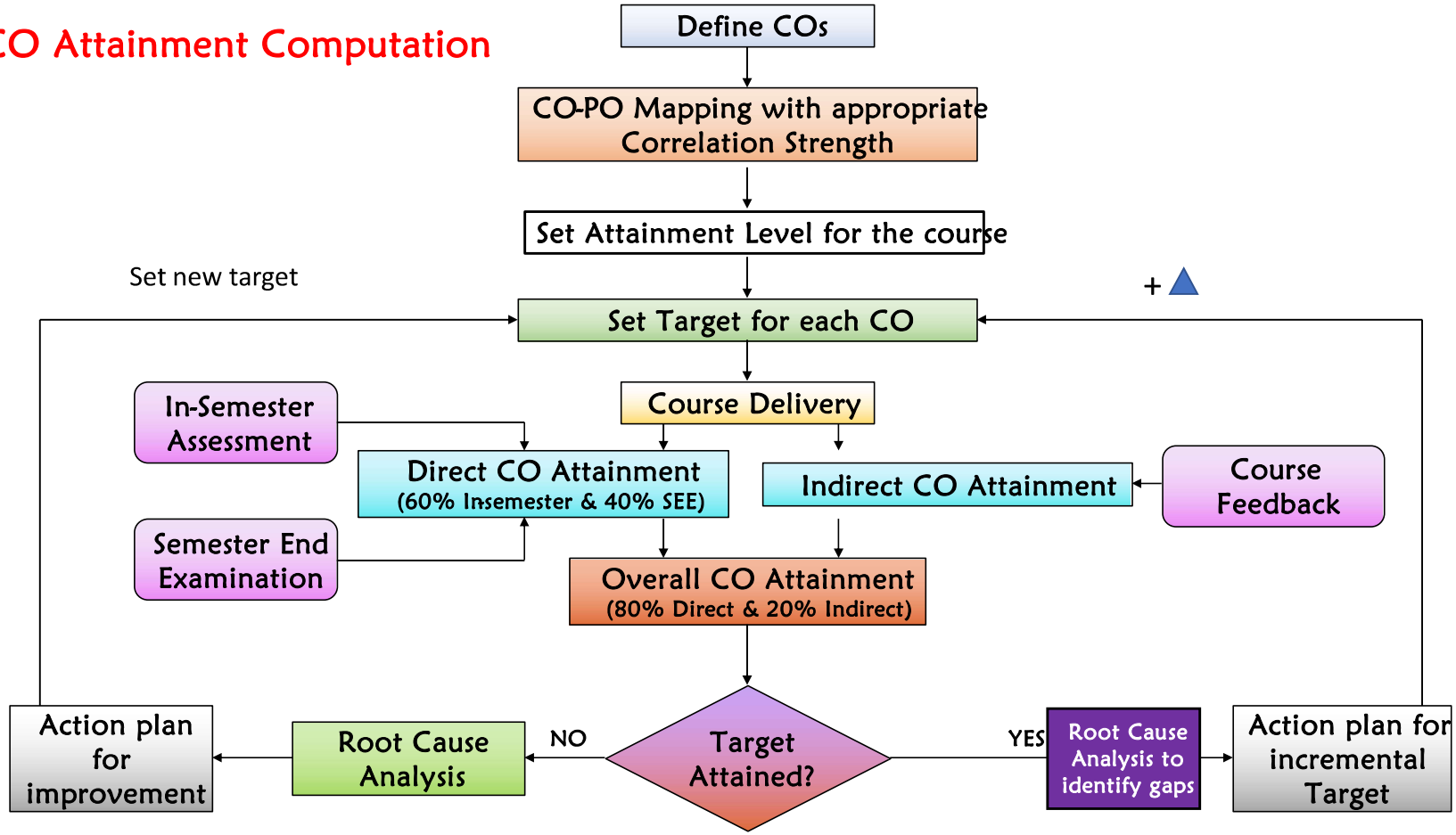
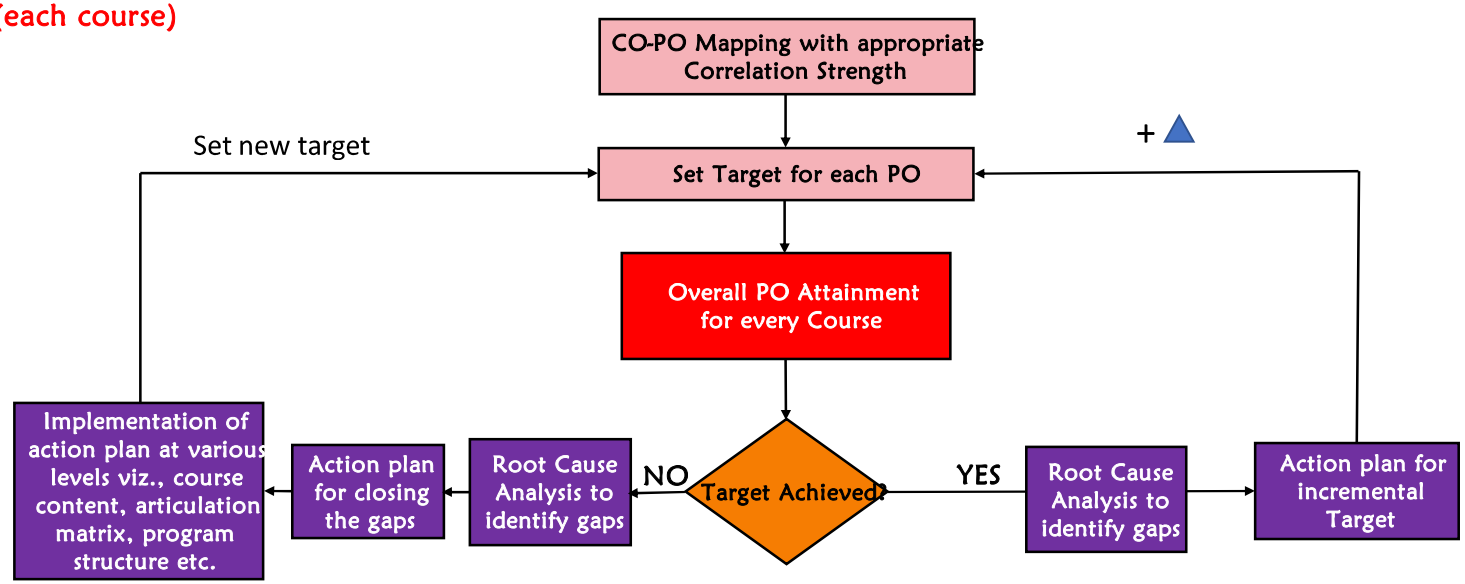
