INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal,Hyderabad– 500043

Mechanical Engineering

Attainment of Program Outcomes (POs) and Program Specific Outcomes (PSOs) of 2017 - 2021 batch (IARE - R16)

S. No	Subject	Course	Sub code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	English for communication	C101	AHS001										2.90					
2	Linear algebra and ordinary differential equations	C102	AHS002	2.40	2.00													
3	Engineering chemistry	C103	AHS005	1.90	2.10					1.80								
4	Applied physics	C104	AHS007	1.40	1.40		1.30											1.70
5	Engineering drawing	C105	AME001	2.20		2.30							2.10		1.80	2.10		
6	Communication skills laboratory	C106	AME101									2.10	2.10					
7	Engineering chemistry laboratory	C107	AHS101	1.60	1.60					1.60								
8	It workshop	C108	AHS103	1.60	1.60			1.60							1.60			1.60
9	Basic workshop	C109	ACS113	1.70		1.70						1.70		1.70				1.70
10	Engineering mechanics	C110	AME002	1.40	1.80	1.50	1.00		1.20									1.80
11	Computational mathematics and integral calculus	C111	AHS003	1.70	1.60													
12	Modern physics	C112	AHS008	1.30	1.40		1.80											1.80
13	Environmental studies	C113	AHS009	1.90			1.80			1.90								
14	Computer programming	C114	ACS001	1.50	1.30	1.60		1.50					1.50		1.50	1.10		
15	Computational mathematics laboratory	C115	AME102	1.40	1.40		1.40									1.40		
16	Engineering physics laboratory	C116	ACS101	2.00	2.00		2.00					2.00						2.00
17	Computer programming laboratory	C117	AHS105	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60		1.60		1.60	1.60		1.60
18	Computer aided engineering drawing practice	C118	AHS102	1.40		1.40		1.40				1.40	1.40					1.40
19	Probability and statistics	C201	AHS010	2.00	1.70		2.20											
20	Thermodynamics	C202	AME003	1.40	1.70	1.30	1.80		1.30								1.50	
21	Mechanics of solids	C203	AME004	1.20	1.30	1.10	1.40		1.10						1.40	0.80		1.10
22	Metallurgy and material science	C204	AME005	2.00	1.50	1.60										2.30		0.70

23	Basic electrical and electronics engineering	C205	AEE018	1.30	0.80											1.30		
24	Metallurgy and mechanics of solids laboratory	C206	AME104	1.00	1.00	1.00						1.00				1.00	1.00	
25	Machine drawing through cad laboratory	C207	AME105		1.30	1.30	1.30	1.30				1.30	1.30			1.30		
26	Basic electrical and electronics engineering laboratory	C208	AEE103	1.60	1.60						1.60	1.60	1.60		1.60	1.60		
27	Mathematical transform techniques	C209	AHS011	0.90	0.50		0.90									0.60		
28	Production technology	C210	AME006	1.30	1.30	1.50			1.80	1.20								1.40
29	Applied thermodynamics	C211	AME007	2.40	2.30	2.10											2.20	
30	Mechanics of fluids and hydraulic machines	C212	AME008	1.60	1.50		1.70											1.20
31	Kinematics of machinery	C213	AME009	1.80	1.50	1.20	2.10	1.20		1.80	2.30		2.10	2.30	2.10	2.30		2.10
32	Computational mechanical engineering laboratory	C214	AME106	1.40	1.40	1.40		1.40				1.40	1.40			1.40	1.40	1.40
33	Production technology laboratory	C215	AME107	2.10	2.10	2.10			2.10	2.10		2.10			2.10			2.10
34	Mechanics of fluids and hydraulic machines laboratory	C216	AME108	2.10	2.10	2.10	2.10	2.10				2.10			2.10		2.10	
35	Machine tools and metrology	C301	AME010	2.70	2.50	2.90		2.40	2.40	2.40					2.40	2.60		
36	Dynamics of machinery	C302	AME011	1.90	1.90	1.20	1.70	1.80		2.30	1.10				1.70			1.10
37	Design of machine members	C303	AME012	1.60	1.40	1.80	2.80		1.70						1.20			1.70
38	Thermal engineering	C304	AME013	1.40	1.40	1.20	1.70		1.20	1.20					1.70		1.50	
39	Business economics and financial analysis	C305	AHS015	1.90	1.60						2.20	2.10		1.70				1.70
40	Thermal engineering laboratory	C306	AME507	1.70	1.70		1.70					1.70			1.70		1.70	
41	Machine tools and metrology laboratory	C307	AME516	1.60	1.60			1.60				1.60			1.60	1.60		
42	Research and content development	C308	AME509	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	2.10
43	Additive manufacturing techniques	C309	AME519	2.00	2.00	2.70	1.90	1.80		2.30	2.40	2.40	1.80	2.40	1.90	2.00		
44	Disaster management	C310	AME109	1.40					1.60	1.60		1.20						
45	Aerospace propulsion and combustion	C311	AME110	2.40	2.50	2.10	2.50						2.40				2.40	2.10
46	Finite element modelling	C312	AHS106	1.90	1.90	1.30	1.90	1.30							1.80		1.30	1.30
47	Instrumentation and control systems	C313	AME014	1.60	1.80	1.80			2.00						1.80		1.10	
48	Instrumentation and control systems laboratory	C314	AME015	2.10	2.10	2.10	2.10	2.10		2.10		2.10			2.10		2.10	2.10
49	Automobile engineering	C315	AME016	2.10	2.10	1.80			1.80	1.80							2.00	
50	Machine design	C316	AME525	1.50	1.50	2.30	1.20	1.20	1.30									
51	Heat transfer	C317	AME526	1.80	1.00	1.40	0.70		1.00	1.30							1.30	
52	Theory of machines lab	C318	AAE551	1.00	1.00		1.00	1.00				1.00						1.00

