
JSPM'S
JAYAWANTRAO SAWANT
COLLEGE OF ENGINEERING

Micro Level Mapping in OBE Process through PI Indicators

Chapter 1. List of POs (Program Outcomes)

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet t h e specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. 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.

5. Modern Tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. 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.

7. 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.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. 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.

11. 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.

12. 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.

Chapter 2. PI Calculator

PO	Competency	Contribution	Performance Indicator	Bloom Level	Wtg (CA)	CO1	PO1-1
Knowledge	1.1: Demonstrate competence in mathematical modelling	35	1.1. Apply the concept of Differential equations, Fourier series, vector calculus, Multiple integrals, linear algebra, and statistics required to solve simple engineering problems.	2,3	0.3	0	54.50
			1.1.2 Apply statistical methods like correlation, regression analysis in analyzing, interpreting experimental data and probability theory in testing and quality control.		0.3	0	
			1.1.3 Apply numerical methods to simulate and solve mechanical engineering problems		0.4	0	
	1.2: Demonstrate competence in basic sciences	10	1.2.1 Describe the basics of engineering physics, chemistry and connect them to few engineering applications.		1	1	
	1.3: Demonstrate competence in engineering fundamentals	15	1.3.1 Explain fundamental concepts of electronics, mechanical, civil, electrical and computer engineering to solve engineering problems.		0.3	1	
			1.3.2 Apply the basic concepts of engineering drawing to develop drawings of engineering components.		0.3		2
			1.3.3 Describe fundamental principles of engineering mechanics to calculate various forces under static and dynamic conditions of mechanical systems and building structures.		0.3		
			1.3.4 Apply computer programming logic to solve simple real-world problems		0.1		
	1.4: Demonstrate competence in specialized engineering knowledge to the program	40	4.1 Describe basic and advanced manufacturing and machining processes along with various quality measures used in mechanical industries.		1		
			1.4.2 Explain the use of fundamental laws of thermodynamics, fluid mechanics and heat transfer to mechanical systems		1	1	
			1.4.3 Explain basic concepts of metallurgy and related material testing techniques.		1		
			1.4.4 Apply suitable expressions/formulae to determine dimensions and strength of machine elements and mechanisms of various machines.		1		
			1.4.5 Apply principles/ computational techniques to solve the complex engineering structural and flow problems		1		

Mapping strength (%)=Competency (%)* Weightage of PI* Mapping index

Chapter 3. CO (Course Outcomes)

C401	**Heating, Ventilation, Air Conditioning and Refrigeration**
C401.1	**ANALYSE** different air-craft refrigeration systems and EXPLAIN the properties, applications and environmental issues of different refrigerants.
C401.2	**ANALYSE** multi pressure refrigeration system used for refrigeration applications.
C401.3	**DISCUSS** types of compressors, condensers, evaporators and expansion valves along with regulatory and safety controls and DESCRIBE Transcritical and ejector refrigeration systems.
C401.4	**ESTIMATE** cooling load for air conditioning systems used with concern of design conditions and indoor quality of air.
C401.5	**DESIGN** air distribution system along with consideration of ventilation and infiltration.
C401.6	**EXPLAIN** the working of types of desiccants, evaporative, thermal storage, radiant cooling, clean room and heat pump systems.

Chapter 4. List of Unmapped PIs

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1.1.2 1.1.3 1.3.2 1.3.4 1.4.1 1.4.3 1.4.4 1.4.5	2.2.12 .2.22. 2.32.2 .42.4. 2 2.4.4	3.1.2 3.1.3 3.1.4 3.1.5 3.1.6 3.2.1 3.2.2 3.3.3 3.3.1 3.3.2 3.4.1 3.4.2	4.2.1 4.2.2 4.3.2 4.3.4	5.1.1 5.1.2 5.2.1 5.2.2 5.3.1 5.3.2	6.1.1 6.2.1	7.1.1 7.1.2 7.2.1 7.2.2	8.1.1 8.2.1 8.2.2	9.1.1 9.1.2 9.2.2 9.2.3 9.3.1	10.1.3 10.2.1 10.3.1 10.3.2	11.1.1 11.1.2 11.2.1 11.3.1 11.3.2	12.1.2 12.2.1 12.2.2 12.3.1 12.3.2