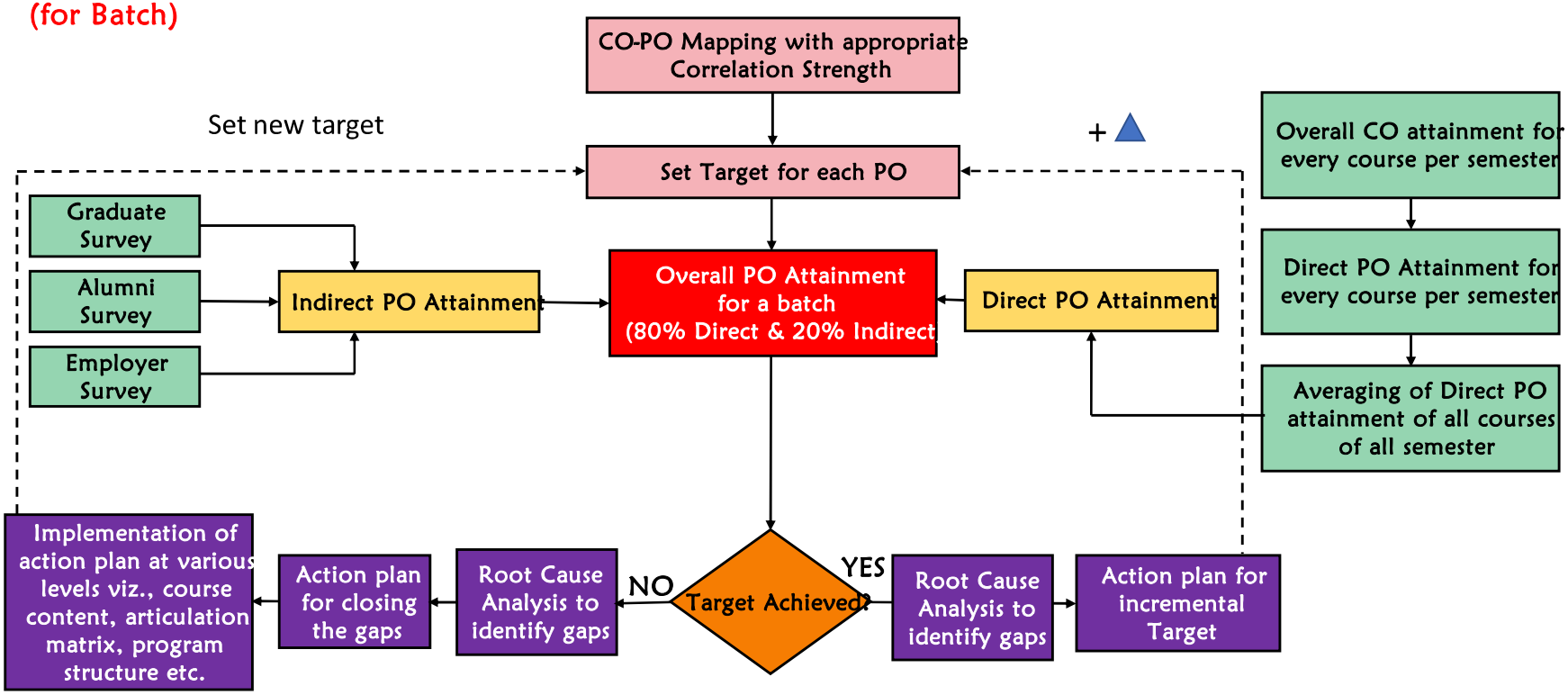
CO Attainment Computation