53	Heat transfer lab	C319	ACE551	1.70	1.70			1.70				1.70						1.70
54	Fluid, thermal modeling and simulation lab	C320	AME111	2.40	2.40	2.40	2.40	2.40	2.40		2.40	2.40	2.40	2.40	2.40		2.40	2.40
55	Ideation and product development	C321	AME112	1.70	1.70	1.70	1.70		1.70	1.70	1.70	1.70	1.70		1.70	1.70		1.70
56	Operations research	C322	AME113	1.20	1.20	1.20	1.20	1.20						1.20	1.20			1.20
57	Engineering optimization	C401	AME017	1.90	2.10		2.80									1.60		
58	Refrigeration and air conditioning	C402	AME018	1.20	1.40		1.00	2.10	2.10	1.80	1.30						1.40	2.10
59	Computer aided design/computer aided manufacturing	C403	AME019	2.80	2.70	2.80		2.90		2.80				2.80	2.90	2.80		
60	Robotics	C404	AME533	2.60	2.60	2.80	2.60											2.80
61	Computer aided modeling and analysis laboratory	C405	AME510	2.40	2.40		2.40					2.40	2.40		2.40	2.40		
62	Computer aided numerical control laboratory	C406	AEE551	2.30	2.30	2.30	2.30	2.30	2.30	2.30		2.30		2.30	2.30	2.30		
63	Energy from waste	C407	ACS553	2.40		2.10			2.20	2.40					2.30			2.50
64	Design of hydraulic and pneumatic systems	C408	AME519	2.30	2.40	1.20									2.00		2.20	
65	Comprehensive examination	C409	AME401	1.00	1.00	1.00					1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
66	Project work	C410	AME302	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	2.10
67	Design for manufacturing and assembly	C411	AME520	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20			1.20	1.20	1.20	1.20	1.20
68	Production planning and control	C412	AME518	2.20	2.00	2.20								2.90				1.70
Direct attainment value				1.8	1.7	1.8	1.8	1.7	1.7	1.9	1.8	1.8	1.9	2	1.8	1.7	1.7	1.7

Overall Attainment

S.No	Assessment Components (Direct + Indirect)	Program Outcomes (POs)														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	Direct Assessment (CIA + SEE + Course End Survey) (a)	1.8	1.7	1.8	1.8	1.7	1.7	1.9	1.8	1.8	1.9	2	1.8	1.7	1.7	1.7
2	Program Exit Survey (b)	2.7	2.7	2.6	2.7	2.7	2.7	2.7	2.6	2.7	2.8	2.7	2.7	2.7	2.7	2.7
3	Alumni Survey (c)	2.7	2.7	2.6	2.7	2.7	2.7	2.7	2.6	2.7	2.8	2.7	2.7	2.7	2.7	2.7
4	Employer Survey (d)	2.6	2.8	2.5	2.3	2.4	2.7	2.6	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Final attainment = a*0.8 + b*0.1 + c*0.05 + d*0.05		2	1.9	2	2	1.9	1.9	2.1	1.9	2	2.1	2.1	2	1.9	1.9	1.9