Chapter 5. Gap Analysis

Sr. No.	Content beyond syllabus	Action Taken	Date-Month-Year	Resource Person with designation	% of students	Relevant COs	Improvement/ Addition in PIs.
1	Real world/practical relevance of content	Unit wise quiz through game pedagogy	Aug.-Oct. 2022	Teacher	100%	All COs	5.1.1, 5.2.2
2	Validation of results using simulator	Extended objective of Performance Simulation of Central Air-conditioning plant using Newton Raphson Method	Aug.2022	Teacher	100%	CO4	1.1.2, 2.2.4, 2.3.1, 2.4.4, 5.1.2
3	Validation of results using simulator	Extended objective of Performance analysis of Counter flow or cross flow cooling tower. (Theoretical/Practical)	Sept.2022	Teacher	100%	CO3	2.2.4, 2.3.1, 2.4.4, 5.1.2
4	Validation of results using simulator	Extended objective of Design of cold storage with process layout.	Sept.22	Teacher	100%	CO3	2.2.4, 2.3.1, 2.4.4, 5.1.2

Sr. No.	Content beyond syllabus	Action Taken	Date-Month-Year	Resource Person with designation	% of students	Relevant COs	Improvement/ Addition in PIs.
5	Comparative analysis of refrigeration system using Cool pack software	Extended objective of exp. analysis of VCC by Cool pack software.	Oct.22	Teacher	100%	CO2	2.4.3, 2.4.4
6	Simulation and analysis of a novel liquid desiccant air-conditioning system	PBL/Mini-project	Jan.22	Self-study with teacher's guidance	Project batch	CO6	2.2.2,2.4.3, 3.1.1,3.1.3, 3.2.1,4.1.3, 5.2.1,8.2.2, 9.2.1,9.2.2, 9.2.3,9.3.1, 10.1.1,10.1.3, 10.2.2,11.3.1, 12.2.1,12.2.2, 12.3.1

