M Tech Thermal Engineering

Program Outcomes and Course Outcomes

2.1. Establish the connect between the courses and POs

It is essential to establish standard process to identify extent of compliance of the curriculum for attaining the Program Outcomes (POs). This helps to identify curricular gaps, and can be used further to undertake improvement actions to bridge the same. This criterion describe the mapping of individual POs with courses, processes and tools, methodology that involed in calculation of attainment of individual POs with respect to individual courses.

POs as defined in Annexure-I

Pos	Courses*
PO1: An ability to independently carry out research /investigation and development work to solve practical problems.	• Mathematical Methods in Engineering (MHP 19001) • Fluid Dynamics (MHP 19003) • Refrigeration and Cryogenics (MHP 19005) • Modeling of IC Engines (MHP 19010) • Solar and Wind System Design (MHP-DE-19002) • Thermal Engineering Lab Practice I • Thermal Engineering Lab Practice II
PO2: An ability to write and present a substantial technical report/document	• Research Methodology and Intellectual Property Rights (ML 19013) • Liberal Learning Course (LL 19001) • Solar and Wind System Design (MHP-DE-19002) • Dissertation (Phase I (MHP 19012)and Phase II(MHP 19014) • Thermal Engineering Lab Practice I • Thermal Engineering Lab Practice II
PO3: Students should be able to demonstrate a degree of mastery over the area as per the	• Energy Conservation and Management (MHP-

specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program	DE-19001) • Nuclear Engineering (MHP-DE-19005) • Micro-fluidics (MHP-DE-19004) • Massive Open Online Course -I (MHP 19013) • Massive Open Online Course -I (MHP 19015) • Design of Heat Exchangers (MHP 19009). • Solar and Wind System Design (MHP-DE-19002) • Dissertation (Phase I (MHP 19012)and Phase II(MHP 19014)
PO4: To produce employable post graduate for industry and research establishments, in the field of heat transfer, fluid dynamics, heat exchanger design, refrigeration, cryogenics, air-conditioning, gas dynamics, gas turbines, and non-conventional sources of energy.	• Design of Thermal System (MHP-DE-19003) • Solar and Wind System Design (MHP-DE-19002) • Computational Fluid Dynamics (MHP 19008) • Heat Exchanger Design (MHP 19009). • Air Conditioning System Design (MHP-DE-19006) • Solar and Wind System Design (MHP-DE-19002) • Thermal Engineering Lab Practice I • Thermal Engineering Lab Practice II
PO5: To inculcate research culture with abilities to publish at national/international level and develop prototype technologies, in the domain of thermal and fluid sciences.	• Advanced Heat Transfer (MHP 19004) • Advanced Thermodynamics (MHP 19002) • Thermal Engineering Lab Practice I (MHP 19006) • Thermal Engineering Lab Practice II (MHP 19011) • Dissertation (Phase I (MHP 19012) and Phase II(MHP 19014) • Solar and Wind System Design (MHP-DE-19002) • Thermal Engineering Lab Practice I • Thermal Engineering Lab Practice II

PO6: To equip masters students with theskills of effective interpersonal communication andattitude of lifelong learning, needed to engage as leader in nurturing diverse teams, with commitment to their ethical and social responsibilities.	• Effective Technical Communication (ML 19014) • Interdisciplinary Open Course (MHP-19007) • Computational Fluid Dynamics (MHP 19008) • Heat Exchanger Design (MHP 19009). • Air Conditioning System Design (MHP-DE-19006) • Solar and Wind System Design (MHP-DE-19002) • Thermal Engineering Lab Practice I • Thermal Engineering Lab Practice II • Dissertation (Phase I (MHP 19012) and Phase II (MHP 19014)

Table: 2.1.1

2.2. Attainment of Program Outcomes

2.2.1. Describe the assessment tools and processes used to gather the data upon which the evaluation of Program Outcome is based

The following tools are used for assessment of the programme objectives of the programme

1. The attainment of the CO is prepared in the statistical manner using result analysis of Test 1 (T1), Test2 (T2), and End Semester Examination (ESE) of each course. The PO attainment obtained after calculating course outcome of each of the course.
2. The feedback of the students during semester, and at the end of the semester isobtained through well-established online feedback system of the institute.
3. Feedback of the alumni is also obtained to understand the satisfaction level of the students once they start their professional careers. This too is further quantified.
4. The PO attainment is finally obtained considering an average PO attainment through the above-mentioned tools of assessment of POs.