PO Attainment Computation (each course)



PO Attainment Computation (for Batch)



Sample computation: Given below

Department of Electrical Engineering

Subject Code: ELE 2223 Name of the Subject: LINEAR CONTROL THEORY

Semester & Academic year

IV & 2024-25

Course Articulation Matrix

CO - PO & CO - PSO mapping																
CO↓	Course Articulation Matrix (CO - PO Mapping strength)												CO - PSO Mapping Strength			
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct investigation of complex problems	Modern tool usage	Engineer and society	Environment and sustainability	Ethics	Individual and Team work	Communication	Project management and finance	Life-long learning				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ELE 2223.1	3	2												3		
ELE 2223.2		3			2									3		
ELE 2223.3		3			2									3		
ELE 2223.4			3	2	2									3		
ELE 2223.5			3	3	3				3					3		2
ELE 2223.6								2						2		
Average	3	2.67	3	2.50	2.25			2	3					2.83		2

CO Attainment

COs	Statement	Target set in the Previous academic year	Attainment in the Previous academic year	Target set in the Current academic year	Attainment in the Current academic year	Proposed Action Plan
1	Derive transfer function and state space models of physical systems by applying the knowledge of mathematics and engineering principles	2	1.86	2	1.93	Separate Tutorial classes were conducted for identified slow learners, but the attendance was poor. Improve the teaching - learning process – increase no. of hours in next revision- slightly reduce the difficulty level
2	Analyse the performance of linear time-invariant systems using principles of mathematics and modern tools.	2	2.35	2.35	2.27	Marginal / all students indirect attainment if collected properly, this will attain.
3	Analyse the stability of linear systems using appropriate graphical techniques and modern tools	2	1.92	2	1.98	Additional tutorial classes done and MATLAB simulation conducted. nearing attainment – Students attention in the class need improvement. Also suggesting more hours on analysis, instead of procedure-based plots.
4	Design controllers to achieve time domain and frequency domain specifications for control system applications.	2	1.65	2	1.63	MATLAB assisted design tried. In the upcoming revision with more hours planning
5	Implement appropriate controllers for engineering and societal applications using modern tools.	2	2.08	2.08	2.08	Combine this CO with CO6

6	Understand the importance of practicing engineering ethics in industrial automation and control.	2	2.89	2.89	2.75	Combine this CO with CO5

Subject Code ELE 2225 Name of the Subject: Electrical Machinery-2

Semester & Academic year

IV & 2024-25

Course Articulation Matrix

	Course Articulation Matrix (CO - PO Mapping strength)												CO - PSO Mapping Strength			
CO↓	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct investigation of complex	Modern tool usage	Engineer and society	Environment and sustainability	Ethics	Individual and Team work	Communication	Project management and finance	Life-long learning				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ELE 2225.1	3	1											2			
ELE 2225.2		2											2			
ELE 2225.3	2	1											2			
ELE 2225.4	2	2											2			
ELE 2225.5		2					3						2			
Average	2.33	1.60					3						2			

CO Attainment

COs	Statement	Target set in the Previous academic year	Attainment in the Previous academic year	Target set in the Current academic year	Attainment in the Current academic year	Proposed Action Plan
1	Estimate the induced EMF and voltage regulation of non-salient pole synchronous generators based on the circuit model	2	1.71	2	2.14	Attained
2	Analyse the performance of the synchronous generators and motors under variable excitation and load conditions	2	1.62	2	1.52	Tutorial classes shall be conducted for slow learners
3	Assess the performance of salient pole synchronous machines based on the two-reaction theory	2	1.73	2	1.28	Additional numerical sheets will be circulated
4	Demonstrate the understanding of constructional features and control circuits of special electrical machines	2	2.48	2.6	2.10	Simulation-assisted teaching shall be incorporated
5	Compare the performance characteristics of special machines based on applications to demonstrate the need for sustainable development	2	2.45	2.6	1.94	More focus on internal assessments will be done

PO attainment of these subjects (two subjects)

Course code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ELE 2223	1.96	2.10	1.73	1.74	1.92			2.77	1.78					2.04		1.78
ELE 2225	1.88	1.82					1.94						1.79			

PO/PSO Attainment of the Semester IV (2023-27 Batch)

PO/PSO	Target set in the previous academic year	Attainment in the Previous academic year	Target set in the Current academic year	Attainment in the Current academic year	Proposed Action Plan
PO1	2	2.03	2.04	1.98	More emphasis on problem-solving and analytical question types in assessments for courses like Linear Control Theory and Power Electronics
PO2	2	2.03	2.03	1.9	
PO3	2	2.05	2.05	1.84	Measures will be taken to integrate real-world design challenges in assignments and mini projects
PO4	2	1.94	2	1.74	More training will be given for doing literature review, data interpretation and result validation in assessments.
PO5	2	2.35	2.35	1.98	Conduct workshops on analytical tools (e.g., MATLAB) on simulation, modeling, and data analysis tools
PO6	2	2.41	2.41	2.12	Integrate topics related to **electrical safety in machines lab and energy conservation, in GTD courses**
PO7	2	2.37	2.37	2.07	Attained
PO8	2	2.89	2.89	2.77	Attained
PO9	2	2.06	2.06	2.13	Attained
PO10	2	1.96	2	2.17	Attained
PO11	2	1.93	2	1.9	Attained
PO12	2	1.93	2.02	2.31	Attained
PSO1	2	2.09	2.1	1.89	Mini projects using simulation tools will be taken up for courses like GTD

PSO2	2	2.01	2.1	1.59	Simulation studies in Linear control systems will be introduced
PSO3	2	1.98	2	1.9	More focus on mini projects will be given in ASD labs.
PSO4	2	2.31	2.31	2.06	-

POs& PSOs Attainment Levels and Actions for improvement – 2020-2024 Batch

POs	Target Level	Attainment Level	Observations
PO1: Engineering knowledge			
PO1	2.45	2.21	Not Achieved
Action plan1: Fundamental core subjects will be taught in earlier semesters for improvement in the attainment level.			
PO2: Problem analysis			
PO2	2.36	2.2	Not Achieved
By introducing simulation-assisted problem solving in relevant courses it can be attained.			
PO3: Design/Development of solutions:			
PO3	2.34	2.24	Not Achieved
By introducing design studies and analysis in relevant courses it can be attained.			
PO4: Conduct investigations of complex problems:			
PO4	2.14	2.35	Achieved
Introduced self-directed learning component in the next curriculum revision for further improvement			
PO5: Modern tool usage:			
PO5	2.3	2.31	Achieved
The introduction of simulation-assisted teaching and inclusion in the assessment can further improve attainment.			
PO6: The engineer and society:			
PO6	2.14	2.32	Achieved