Chapter 6. Addressing Unmapped PIs through Moodle Activities

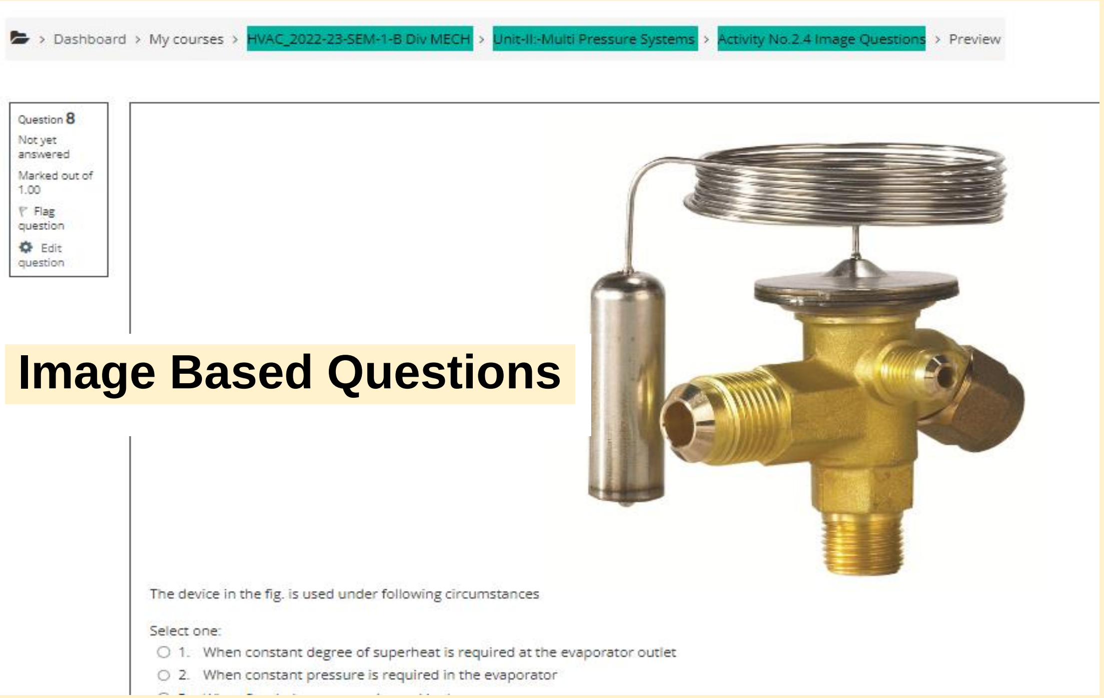
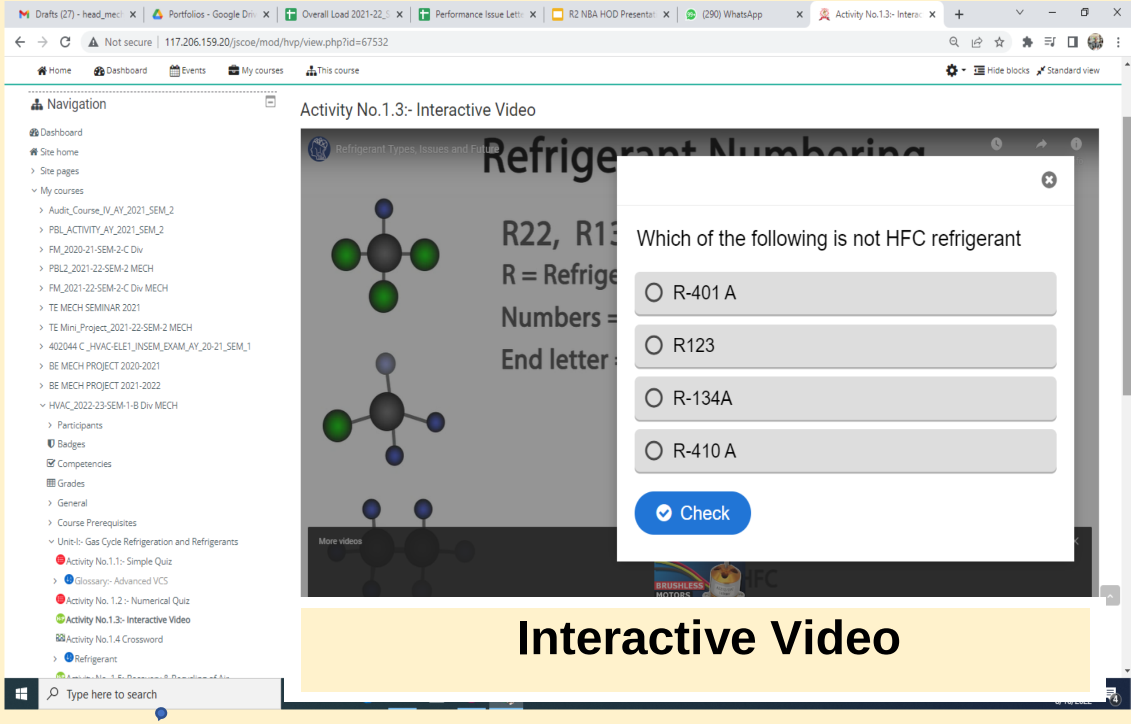


Image Based Questions



Interactive Video

5.1.1 Identify modern engineering tools such as ICT, computer aided drafting, modeling and analysis; techniques and resources for engineering activities

5.2.2 Demonstrate proficiency in using discipline specific tools

<u>Mapping strength increased to 40%</u>

Performance Simulation of Central Air-conditioning plant using Newton Raphson Method.