Tools and Processes:

- Students Regular Academic Evaluation Schemes: A continuous assessment comprising of three tests round-the–semester examinations (Test-1, Test-2 and End-Semester Examination) is carried out for each student for every theory and laboratory course. For assessing the hands-on skill of student, an industry expert is

appointed optionally, whereas, the project work/dissertation is mandatorily assessed by an external examiner.

- For every theory and laboratory course, students (in attending classes) are appealed to give mandatory feedback for course teachers on the scale of 1-3 on certain attributes, twice in a semester. The scores are used to improve the skills of concerned teachers towards learner satisfaction.
- The industries which visit campus for placements of students are requested to give written feedback about quality of job seekers, the skills/knowledge they lack etc. The feedback is passed on to the departments for modification of curriculum as per needs of industry. Special programs are designed for underperforming candidates for soft skill polishing, to raise employment percentage.
- Curriculum revision takes place with regular frequency with due participation of industry, senior alumni and academia (from reputed organizations such as IITs) realizing needs of time and technology, for making the learner meet targeted outcomes.
- Every individual teacher is appraised for his/her contributions as per internally developed appraisal format. With the individual scores added to department's assessment as an ensemble. The institute's scores are calculated by accumulating departments' scores, that indicate the magnitude of attainment of mission and goals which are set.
- The formal feedback process from younger alumni, parents/guardians, and employers is being done. Optional third-party audits, from eminent educationists and organizations have been conducted in the past. Making this a regular practice may accelerate the attainment of certain outcomes.

Program Objectives specified by course:

PO1	An ability to independently carry out research /investigation and development work to solve practical problems
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4	To produce employable post graduate for industry and research establishments, in the field of heat transfer, fluid dynamics, heat exchanger design, refrigeration, cryogenics, air-conditioning, gas dynamics, gas turbines, and non-conventional sources of energy.
PO5	To inculcate research culture with abilities to publish at national/international level and develop prototype technologies, in the domain of thermal and fluid sciences.
PO6	To equip masters students with the skills of effective interpersonal communication and attitude of lifelong learning, needed to engage as leader in nurturing diverse teams, with commitment to their ethical and social responsibilities.

Observations:

Programme Outcomes (POs) arecalculated based on the marks secured by the students and the feedback taken from the students for the course at the end of Semester. Presently, 90% weightage is given for the marks secured by the students and 10% for the feedback for calculation of attainment of Course Outcomes (COs) and Programme Outcomes (POs).

Sample CO-PO attainment sample calculations for Semester Icourse and Semester II course are given below:

Subject: Fluid Dynamics (A.Y. 2019-20 Semester I)

Course Objectives:

CO1	Student will be able to understand and define the fluid flow problems along with range of governing parameters
CO2	Student will be able to take up the fluid flow problems of industrial base.
CO3	Student will be able to devise the experiments in the field of fluid mechanics.
CO4	Student will be able to understand the flow patterns and differentiate between the flow regimes and its effects.

Programme Outcomes of the course:

PO1	An ability to independently carry out research /investigation and development work to solve practical problems
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4	To produce employable post graduate for industry and research establishments, in the field of heat transfer, fluid dynamics, heat exchanger design, refrigeration, cryogenics, air-conditioning, gas dynamics, gas turbines, and non-conventional sources of energy.
PO5	To inculcate research culture with abilities to publish at national/international level and develop prototype technologies, in the domain of thermal and fluid sciences.
PO6	To equip masters students with the skills of effective interpersonal communication and attitude of lifelong learning, needed to engage as leader in nurturing diverse teams, with commitment to their ethical and social responsibilities.