PO7: Environment and sustainability:			
PO7	2.12	2.17	Achieved
The impact of engineering solutions in societal and environmental contexts in group group assignments can further improve attainment.			
PO8: Ethics:			
PO8	2.04	2.23	Achieved
Two courses on creativity and human values are added in the first year. SDL module on ethics will be introduced.			
PO9: Individual and team work:			
PO9	2.39	2.3	Not Achieved
Mini Project and Group Assignments will be introduced			
PO10: Communication:			
PO10	2.32	2.39	Achieved
Group Assignments and presentations on the same will be introduced.			
PO11: Project management and Finance:			
PO11	2.10	2.08	Not Achieved
Peer-to-peer assessment will be incorporated for evaluation of project management skills.			
PO12: Life-long learning:			
PO12	2.11	2.18	Achieved
Self-study topics and their assessment in each course is introduced in the next curriculum revision.			
PSO 1: Apply the engineering knowledge to analyse and evaluate the components of power system, its operation, control and protection			
PSO 1	2.18	2.24	Achieved
Action N: Simulation studies in the areas of power system, control system, etc are introduced in the next curriculum revision.			
PSO 2: Model and Analyse linear and non-linear systems in both continuous and discrete domains.			

PSO 2	2.12	2.18	Achieved
System simulation using simulation tools.			
PSO 3: Design and develop electronic circuits and systems for specified applications			
PSO 3	2.23	2.14	Not Achieved
Action N: Mini Project is introduced in the relevant course.			
PSO 4: Apply programming skills to develop models and intelligent systems.			
PSO 4	2	2.37	Achieved
Action N: The attainment is greater than the set target level. The target level shall be set higher for the next batch.			

Department of Chemical Engineering	
PSO	**PSO Statements**
PSO 1	Apply the principles of unit operations and unit processes to design chemical process equipment.
PSO 2	Develop, Model, Simulate and optimize the chemical process systems.
PSO 3	Recommend sustainable solutions for environmental and energy engineering related challenges.

Course 1

CHE 2221 Particle Technology

IV Semester

Academic Year 2024-25

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1		1	2	1	1	1		1	2		2
CO2	2	2	1	1		1	2	1	1	1		1	2		2
CO3	2	2	1	1		1	2	1	1	1		1	2		2
CO4	2	2	1	1		1	2	1	1	1		1	2		2
CO5	2	2	1	1		1	2	1	1	1		1	2		2
Average	2	2	1	1		1	2	1	1	1		1	2		2

CO Attainment

COs	Statement	Target set in the Previous academic year	Attainment in the Previous academic year	Target set in the Current academic year	Attainment in the Current academic year	Proposed Action Plan
1	Demonstrate the basic principle of screening operation	2	2.01	2.02	2.03	The target set has been achieved, and it will be slightly revised in the next year. Additional self-learning resources, such as online tutorials and practice exercises will be provided to maintain and enhance attainment levels.
2	Illustrate the concepts of size reduction operations	2	1.7	2	1.5	The target set is not attained and improves the Target attainment. As discussed in the root cause analysis, further explanation of more theoretical concepts and numerical problem-solving and giving more exercise problems for practice to the students.
3	Examine the basic principle of the solid-liquid separation operation	2	2.02	2.03	1.7	The target set is not attained. Incorporating more examples to improve conceptual clarity and application-oriented learning. Additional exercise problems can be incorporated to attain the target value.
4	Analyse the concept of filtration, and centrifugation operation	2	2.08	2.09	2.3	The target set has been achieved, and it will be slightly revised in the next year. Additional self-learning resources, such as online tutorials and practice exercises will be provided to maintain and enhance attainment levels.
5	Design the continuous thickener in a steady state operation	2	2.04	2.05	2.06	The target set has been achieved, and it will be slightly revised in the next year. Efforts will be made for better conceptual understanding and application-oriented learning

Course 2

CHE 4073 Machine Learning in Chemical Engineering

VII Semester

Academic Year 2024-25

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3			1	2	1	1	1	2	3	
CO2	2	2	2	2	3			1	2	1	1	1	2	3	
CO3	2	2	2	2	3			1	2	1	1	1	2	3	
CO4	2	2	2	2	3			1	2	1	1	1	2	3	
CO5	2	2	2	2	3			1	2	1	1	1	2	3	
Average	2.00	2.00	2.00	2.00	3.00			1.00	2.00	1.00	1.00	1.00	2	3	

CO Attainment

COs	Statement	Target set in the Previous academic year	Attainment in the Previous academic year	Target set in the Current academic year	Attainment in the Current academic year	Proposed Action Plan
1	Assess the importance of machine learning concepts in the chemical engineering domain, their applications in the chemical engineering domain, and able to distinguish between supervised and unsupervised learning algorithms	2.8	2.6	2.8	2.68	The Course Outcome (CO) target we set was positioned near the upper limit based on the impressive results we achieved in the previous assessment. To ensure we meet this ambitious target, it may be necessary to incorporate an additional lecture into the syllabus. This extra session will allow us to delve deeper into the subject matter and reinforce key concepts. Additionally, we'll provide supplementary teaching materials, such as curated readings, and relevant case studies, to enhance students' understanding and engagement. By implementing these strategies, we aim to effectively bridge any gaps and empower our students to succeed in meeting the established CO target.
2	Formulate the problem for regression and classification and obtain the solution using MATLAB	2	2.49	2.5	2.2	Additional Coding exercises MATLAB (Using MATLAB apps/ python script) can be incorporated to attain the target attainment, and additional teaching material could be used to achieve the target.
3	Analyse the concept of underfitting and overfitting of the model and take the	2	1.98	2	2.36	Target attainment can be increased to enhance the learning outcome of the

	correct decision to address the bias and variance of a model.					students. Additionally, More emphasis could be given to understanding the concept.
4	Develop the support vector machine algorithms as classification learning algorithms and their solution using MATLAB.	2	2.45	2.5	2.63	Target attainment can be increased to enhance the learning outcome of the students. Additionally, More emphasis could be given to understanding the concept.
5	Formulate unsupervised learning algorithm and develop a principal component analysis algorithm using MATLAB	2.2	2.51	2.6	2.25	More emphasis has to be given to this CO so that students will be able to understand concepts very clearly, which results in attaining the target. Students have to take it seriously the course project assigned. Additional application-oriented problems can be taken up in the class and solved using MATLAB/Python course project assigned.