POs Attainment Levels and Actions for improvement

Pos	Target Level	Attainment Level	Observation
PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.			
PO1	**2.0**	**2.0**	**Target level has been Achieved. However, following observations were made:** 1. Mechanical engineering curriculum requires the strong foundation of theoretical and practical knowledge of science and mathematics, which the students study during their entire programme, especially in their first year, but improvement in correlating the theoretical concepts with applications is required. 2. Students should give more attention to solve the subjects having critical thinking.
Action: 1.The department encouraging the students to participate in Professional activities/ Design challenges such as, SAE-SUPRA (Formula Student Racing Car), CII design, Robotic challenge by Flipkart, SAE Aeromodelling Competitions and SAE student conventions which enhanced their Engineering knowledge with defined level of their standards. 2. Additional classes are conducted for enhancing the mathematical fundamentals. 3. More tutorial sessions conducted for core subjects such as Applied thermodynamics, Kinematics of Machinery, Design of Machine Members and Thermal Engineering for problem solving. 4. Assignments will be given for practice.			
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.			
PO2	**1.6**	**1.9**	**Target level has been Achieved. However, following observations were made:** 1. Students should focus on real world Problems 2. Research exposure of the students to be enhanced.
Action :			

1. More emphasize on tutorial classes for problem solving.
2. More problems of assignment and the observing the same on a regular basis.
3. Students are motivated to observe, their homes and surroundings to gain insight into real life engineering problems and think of possible approaches/solutions to these problems by interactive sessions.
4. Gained knowledge on complex engineering problems and solution on visiting field/ industry and internships.
5. Students are inspired to participate technical events like, Azadi ka Amrit Mahotsav and industry exhibitions air shows for developing an analytical mind which can work towards problem solving.

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.

PO3	**1.6**	**1.9**	**Target level has been Achieved.** Most of the projects developed by the student as course/ mini projects/ major projects (final year) are considering the social and environmental issues.

Action:
1. More design classes to be taught in tutorial classes.
2. More emphasis on mathematical basic to be given in the previous course
3. Students are motivated to include all standard parameters and constraints according to National and International safety norms and to address environmental concerns.
4. Practical approach of teaching to be adapted.

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.

PO4	**1.7**	**2.0**	**Target level has been Achieved. However, following observations were made:** 1. Develop the ability to experimentally analyze the problems through relevant softwares. 2. Most of the project works are research based where students have to design experiments analyses and synthesis the data, produce results and derive specific conclusions.

Action:
1. Conducted expert talk on emerging technologies for employing complex problem-solving methods by Industry and academia experts.
2. Courses are included and syllabi updated to include and inculcate the analysis and research skills.

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.