Mapping of Cos and POs, carried out by faculty as shown below:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	0	2	3	3	0
CO2	3	0	3	2	2	0
CO3	3	0	3	3	3	0
CO4	3	0	2	2	2	2

3 : High; 2 : Moderate; 1 : Low; 0 : No mapping

The average target PO attainment level is obtained by averaging as follows

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3.0	0	2.0	3.0	3.0	0
CO2	3.0	0	3.0	2.0	2.0	0
CO3	3.0	0	3.0	3.0	3.0	0
CO4	3.0	0	2.0	2.0	2.0	0
PO Level	3.0	0	2.5	2.5	2.5	0

Two types of attainment tools are used for calculation of CO attainment.

1. Direct Assessment Tool

It is calculated based on the performance of student in the examinations (Test 1, Test2 and End Semester Exam). A weightage of 90% is provided to this method of direct calculations of attainment.

Question papers are set according to the Course Objectives specified as defined earlier. After the examination, the marks for respective question is entered in the sheet as shown.

		Test_1						Test 2						End Semester Examination					
	CO (Keep BLANK if NO attainment)	1	-	-	4	-	-	-	2	-	4	-	-	-	2	3	4	-	-
MIS No.	Max. marks FOR each Question	12	0	0	8	0	0	0	8	0	12	0	0	0	16	14	30	0	0
121925001	Chaudhari Akshay S.	3	-	-	6	-	-	-	6	-	8	-	-	-	10	12	23	-	-
121925002	Chaudhari Rahul S.	5	-	-	8	-	-	-	4	-	10	-	-	-	8	7	25	-	-
121925003	Chitale Pushkar R.	6	-	-	7	-	-	-	4	-	4	-	-	-	7	11	20	-	-
121925004	Gadhave Dhiraj Manik	1	-	-	3	-	-	-	4	-	2	-	-	-	7	5	20	-	-
121925005	Ghodake Bharati R.	0	-	-	3	-	-	-	4	-	3	-	-	-	1	11	13	-	-

After this, the faculty enters the cutoff in the sheet

Average Marks			
LL (1)	60	51	60
ML (2)	65	61	65
HL(3)	65	>	70
NA(0)	45	<=	45
% CUT-OFF		45	PC

The CO attainment calculation method used based on the average marks entered as shown above. The attainment calculation is shown as below:

No. of students ABSENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of students who NOT attempted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of students who attempted	20	0	0	20	0	0	0	20	0	20	20	0	0	20	20	20	20	20	20
No. of students who got > 45 %	12	0	0	15	0	0	0	18	0	16	19	0	0	15	9	20	20	14	20
% of students who got > 45 %	60	-	-	75	-	-	-	90		80	95	-	-	75	45	100	100	70	0
Attainment: Cut off method	1	-	-	3	-	-	-	3	-	3	3	-	-	3	0	3	3	3	0
Net Attainment	2	0	0	3	0	0	0	3	0	3	3	0	0	3	0	3	3	3	0

2. Indirect Assessment Tool

It is calculated from the Course Exit Survey conducted after completion of every course where students give their feedback. 10% weightage is given to this method. The student needs to give rating on how he/she is agrees on the attainment of the COs in a particular course. The calculations are done in similar manner as Direct Assessment

Indirect Assesment Tools			
Course Exit Survey			
CES1	CES2	CES3	CES4
CO1	CO2	CO3	CO4
3	3	3	3
1.35	1.35	1.35	1.35
2.6	2.6	2.5	2.6
3	3	3	3
3	3	3	3
2	2	2	2
3	3	3	3
3	3	3	3
3	3	3	3

No. of students ABSENT	0	0	0	0	0	0	0
No. of students who NOT attempted	0	0	0	0	0	0	0
No. of students who attempted	20	20	20	20	20	20	20
No. of students who got > 45 %	12	15	18	16	10	16	19
% of students who got > 45 %	60	75	90	80	50	80	95
Attainment: Cut off method 1	1	3	3	3	1	3	3
Net Attainment	**1**	**3**	**3**	3	1	3	3

Total CO attainment is calculated as below

Total CO attainment = 0.9 x (CO attained through direct Assessment tool)

+

0.1 x (CO attained through indirect Assessment tool)

Further the average CO is calculated by averaging as shown below.