PO attainment for these subjects

Course code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CHE 2221	1.92	1.92	1.92	1.92	NA	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92
CHE 4073	2.42	2.42	2.42	2.42	2.42	NA	NA	2.42	2.42	2.42	2.42	2.42	2.42	2.42	NA

PO/PSO Attainment of the IV Semester

Sem	SL. No	Course Code	Average PO & PSO Attainment														
			PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
IV (AY 2023-24)	1	MAT2224	2.04	2.12										2.09			
	2	CHE2221	1.92	1.92	1.92	1.92		1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92
	3	CHE2222	1.78	1.78	1.78	1.78		1.78	1.78	1.78		1.78		1.78	1.78	1.78	1.78
	4	CHE2223	1.78	1.78	1.78	1.75	1.78			1.78	1.78		1.78	1.78	1.78	1.78	
	5	CHE2224	2.43	2.43	2.43	2.43		2.43	2.43	2.43	2.43	2.43		2.43	2.43		2.43
	6	CHE2225	1.92	1.92	1.92	1.92		1.92	1.92	1.92	1.92	1.92		1.92	1.92		1.92
	7	CHE2241	2.31	2.31	2.31	2.31		2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31		2.31
	8	CHE2242	2.44	2.42	2.42	2.43	2.43			2.43	2.43			2.43	2.43	2.43	
Average PO Attainment			**2.08**	**2.09**	**2.08**	**2.08**	**2.10**	**2.07**	**2.07**	**2.08**	**2.13**	**2.07**	**2.00**	**2.08**	**2.08**	**1.98**	**2.07**

IV (AY 2022 -23)	1	MAT2224	2.08	2.14									2.12			
	2	CHE2221	2.10	2.10	2.10	2.10		2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
	3	CHE2222	1.72	1.72	1.72	1.72		1.72	1.72	1.72		1.72		1.72	1.72	1.72	1.72
	4	CHE2223	1.99	1.99	1.99	1.99		1.99	0.00	1.99		1.99		1.99	1.99	1.99	
	5	CHE2224	2.20	2.20	2.20	2.20		2.20	2.20	2.20	2.20	2.20		2.20	2.20		2.20
	6	CHE2225	2.20	2.20	2.20	2.20		2.20	2.20	2.20	2.20	2.20		2.20	2.20		2.20
	7	CHE2241	2.44	2.44	2.44	2.44		2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44		2.44
	8	CHE2242	2.80	2.80	2.80	2.80								2.80	2.80		
Average PO Attainment			**2.19**	**2.20**	**1.93**	**1.93**	**0.00**	**1.58**	**1.33**	**1.58**	**1.12**	**1.58**	**0.57**	**2.20**	**1.93**	**0.73**	**1.33**

POs& PSOs Attainment Levels and Actions for improvement – Batch 2020-2024

POs	Target Level	Attainment Level	Observations
PO1: Engineering knowledge			
PO1	2	2.22	The level of attainment reached was deemed satisfactory in both direct and indirect assessments. Nonetheless, there is a necessity to enhance this level to establish higher target goals for the future.
Action 1: The delivery and assessment of engineering fundamentals courses shall be improved. **Action 2:** A connection between the mathematical concept and its application in engineering analysis shall be made by including chemical engineering application-oriented problems in mathematics courses.			
PO2: Problem analysis			
PO2	2	2.28	The level of attainment reached was deemed satisfactory in both direct and indirect assessments. Nonetheless, there is a necessity to enhance this level to establish higher target goals for the future.
Action 1: Analytical and problem-solving skills of students shall be improved through increased emphasis on numerical problem solving through tutorials and enhanced student-teacher interaction outside the classroom. **Action:2:** Additional questions shall be given to the students after every lecture hour. **Action 3:** Relevant software may be introduced to understand the subject very effectively. **Action 4:** Remedial classes shall be introduced for the slow learners and stated implemented.			
PO3: Design/Development of solutions:			
PO3	2	2.02	The level of attainment reached was deemed satisfactory in both direct and indirect assessments. Nonetheless, there is a necessity to enhance this level to establish higher target goals for the future.
Action 1: Mini project-based courses may be introduced to enhance engineering knowledge through experiential learning **Action 2:** Students shall be encouraged to take up internships at reputed industries. **Action 3:** Students can take up minor specialization in the exciting field of study. **Action 4:** Guest lectures from R&D and Industry/Reputed Institutions in the emerging field shall be conducted.			