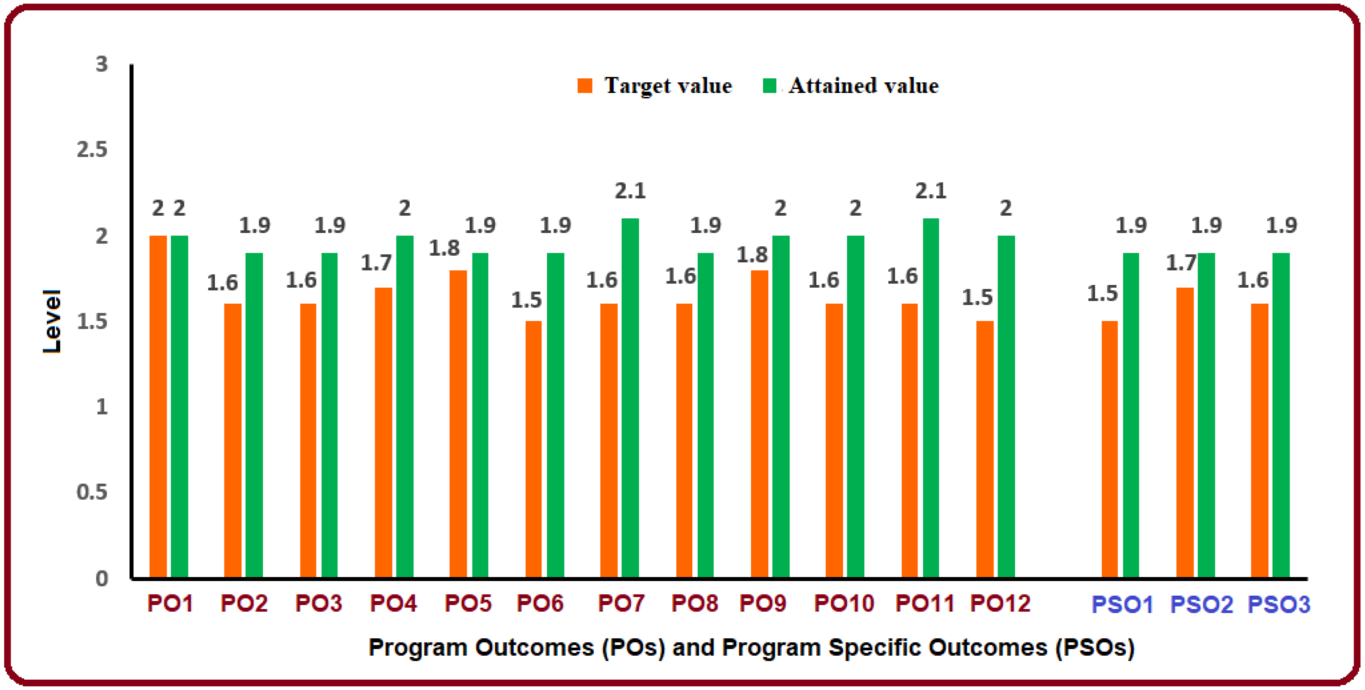
<table>
<tr><td>PO5</td><td>1.8</td><td>1.9</td><td>Target level has been Achieved. However, following observations were made:
1. Students were needed to be encouraged to use the Design/Analysis tools for better opening for placements and/or higher studies.
2. It is perceived that Up-gradations of tools and resources are essential to meet the industry standards and research.</td></tr>
<tr><td colspan="4">Action:
1. Conducted hands on training and certificationprogrammes on modelling and simulation tools like, ANSYS, MATLAB, QForm, Fusion 360, Revit, Solid works and CATIA.
2. Conducted workshop on CNC Programming to prepare online and offline program techniques.
3. Training programs on basic Electro hydraulic and pneumatic technologies using trainer kits.
4. Students are taught with modern modes and methods of teaching like using interactive and digital boards and learning in smart class rooms equipped with real time lecture facilities</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td>PO6</td><td>1.5</td><td>1.9</td><td>Target level has been Achieved. However, following observations were made:
1. Exploration of problems faced by society were addressed.
2. The students are found to be less active as far as social activities were concerned; also, they aresensitized about the basic health and safety issues with engineering point of view.
3. Students need to be giving more significance to these dimensions in the professional career.</td></tr>
<tr><td colspan="4">Action:
1. Students are encouraged to take up the project works on environment , health and social problems which include examples related to Desktop oil extraction Machine, Pharmaceutical Blending Machine, Rice planting and paddy cutting machines, Milk Extraction Machine, Rescue Robot in disaster management, and assistance in Mask design in the pandemic.
2. To understand the safety concerns and social aspects, students visited industry to expand their practical knowledge with the effect of improved practices in engineering
3. Project works on Experimental investigation of Effective Waste Recovery from Automotive Exhausts.</td></tr>
<tr><td colspan="4">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.</td></tr>
</table>

PO7	**1.6**	**2.1**	**Target level has been Achieved. However, following observations were made:** 1.The issues of global and environmental responsiveness among the student should be improved. 2. The concept of sustainability should reach the students.
Action: 1. Students are encouraged to do projects on composite materials, Solar energy operated vehicle ,Solar Refrigeration system and alternate fuels (Bio fuel). 2. Courses and expert lectures, that deal with environmental and sustainability issues, have been introduced with the aim of understanding the impact of professional engineering solutions in societal and environmental contexts and understanding the need for bringing about sustainability in overall development.			
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.			
PO8	**1.6**	**1.9**	**Target level has been Achieved. However, following observations were made:** 1. The students are doing better in improving the overall expertise in field of engineering but due to less stress on communications and ethical/ moral knowledge, there is some lagging. 2. Ethical practice of engineering system is implemented.
Action : 1.Guest lectures are conducted to improve the moral values. 2. Students are enthused and made aware about the demands of engineering profession, duties towards society & fellow human beings and importance of honesty and ethics.			
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.			
PO9	**1.8**	**2.0**	**Target level has been Achieved. However, following observations were made:** The students seem ready for working both as individuals and in a team work.
Actions Taken: **Action :** 1. Group of students participated in the national level competitions such as, SAE – SUPRA, SAE student convention, SAE Aero modelling, Flipkart Robotic challenge, Design challenges at various National Level Institutes. 2. The laboratory work of the students is conducted by framing student groups so that students learn to work in a team environment.			