Total CO Attainment

	CO1	CO2	CO3	CO4	CO5	CO6
Direct	1.8	1.8	2.7	2.7	-	-
Indirect	0.3	0.3	0.3	0.3	-	-
	2.1	2.1	3	3	-	-

Total	**2.1**	**2.1**	**3**	**3**	**-**	**-**	**Avg. CO**	**2.55**

CO-PO attainment mapping

Actual attainment of PO by attainment of CO is calculated as shown

$$(CO1\text{-}PO1)\ \text{attained} = \frac{(CO1-PO1)\ targeted \times Average\ CO}{3}$$

Using this formula, the complete attainment matrix is filled as shown below

CO-PO Mapping Attainment

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
PO Level	3	0	2.5	2.5	2.5	0
CO1	1.2	0	0.8	1.2	1.2	0
CO2	2.1	0	2.1	1.4	1.4	0
CO3	3	0	3	3	3	0
CO4	3	0	2	2	2	0
Fluid Dynamics	**2.33**	**0**	**1.98**	**1.9**	**1.9**	**0**
PO Attainment %	77.7	0	79.2	76	76	0

$$\text{Respective PO Attainment \%} = \frac{PO\ attained \times 100}{PO\ targeted}$$

Subject: Heat Exchanger Design (A.Y. 2018-19 Semester II)

Course Objectives:

CO1	Student will be able to select the appropriate heat exchanger
CO2	Student will be able to estimate fouling rates according to design conditions
CO3	Student will be able to perform sizing and rating of heat exchangers for complicated designs
CO4	Student will be able to design, analyze and evaluate heat exchangers and use of commercial software
CO5	Student will be able to perform optimum design of heat exchangers

Programme Outcomes of the course:

PO1	An ability to independently carry out research /investigation and development work to

	solve practical problems
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4	To produce employable post graduate for industry and research establishments, in the field of heat transfer, fluid dynamics, heat exchanger design, refrigeration, cryogenics, air-conditioning, gas dynamics, gas turbines, and non-conventional sources of energy.
PO5	To inculcate research culture with abilities to publish at national/international level and develop prototype technologies, in the domain of thermal and fluid sciences.
PO6	To equip masters students with the skills of effective interpersonal communication and attitude of lifelong learning, needed to engage as leader in nurturing diverse teams, with commitment to their ethical and social responsibilities.

Mapping of Cos and POs, carried out by faculty as shown below:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	3	3	-
CO2	3	-	3	2	2	-
CO3	2	-	3	3	3	-
CO4	3	-	3	3	3	-
CO5	3	-	3	3	3	-

3 : High; 2 : Moderate; 1 : Low; 0 : No mapping

The average target PO attainment level is obtained by averaging as follows

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	3	3	-
CO2	3	-	3	2	2	-
CO3	2	-	3	3	3	-
CO4	3	-	3	3	3	-
PO Level	2.8	-	2.8	2.8	2.8	-

Two types of attainment tools are used for calculation of CO attainment.

1. Direct Assessment Tool

It is calculated based on the performance of student in the examinations (Test 1, Test2 and End Semester Exam). A weightage of 90% is provided to this method of direct calculations of attainment.

Question papers are set according to the Course Objectives specified as defined earlier. After the examination, the marks for respective question is entered in the sheet as shown.