PO4: Conduct investigations of complex problems:			
PO4	2	1.68	The direct assessment results showed a significantly low level of attainment, while the indirect assessment results were found to be satisfactory. Therefore, it is essential to make improvements to achieve a higher target level in the future.
Action 1: The students shall be taken to industrial visits to understand the real-world problem in the chemical process industry. **Action 2:** The student can take up internship in chemical process industry to understand the complex problem in industry. **Action 3:** Suitable mini projects and case studies will be included in courses related to this PO to increase correlation and attainment. **Action 04:** Mini project-based courses may be introduced to enhance engineering knowledge through experiential learning.			
PO5: Modern tool usage:			
PO5	2	1.40	The results of the direct assessment showed a significantly low level of achievement, while the results of the indirect assessment were found to be satisfactory. Therefore, it is essential to make improvements to achieve a higher target level in the future.
Action 1: The teaching-learning process shall be improved by incorporating ASPEN Plus / MATLAB / JMP/COMSOL and HINT software tools. **Action 2:** Online platforms like MS Team could connect Alumni/ industrial experts.			
PO6: The engineer and society:			
PO6	2	1.68	The results of the direct assessment indicated a significantly low level of achievement, while the results of the indirect assessment were satisfactory. Therefore, it is crucial to implement improvements to reach a higher target level in the future.
Action 1: Students shall be advised to take up the local/societal problems related to Agricultural and water management. **Action 2;** Disaster management studies could be introduced, which will cater to the local industry. **Action 3:** Students shall be advised to validate their solutions and projects and analyse the societal impact of their project work. **Action 4:** Sufficient orientation shall be provided to enhance the contextual knowledge of social responsibilities related to engineering practice.			

PO7: Environment and sustainability:			
PO7	2	1.63	The results of the direct assessment indicated a significantly low level of achievement, while the results of the indirect assessment were satisfactory. Therefore, it is crucial to implement improvements to reach a higher target level in the future.
Action 1: Students can choose a newly introduced minor specialization in Renewable Energy Engineering. **Action 2:** Students shall be encouraged to take courses like Pollution Control Engg and Environmental Biotechnology. **Action 3:** More emphasis shall be placed on the need for sustainable development through the courses mapped to this PO.			
PO8: Ethics:			
PO8	2	1.59	The attainment level achieved through direct assessment found to be very low, whereas indirect assessment target found to be satisfactory. Therefore, it needs to be improved and further scope for higher target level.
Action 1: Courses on "Universal Human values" may be incorporated in the revised curriculum.			
PO9: Individual and team work:			
PO9	2	1.45	The assessment results indicated a significantly low level of achievement, while the results of the indirect assessment were satisfactory. Therefore, it is crucial to implement improvements to reach a higher target level in the future.
Action 1: Students are encouraged to take-up multidisciplinary group projects. **Action 2**: Group assignments may be given to students. **Action 3:** Guest lecture by Industrial experts and management experts. **Action 4:** Additional Co curriculum and Extra Curriculum activities through IIChe forum.			
PO10: Communication:			
PO10	2	1.45	The attainment level achieved through direct assessment found to be very low, whereas indirect assessment target found to be satisfactory. Therefore, it needs to be improved and further scope for higher target level.

Action 1: Students are encouraged to participate in technical paper presentations, Project exhibitions, etc., outside the institute. **Action 2:** Students are encouraged to write a technical review article. **Action 3:** Students shall be encouraged to publish research papers in peer review journals and conference presentations.			
PO11: Project management and Finance:			
PO11	2	1.20	The attainment level achieved through direct assessment found to be very low, whereas indirect assessment target found to be satisfactory. Therefore, it needs to be improved and further scope for setting higher target level.
Action1: Additional opportunities shall be provided to demonstrate and enhance their engineering and management skills in multidisciplinary environments through guest lectures, projects, seminars etc. **Action 2:** Students are encouraged to take up Open Elective in the Department of Humanities Action 3: students are encouraged to take additional courses in Coursera and NPTL forum.			
PO12: Life-long learning:			
PO12	2	1.80	The attainment level achieved through direct and indirect assessment found to be very close to the target set. Therefore, it needs to be improved and further scope for higher target level.
Action 1: Students can take additional courses in an Online educational portal like COURSERA. **Action 2:** Students are encouraged to participate in an industrial tour, additional project work under the supervision of the faculty. **Action 3:** Students shall choose flexible core courses in the revised curriculum. **Action 4:** A holistic growth of knowledge of the individual shall be ascertained to maintain the zest for lifelong learning.			
PSO 1: Apply the principles of unit operations and unit processes to design chemical process equipment.			
PSO 1	2	1.94	The attainment level achieved through direct and indirect assessment found to be very close to the target set. Therefore, it needs to be improved and further scope for setting higher target level.
Action 1: More emphasis shall be given on engineering fundamentals while delivering the courses. **Action 2:** Mini-project work may be introduced as part of the courses to enhance students' ability to apply engineering concepts to develop improved chemical process systems.			

PSO 2: Develop, Model, Simulate and optimize the chemical process systems.			
PSO 2	2	1.80	The attainment level achieved through direct assessment found to be very low, whereas indirect assessment target found to be satisfactory. Therefore, it needs to be improved and further scope for setting higher target level.
Action 1: More emphasis on software tools in theoretical courses by incorporating ASPEN/ MATLAB/JMP and HINT tools. **Action 2:** Connect with an Industrial expert to have more of practical knowledge.			
PSO 3: Recommend sustainable solutions for environmental and energy engineering related challenges			
PSO 3	2	1.43	The assessment results indicated a significantly low level of achievement, while the results of the indirect assessment were satisfactory. Therefore, it is crucial to implement improvements to reach a higher target level in the future.
Action 1: Efforts shall be made to improve the course content and delivery in the related subjects to improve the domain knowledge.			