REFRIGERANT COMPRESSOR DATA

Refrigerant- HFC 134a

Cooling Capacity					Compressor Power					
TL	**TH**	**QL**			**TL**	**TH**	**HR**	**W**		
12.50	30	59171			12.50	30	67900	8729		
7.5	30	49185			7.5	30	57600	8415		
5	30	44680			5	30	52900	8220		
0	30	36579			0	30	44400	7821		
-5	30	29604			-5	30	36900	7296		
-10	30	23650			-10	30	30400	6750		
-15	30	18613	22016.45	18.28534	-15	30	24800	6187	5740	-7.22483
-20	30	14389	16711.96	16.144	-20	30	19900	5511	4989.55	-9.46199
-25	30	10873	11407.47	4.915571	-25	30	15600	4727	4239.1	-10.3216
-30	30	7961	6102.98	-23.339	-30	30	12000	4039	3488.65	-13.6259
12.50	40	52165	47485.65	-8.9703	12.50	40	62600	10435	10772.98	3.23886
7.5	40	43231	42181.16	-2.42845	7.5	40	53200	9969	10022.53	0.536914
5	40	39210	39528.91	0.813338	5	40	48900	9690	9647.3	-0.44066
0	40	31998	34224.42	6.957997	0	40	41100	9102	8896.85	-2.2539
-5	40	25804	28919.93	12.07538	-5	40	34200	8396	8146.4	-2.97284
-10	40	20522	23615.44	15.07377	-10	40	28200	7678	7395.95	-3.67348
-15	40	16050	18310.95	14.08692	-15	40	22900	6850	6645.5	-2.9854
-20	40	12282	13006.46	5.898551	-20	40	18300	6018	5895.05	-2.04304

$Q_L = 1060.898\ T_L - 370.55 T_H + 49046.42$

$W = 150.09\ T_L + 90.55 T_H + 5274.85$

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.979581
R Square	0.959579
Adjusted R	0.956585
Standard E	3208.178
Observatic	30

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	2	6.6E+09	3.3E+09	320.4859	1.55E-19
Residual	27	2.78E+08	10292403		
Total	29	6.88E+09			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	49046.42	2948.604	16.63378	1.03E-15	42996.38	55096.45
TL	1060.898	42.80425	24.78488	4.16E-20	973.0712	1148.725
TH	-370.55	71.73703	-5.16539	1.95E-05	-517.742	-223.358

Extended Objectives 1

Formulate problem statement from actual data :- Develop equations using Compressor catalog.

1.1.2 Apply statistical methods like correlation, regression analysis

Performance Simulation of Central Air-conditioning plant using Newton Raphson Method.

Performance Analysis of Chilled water air-conditioning plant

Problem Statement

The performance data of chilled water air-conditioning plant in the given operating range is given below;

UA value Condenser	UA value Evaporator	Cooling water flow rate	Chilled water flow rate	Temperature			
				Condenser in	Condenser out	Chiller water in	Chilled water out
W/K	W/K	kg/s	kg/s	(^{0}C)	(^{0}C)	(^{0}C)	(^{0}C)
20700	23840	8.05	7.2	30	NA	11	NA

Refrigerating Capacity $Q_L = 49046.42 + 1060.898T_L - 370.55T_H$

Power Consumption $W = 5274.84 + 150.09T_L + 90.55T_H$

Find the temperature of cooling water leaving the condenser and chilled water leaving the evaporator, power consumption, cooling capacity and COP of the system.

Final Performance Parameters		
Cooling water outlet temperature	31.63	C
Chilled water outlet temperature	9.50	C
Evaporating Temperature	8.25	C
Condensing Temperature	33.55	C
Work Input	9.55	kW
Cooling Capacity	37.41	kW
COP	3.92	

Extended Objectives 2 :- Compare the results with the help of simulator

2.2.4 Compare and contrast alternative solution processes

Chapter 8. Addressing Unmapped PIs through Student Activities

Investigation of viscosity degradation of lubricating oil used in vehicle

3.1.1 Understands the nature of the complex/open-ended engineering problems

3.1.4 Extract engineering requirements from relevant engineering Codes and Standards such as ASME, SAE, ISO and ASHRAE.

2.2.2 Identify, assemble and evaluate information and resources.

2.4.3 Predicts and justifies problem outcomes.

Chapter 9. Enrichment