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.			
PO10	**1.6**	**2.0**	**Target level has been Achieved. However, following observations were made:** The communication, presentation and report writing skills are to be further enhanced among the students.
Action : 1. Soft skill training is imparted to students to develop various expressions of communication or technical talks by group discussion, Business presentations, Budget estimations and new learning outcomes. 2. Students that are seen to be weak in communication skills are encouraged to undergo relevant courses and are also referred to language lab for improving their communication skills.			
P11: 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.			
PO11	**1.6**	**2.1**	**Target level has been Achieved. However, following observations were made:** Few courses of curriculum give information of Management principle and applying managerial principles to his/her work including financial inferences and to manage the project in multidisciplinary environments.
Action 1: : 1. The Project based learning and Research based Learning also studied for implementing their projects. 2. The awareness is created among the student regarding the management principles and managing projects. The relevant courses are revised and upgraded regularly to cater to latest techniques and trends in the area.			
P12: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.			
PO12	**1.5**	**2.0**	**Target level has been Achieved. However, following observations were made:** The pre final year and final year courses of the program are demonstrating the resource for contemporary issues and lifelong learning.
Action: 1. Expert talks for different topics were conducted in our institutions.			

PSOs Attainment Levels and Actions for improvement

<table>
<tr><th>PSOs</th><th>Target Level</th><th>Attainment Level</th><th>Observation</th></tr>
<tr><td colspan="4">PSO1: Focus on Ideation and Research towards Digital manufacturing in Product development using Additive manufacturing, Computer Numerical Control (CNC) simulation and high speed machining.</td></tr>
<tr><td>PSO1</td><td>1.5</td><td>1.9</td><td>Target level has been Achieved. However, following observations were made:
Different manufacturing methods and designs are used to develop/ implement, test, validate and maintain the Mechanical engineering foundation for industry. Publish/ exhibit/ innovate through conferences, journals etc.</td></tr>
<tr><td colspan="4">Action:
1. CNC simulations and training is given to students with real time problems.
2. Concepts of Rapid prototyping and new developments are imparted to students.
3. Students are motivated to take up the real life problems during their project work so that they can design, analyze and find solution which gives exposure to latest technologies.</td></tr>
<tr><td colspan="4">PSO2: Formulate and Evaluate concepts of Thermo-Fluid Systems to provide solutions for Inter Disciplinary Engineering Applications.</td></tr>
<tr><td>PSO2</td><td>1.7</td><td>1.9</td><td>Target level has been Achieved. However, following observations were made:
Concepts of Thermo-fluid systems provide various solutions through modelling and optimization methods.</td></tr>
<tr><td colspan="4">Action :
1. Guest lecture arranged the following topics such as ANSYS CFD simulations, QForm for metal forming simulations, Aerodynamic testing of wing bodies, Turbine blades to enhance the simulation knowledge..
2. Academic workshops and conferences are coming into picture to apply more knowledge in terms of conduction of experiments and analysis as required</td></tr>
<tr><td colspan="4">PSO3 : Make use of Computational and Experimental tools for Building Career Paths towards Innovation Startups, Employability and Higher Studies.</td></tr>
<tr><td>PSO3</td><td>1.6</td><td>1.9</td><td>Target level has been Achieved. However, following observations were made:
Computational and Experimental knowledge / skills to be transferred to the Mechanical engineers.</td></tr>
<tr><td colspan="4">Action:
1. Students are encouraged to participate in lectures conducted by MSME – Govt of India and NIT Ahmedabad to take up entrepreneurship and focus on Higher education and Research.
2. Project works are encouraged that involve the usage of modern tools and techniques of Data Collection/ Analysis/ Implementing</td></tr>
</table>


Target value
Attained value
Level
3
2.5
2
1.5
1
0.5
0
2 2
1.6 1.9
1.6 1.9
1.7 2
1.8 1.9
1.5 1.9
1.6 2.1
1.6 1.9
1.8 2
1.6 2
1.6 2.1
1.5 2
1.5 1.9
1.7 1.9
1.6 1.9
PO1
PO2
PO3
PO4
PO5
PO6
PO7
PO8
PO9
PO10
PO11
PO12
PSO1
PSO2
PSO3
Program Outcomes (POs) and Program Specific Outcomes (PSOs)

HOD-ME