		TEST_1						TEST_2						END SEM EXAM					
	Question Number																		
	CO (Keep BLANK if NO attainment)	1	2	-	-	-	-	-	2	3	-	-	-	-	-	3	4	5	-
MIS no.	Max. marks FOR each Question	10	10	0	0	0	20	0	5	15	0	0	20	0	0	20	20	20	60
121825001	AKSHAY BHIMASHANKAR PATIL	5	7	-	-	-	-	-	4	4	-	-	-	-	-	9	9	7	-
121825002	ASHWIN SUNIL RODE	2.5	9	-	-	-	-	-	4	7	-	-	-	-	-	10	15	15	-
121825003	BHARATKUMAR ROHIDAS KAMBLE	5.5	5	-	-	-	-	-	4	5	-	-	-	-	-	8.5	14	10	-
121825004	DADMAL HUTASHANI	6	7	-	-	-	-	-	0	1	-	-	-	-	-	12	6	11	-
121825005	HARISH MADAN SONAWANE	3.5	4	-	-	-	-	-	2	4	-	-	-	-	-	8	12	9	-
121825006	INDRAJEET NAMDEO PATIL	6	6	-	-	-	-	-	2	8	-	-	-	-	-	18.5	14	14	-
121825008	LANDE ANEEKET LAXMAN	**7.5**	**6**	**-**	**-**	**-**	**-**	**-**	**2**	**7**	**-**	**-**	**-**	**-**	**-**	**8**	**8**	**12**	**-**

After this, the faculty enters the cutoff in the sheet

Average Marks			
LL (1)	60	51	**60**
ML (2)	**65**	**61**	**65**
HL(3)	**65**	>	**70**
NA(0)	**45**	<=	**45**
% CUT-OFF		45	**PC**

The CO attainment calculation method used based on the average marks entered as shown above. The attainment is calculation is shown as below:

No. of students ABSENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of students who NOT attempted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

No. of students who attempted	15	15	0	0	0	0	0	15	15	0	0	0	0	0	15	15	15	0
No. of students who got > 45 %	7	13	0	0	0	0	0	6	3	0	0	0	0	0	9	11	11	0
% of students who got > 45 %	47	87	-	-	-	-	-	40	20	-	-	-	-	-	60	73	73	-
Attainment: Cut off method	1	3	-	-	-	-	-	0	0	-	-	-	-	-	1	3	3	-
Net Attainment	**1**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**0**

2. Indirect Assessment Tool

It is calculated from the Course Exit Survey conducted after completion of every course where students give their feedback. 10% weightage is given to this method. The student needs to give rating on how he/she is agrees on the attainment of the COs in a particular course. The calculations are done in similar manner as Direct Assessment.

Indirect Assesment Tools				
Course Exit Survey				
CES1	**CES2**	**CES3**	**CES4**	**CES5**
CO1	**CO2**	**CO3**	**CO4**	**CO5**
3	**3**	**3**	**3**	**3**
1.35	1.35	1.35	1.35	1.35
2.3	2.5	2.2	2.2	2.7
2	3	2	3	2
2	2	2	2	2
1	1	1	1	1
3	2	1	2	3
2	3	3	2	3
3	3	3	3	3

No. of students ABSENT	0	0	0	0	0	0	0
No. of students who NOT attempted	0	0	0	0	0	0	0
No. of students who attempted	15	15	15	15	15	15	15
No. of students who got > 45 %	7	13	6	3	9	11	11
% of students who got > 45 %	47	87	40	20	60	73	73
Attainment: Cut off method	1	3	0	0	1	3	3
Net Attainment	**1**	**3**	**0**	**0**	**1**	**3**	**3**

Total CO attainment is calculated as below:

Total CO attainment = 0.9 x (CO attained through direct Assessment tool) +

0.1 x (CO attained through indirect Assessment tool)

Further the average CO is calculated by averaging as shown below.

Total CO Attainment

CO1	CO2	CO3	CO4	CO5	CO6

Direct	0.9	2.7	0.9	2.7	2.7	-		
Indirect	0.3	0.3	0.3	0.3	0.3	-		
	1.2	3	1.2	3	3	-		
Total	**1.2**	**3**	**1.2**	**3**	**3**	**-**	**Avg. CO**	**2.28**

CO-PO attainment mapping

Actual attainment of PO by attainment of CO is calculated as shown

(CO1-PO1) attained = $\frac{(CO1-PO1)\ targeted \times Average\ CO}{3}$

Using this formula, the complete attainment matrix is filled as shown below;