Mechanical Engineering

Subject Code: MIE 2225

Name of the Subject: **Manufacturing Processes – II**

Semester & Academic year: IV 2023-24 and 2024-25

Course Articulation Matrix

MIE 2225.1	Discuss the hot and cold working of metals, illustrate the principle of rolling, drawing and extrusion technique in line with their applications.
MIE 2225.2	Illustrate the construction features, specifications and applications pertaining to broaching, planer, slotting and shaping machines, describe the function, types, work holding principles, locating and clamping methods of jigs and fixtures used for lathe and milling.
MIE 2225.3	Outline the lapping, honing, polishing and other micro finishing processes, elucidate the powder coating, thermal spraying and other deposition techniques in line with industrial applications also discuss the powder blending, compaction, sintering and finishing operations with relevant advantages, limitations and applications.
MIE 2225.4	Discuss the characteristics of rapid prototyping processes and technologies in line with relevant industrial applications.
MIE 2225.5	Discourse the economics of machining in relation to choice of feed, speed, material removal, maximum production rate and optimal tool life.

CO Attainment

COs	Statement	Target set in the Previous academic year	Attainment in the Previous academic year	Target set in the Current academic year	Attainment in the Current academic year	Proposed Action Plan
1	MIE 2225.1	2.00	2.57	2.20	2.28	Target may be revised to 2.3
2	MIE 2225.2	2.00	2.20	2.20	1.75	Additional discussion will be taken up for topics pertaining to working of broaching, shaper, planer and slotting machines. Focus on work holding principles, locating and clamping methods in line with different jigs and fixtures would be considered, so as to achieve the set target level.
3	MIE 2225.3	2.00	2.39	2.20	2.45	Target may be revised to 2.3
4	MIE 2225.4	2.00	2.82	2.20	2.45	Target may be revised to 2.3
5	MIE 2225.5	2.00	2.67	2.20	2.56	Target may be revised to 2.3

Subject Code: MIE 2224 **Name of the Subject:** Turbomachines

Semester & Academic year: IV 2023-24 and 2024-25

Course Articulation Matrix

MIE 2224.1	Apply the principles of dimensional analysis, similitude analysis and thermodynamics to turbomachines
MIE 2224.2	Describe the fundamental principles and performance characteristics of power developing turbomachines
MIE 2224.3	Describe the fundamental principles and performance characteristics of power absorbing turbomachines
MIE 2224.4	Formulate mathematical models pertaining to different turbomachines
MIE 2224.5	Determine the performance and design parameters of different turbomachines.

CO Attainment

COs	Statement	Target set in the Previous academic year	Attainment in the Previous academic year	Target set in the Current academic year	Attainment in the Current academic year	Proposed Action Plan
1	MIE 2224.1	2.00	2.29	2.23	2.10	Target not attained. More practice problems will be given.
2	MIE 2224.2	2.00	2.10	2.05	2.07	Target is attained. It could be improved by providing additional reference materials and conducting surprise quizzes
3	MIE 2224.3	2.00	2.33	2.39	2.01	Target not attained. It could be improved by providing additional reference materials and conducting surprise quizzes
4	MIE 2224.4	2.00	2.29	2.15	1.74	Target not attained. Practice of derivations will be stressed, and students will be advised not to depend on the formula book for the derivations.
5	MIE 2224.5	2.00	1.93	1.80	1.87	Target is attained. It could be improved by giving more practice problems and take-home assignments.

PO attainment of these subjects (two subjects)

Course code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
MIE2225	2.30	2.30												2.30		
MIE2224	1.82	1.74													1.82	

PO/PSO Attainment of the Semester

PO/PSO	Target set in the previous academic year	Attainment in the Previous academic year	Target set in the Current academic year	Attainment in the Current academic year	Proposed Action Plan
PO1	2.00	2.47	2.15	2.09	To improve the CO attainments in core mechanical subjects, faculty are suggested to add more practical aspects, solve numerical and give emphasis to fundamentals. Tutorial sessions for the courses with mathematics will be enhanced.
PO2	2.00	2.38	2.15	2.00	To improve the CO attainments in core mechanical subjects, faculty are suggested to add more practical aspects, solve numerical and give emphasis to fundamentals. Tutorial sessions for the courses with mathematics will be enhanced Practical problems will be solved
PO3	2.00	2.25	2.15	1.86	Practical applications, and case studies will be discussed in design and manufacturing related subjects More complex problems mimicking the industrial scenarios may be discussed to gain the insights of the critical testing procedures.
PO4					
PO5	2.00	2.65	2.15	2.40	CO and PO target will be revised to higher values Students will be encouraged to take-up projects works to develop new products/processes using modern tools
PO6					
PO7	2.00	2.63	2.15	2.33	CO and PO target will be revised to higher values Students and faculty are encouraged to solve and implement practical problems impacting environment in the course material
PO8	2.00	2.47	2.15	2.16	CO and PO target will be revised to higher values Case studies involving ethical consideration will be included in the respective modules.
PO9	2.00	2.67	2.15	2.49	CO and PO target will be revised to higher values
PO10	2.00	2.67	2.15	2.49	CO and PO target will be revised to higher values

PO11					
PO12	2.00	2.47	2.15	2.26	CO and PO target will be revised to higher values
PSO1	2.00	2.20	2.15	2.25	CO and PO target will be revised to higher values To improve the CO attainments in core mechanical subjects, faculty are suggested to add more practical aspects, solve numerical and give emphasis to fundamentals
PSO2	2.00	2.60	2.15	2.21	CO and PO target will be revised to higher values More case studies related to materials and manufacturing domain will be addressed
PSO3	2.00	2.43	2.15	1.86	To improve the CO attainments in core mechanical thermofluidic subjects, faculty will add more practical aspects, solve numerical and give emphasis to fundamentals. Tutorial sessions for the courses with mathematics will be enhanced Practical problems will be solved

POs& PSOs Attainment Levels and Actions for improvement – 2020-2024

POs	**Target Level**	**Attainment Level**	**Observations**
PO1: Engineering knowledge			
PO1	2.25	2.28	The attainment values in the PO are found to be higher than the required target level.
Action plan • To further improve the CO attainments in core mechanical subjects, faculty are suggested to add more practical aspects, solve numerical and give emphasis to fundamentals. • Students will be requested to join online certificate courses like NPTEL, Coursera, Udemy, and other reputed organizations and academic agencies to gain more knowledge.			

PO2: Problem analysis			
PO2	2.25	2.18	CO attainments were found to be lower than target level for few of the courses, resulting in the lesser attainment
• To improve the CO attainments in core mechanical subjects, faculty are suggested to add more practical aspects, solve numerical and give emphasis to fundamentals. • Tutorial sessions for the courses in mathematics will be enhanced. • Faculties and students will be encouraged to join online certificate courses like NPTEL, Coursera, Udemy, and other reputed organizations and academic agencies to impart skill-based training			
PO3: Design/Development of solutions:			
PO3	2.25	2.16	The attainment values in the PO are found to be lower than the required target level.
• To improve the CO attainments in core mechanical subjects, faculty are suggested to add more practical aspects, solve numerical and give emphasis to fundamentals. • Tutorial sessions for the courses in mathematics will be enhanced. • Assignments and seminars are given, and they are expected to study the real-world problems and give presentations about their ideas to solve them. • Students will be encouraged to participate in hackathons, government and private hosted competitions			
PO4: Conduct investigations of complex problems:			
PO4	2.25	2.28	The attainment values in the PO are found to be higher than the required target level.
• Practical applications and case studies will be discussed in design and manufacturing related subjects • More complex problems mimicking the industrial scenarios may be discussed to gain insight into the critical testing procedures. • Students will be encouraged to carry mini projects and open-ended experiments using software like Ansys, 3D experience, Fusion360 to analyze complex problems, which can simulate their study behavior			

PO5: Modern tool usage:			
PO5	2.25	2.34	The attainment values in the PO are found to be higher than the required target level.
• Students will be encouraged to carry mini projects and open-ended experiments using software like Ansys, 3D experience, MATLAB, Minitab, Fusion360, etc. • They will also be encouraged to take-up projects works to develop new products/processes			
PO6: The engineer and society:			
PO6	2.25	2.56	
• Encouraged to participate in the extra-curricular activities through NSS, NCC, etc. • Encouraged to identify the problems in society and the scope for solving through engineering. • Faculty suggested adopting practical and creative learning methods and including concepts of societal application in the courses. • Encouraged to attend blood donation drives, tree plantations and other outreach activities.			
PO7: Environment and sustainability:			
PO7	2.25	2.22	The attainment values in the PO are found to be lower than the required target level.
• Students and faculty are encouraged to solve and implement practical problems impacting environment in the course material • Encourage to take up activities promoting sustainability and address environmental issues in the vicinity. • Permitted to organize and participate in the events organized by NSS, NCC, Swatch Bharat supporting environmental protection			
PO8: Ethics:			
PO8	2.25	1.91	The attainment values in the PO are found to be lower than the required target level.
• A professional skill course on ethics will be introduced to further strengthen the PO			

PO9: Individual and team work:			
PO9	2.25	2.00	The attainment values in the PO are found to be lower than the required target level.
• Laboratory courses will include open-ended experiments to inculcate teamwork and continuous learning. • Students are encouraged to participate in team events to build up team skills without losing their individual effective contributory efforts. The same style of working is adopted in curricular projects too • Encouraged to join major student projects to build teamwork			
PO10: Communication:			
PO10	2.25	2.60	Attainment level is very good. Attainment can be increased further by encouraging students to communicate effectively on latest technical topics, English courses and complex engineering activities
• Course on communication skills will include more interactive sessions • Technical presentation is included as a component for assigning internal marks. • Presentation sessions will be arranged after completing Industrial visit/ In-plant training/ Internship. • Encouraged to participate in the seminar/technical events organized by other institutions.			
PO11: Project management and Finance:			
PO11	2.25	2.64	The attainment values in the PO are found to be higher than the required target level.
• Project batches will also be encouraged to concentrate on project management and finance. • Engineering Economics and cost analysis is offered to learn the techniques for selecting/evaluating projects and best alternatives.			

PO12: Life-long learning:			
PO12	2.25	2.09	The attainment values in the PO are found to be lower than the required target level.
• Students will be encouraged to carry industrial visit/in-plant training/Internship for self-learning. Students will be requested to join online certificate courses like NPTEL, Coursera, Udemy, and other reputed organizations and academic agencies to gain more knowledge.			
PSO 1:			
PSO 1	2.25	2.21	The attainment values in the PSO are found to be lower than the required target level.
• To improve the CO attainments in core mechanical subjects, faculty are suggested to add more practical aspects, solve numerical and give emphasis to fundamentals. • Tutorial sessions for the courses in mathematics will be enhanced. • Faculties and students will be encouraged to join online certificate courses like NPTEL, Coursera, Udemy, and other reputed organizations and academic agencies to impart skill-based training • Practical applications and case studies will be discussed in design and manufacturing related subjects • More complex problems mimicking the industrial scenarios may be discussed to gain insight of the critical testing procedures.			
PSO 2:			
PSO 2	2.25	2.27	The attainment values in the PO is found to be higher than the required target level.

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- To improve the CO attainments in core mechanical subjects, faculty are suggested to add more practical aspects, solve numerical and give emphasis to fundamentals.
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<tr><td colspan="4">PSO 3:</td></tr>
<tr><td>PSO 3</td><td>2.25</td><td>2.14</td><td>The attainment values in the PO are found to be lower than the required target level.</td></tr>
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