CO-PO Mapping Attainment

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
PO Level	2.8	0	2.8	2.8	2.8	2.8
CO1	1.2	0	0.8	1.2	1.2	1.2
CO2	3	0	3	2	2	3
CO3	0.8	0	1.2	1.2	1.2	0.8
CO4	3	0	3	3	3	3
CO5	3	0	3	3	3	3
Heat Exchanger Design	**2.2**	**0**	**2.2**	**2.08**	**2.08**	**2.2**
PO Attainment %	78.6	0	78.6	74.3	74.3	78.6

Respective PO Attainment % = $\frac{PO\ attained \times 100}{PO\ targeted}$ Observations on attainment levels for each of thePOs.

2.2.2. POs attainment levels with observations (40) POsAttainment

The following table shows % of PO Attainment through Direct Assessment Tool:

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6
CAY 2019-20 Semester I & III							
MHP 19001	Mathematical Methods in Engineering	77.9	-	-	77.9	-	-
MHP 19002	Advanced Thermodynamics	81.3	-	-	79.8	79.2	-
MHP-DE-19001	Energy Conservation and Management	77.5	-	77.5	77.5	74.5	-
MHP-DE-19005	Nuclear Engineering	91.3	-	91.6	91.3	91.6	-
MHP 19003	Fluid Dynamics	77.7	-	79.2	76	76	-
MHP 19004	Advanced Heat Transfer	75.6	-	78.2	75.6	75.6	-
MHP 19005	Refrigeration and Cryogenics	83.3	-	-	85.8	81.3	-
MHP 19006	Thermal Engineering Lab Practice I	89.9	90	-	89.9	89.9	89.9
	Overall % of PO Attainment	**81.8**	**90.0**	**81.6**	**81.7**	**81.2**	**89.9**

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6
CAY 2019-20 Semester II& IV							
MHP-DE-19002	Solar and Wind System Design	82.8	76	77.5	77.5	74.2	-
MHP(DE)-19004	Micro-fluidics	85	-	85.2	85.3	85.3	-
MHP(DE)-19006	Air Conditioning System Design	94.9	-	-	95.2	95.2	-
MHP-19008	Computational Fluid Dynamics	81	-	80.8	80.4	81	82.2
MHP-19009	Heat Exchanger Design	78.6	-	74.3	74.3	74.3	-
MHP-19010	Modeling of IC Engines	90.7	-	90	90.4	87.3	-
MHP 19011	Thermal Engineering Lab Practice II	82.4	82.4	-	82.4	82.4	85
MHP 19012	Dissertation Phase-I	-	91.4	91.8	-	92.3	92.1
	Overall % of PO Attainment	**85.1**	**83.3**	**83.3**	**83.6**	**84.0**	**86.4**

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6
CAY 2018-19 Semester I & III							
MHP 19001	Mathematical Methods in Engineering	83.5	-	-	83.5	-	-
MHP 19002	Advanced Thermodynamics	79.5	-	-	77.9	81.2	-
MHP-DE-19001	Energy Conservation and Management	74.9	-	74.9	74.9	77.5	-
MHP-DE-19005	Nuclear Engineering	83.3	-	82.4	82.2	81.6	-
MHP 19003	Fluid Dynamics	80	-	78	76	76	-
MHP 19004	Advanced Heat Transfer	75.6	-	75.6	75.6	75.6	-
MHP 19005	Refrigeration and Cryogenics	87.3	-	-	87.6	86.9	-
MHP 19006	Thermal Engineering Lab Practice I	93.6	93	-	93.6	93.6	92.9
MHP 19012	Dissertation Phase-I: Experimental Work	-	90.2	90.2	-	90.2	90.2
	Dissertation Phase-I: Numerical Work	-	89.9	90	-	90	90
	Dissertation Phase-I: Experimental & Numerical Work	-	89.9	90	-	90	90
	Overall % of PO Attainment	**82.2**	**90.8**	**83.0**	**81.4**	**84.3**	**90.8**

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6
CAY 2018-19 Semester II& IV							
MHP-DE-19002	Solar and Wind System Design	86.7	82.6	83.5	83.5	86.7	-
MHP(DE)-19006	Air Conditioning System Design	76.1	-	-	76.5	76.5	-
MHP-19008	Computational Fluid Dynamics	76	-	77.5	72.3	76	79.2
MHP-19009	Heat Exchanger Design	78.6	-	78.6	74.3	74.3	-
MHP-19010	Modeling of IC Engines	85	-	83.8	83.8	80.7	-
MHP 19011	Thermal Engineering Lab Practice II	93.3	93.3	-	93.3	93.3	93
MHP 19014	Dissertation Phase-II: Experimental Work	-	91.2	91.7	-	91.4	91.4
	Dissertation Phase-II: Numerical Work	-	91.7	91.7	-	91.4	91.4
	Dissertation Phase-II: Experimental & Numerical Work	-	91.2	91.7	-	91.4	91.4
	Overall % of PO Attainment	**82.6**	**90.0**	**85.5**	**80.6**	**84.6**	**89.3**

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6
CAY 2017-18 Semester I & III							
MHP 19001	Mathematical Methods in Engineering	77.5	-	-	77.5	-	-
MHP 19002	Advanced Thermodynamics	82.7	-	82	81.6	81.2	-
MHP-DE-19001	Energy Conservation and Management	91	-	91	91	91	-
MHP-DE-19005	Nuclear Engineering	84.7	-	85.6	75	84	-
MHP 19003	Fluid Dynamics	73.7	-	74.4	73.2	73.2	-
MHP 19004	Advanced Heat Transfer	75.6	-	75.6	75.6	75.6	-
MHP 19005	Refrigeration and Cryogenics	80	-	-	81.5	78.7	-
MHP 19006	Thermal Engineering Lab Practice I	89.9	90	-	89.9	89.9	89.9
MHP 19012	Dissertation Phase-I:Experimental Work	-	90	90	-	90	90.2
	Dissertation Phase-I:Numerical Work	-	90	90	-	90	90.2
	Dissertation Phase-I:Experimental& Numerical Work	-	90	90	-	90	90.2
	Overall % of PO Attainment	**81.9**	**90.0**	**84.8**	**80.7**	**84.4**	**90.1**

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6
CAY 2017-18 Semester II& IV							
MHP-DE-19002	Solar and Wind System Design	64.8	70	72.3	72.3	68.7	-
MHP(DE)-19006	Air Conditioning System Design	86.1	-	-	85	85	-
MHP-19008	Computational Fluid Dynamics	79	-	82.5	75.8	79	40
MHP-19009	Heat Exchanger Design	80.7	-	80.7	80.7	80.7	-
MHP-19010	Modeling of IC Engines	72.1	-	70	74.6	67.9	-
MHP 19011	Thermal Engineering Lab Practice II	70	70	-	70	70	70
	Overall % of PO Attainment	**75.5**	**70.0**	**76.4**	**76.4**	**75.2**	**55.0**

Conclusions:

PO1: The Program Outcome reflects the ability of student to be able to carry out independent research investigation and development work to solve practical problems. Attainment of 81.51% is reported. Mostly, independent research is covered during their Project work and in some cases of Labs. This needs to be improved.

PO2: Technical report writing for the students is majorly evaluated during their Seminar and Project. Special courses 'communication skill' and 'research methodology' has been introduced to improve the report writing skill. Attainment is observed to be 85.68% for this PO and needs improvement.

PO3: This reflects the mastery of student in the field of Thermal Engineering. The overall attainment of 82.49% is reported. This attainment requires improvement.

PO4: This PO ensures the employability of student for industry and research establishments in the field of Thermal Engineering. The overall attainment level of 80.73% is reported. This also needs improvement.

PO5: This PO ensures ability of student to publish research papers at national / international level and to enhance research in thermal and fluid sciences. The attainment level of 82.28% is observed.

PO6: This PO ensures effective interpersonal communicationand attitude of lifelong learning,needed for leadership skills in context for commitment towards ethical and social responsibilities.The PO attainment of 83.58% is observed and it is necessary to increase it further through continuous improvement