Department of Mechanical Engineering
Academic Year 2021 – 2022 (Even Semester)

Degree, Semester & Branch: IV Semester B.E. Mechanical Engineering
Course Code & Title: ME8493 Thermal Engineering - I
Name of the Faculty member(s): Dr.V.Sivakumar, ACSP/ Mechanical
Mr.M.Ashok Kumar, AP (SG)/Mechanical

Innovative Practice Description

- **Unit / Topic: Unit – I / Change in air standard efficiency with respect to cut-off ratio**
- **Course Outcome:** CO1 – The students will be able to apply thermodynamic concepts for different air standard cycle and solve problems.

Topic Learning Outcome: TLO 3: Derive the expression for air standard efficiency and Mean Effective Pressure for the Otto, Diesel, Dual and Brayton cycle.

- **Activity Chosen:** Software tool used
- **Justification:** The change in efficiency with respect to compression ratio in Otto cycle and with respect to cut-off ration in Diesel cycle can be visualize by the students while using a software tool like MATLAB.
- **Time Allotted for the Activity:** 15 min

Details of the Implementation:

In internal combustion engine the heat energy is converted into work energy. Diesel engine follows the diesel cycle and the heat added in diesel cycle by constant pressure process. During constant pressure heat addition there is a volume change in the cylinder of the engine, this volume ration is during the constant pressure heat addition is called cut-off ratio. The air standard efficiency of the diesel engine is mainly depends on two variables Compression ratio and cut-off ratio. In order to understand the change in air standard efficiency with respect to cut-off ratio, the air standard efficiency has to be calculated for the different cut-off ratio manually and it is time consuming. So make the students to understand the concept of air standard efficiency variation in the diesel engine with respect to the cut-off ration, we encourage our students to calculate the air standard efficiency of diesel cycle with respect to the cut-off ratio by using MATLAB coding. Compression ratio is an important parameter which is influenced on the air standard efficiency in both petrol engine and diesel engine. So the students are encouraged to visualize change in air standard efficiency with change in compression ratio using MATLAB coding.

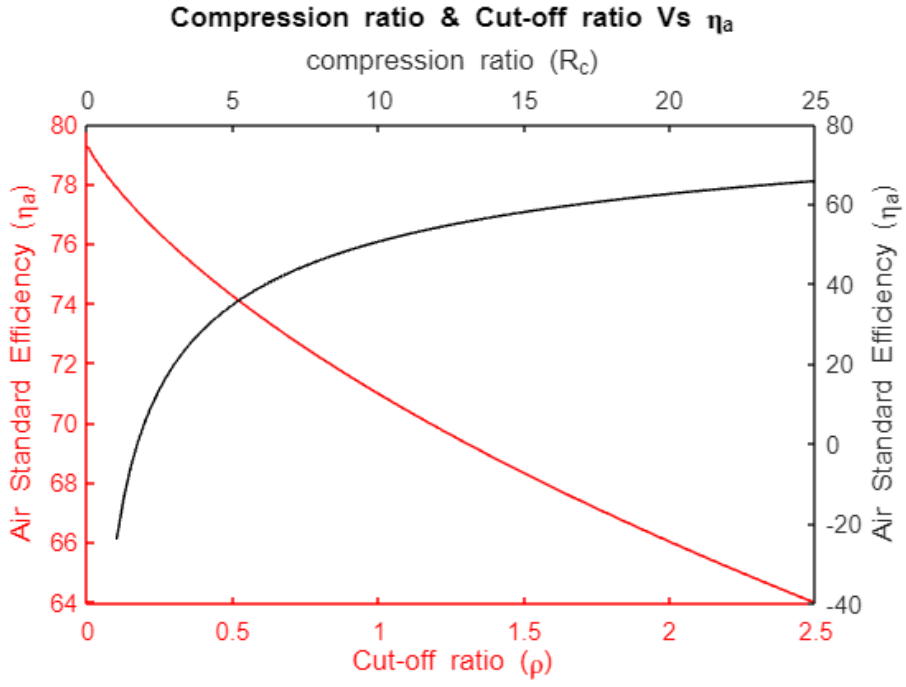
Problem Statement

Draw the graph Cut-off ratio Vs. Air standard efficiency for the diesel cycle using MATLAB Coding.

MATLAB Program:

```
gamma = 1.4;
x1 = linspace(0,2.5,100);
y1 = (1-((1/22.^(gamma-1)).*(1/gamma).*((x1.^gamma)-1)./((x1)-
1)))*100;
x2 = linspace(1,25,100);
y2 = (1-((1./x2.^(gamma-1)).*(1/gamma).*((2.5.^gamma)-1)./((2.5)-
1))).*100;
t = tiledlayout(1,1);
ax1 = axes(t);
plot(ax1,x1,y1,'-r')
ax1.XColor = 'r';
ax1.YColor = 'r';
ax2 = axes(t);
plot(ax2,x2,y2,'-k')
ax2.XAxisLocation = 'top';
ax2.YAxisLocation = 'right';
ax2.Color = 'none';
ax1.Box = 'off';
ax2.Box = 'off';
xlabel(ax2,'compression ratio (R_c)')
ylabel(ax2,'Air Standard Efficiency (\eta_a)')
xlabel(ax1,'Cut-off ratio (\rho)','Color','r')
ylabel(ax1,'Air Standard Efficiency (\eta_a)','Color','r')
title('Compression ratio & Cut-off ratio Vs \eta_a')
```

Output:



PO / PSO mapping for the activity:

Innovative Practice	PO1	PO2	PO5	PSO3
Level of mapping	3	3	1	3
Justification for correlation	To solve the problem the student will apply the mathematical, science and engineering fundamentals – Level 3	Derive the formula using mathematics, natural science and engineering science to calculate the performance parameters – Level 3	To explain the relationship between compression ratio and air standard efficiency using MATLAB – Level 1	Calculate the performance parameters of Gas power cycles – Level 3

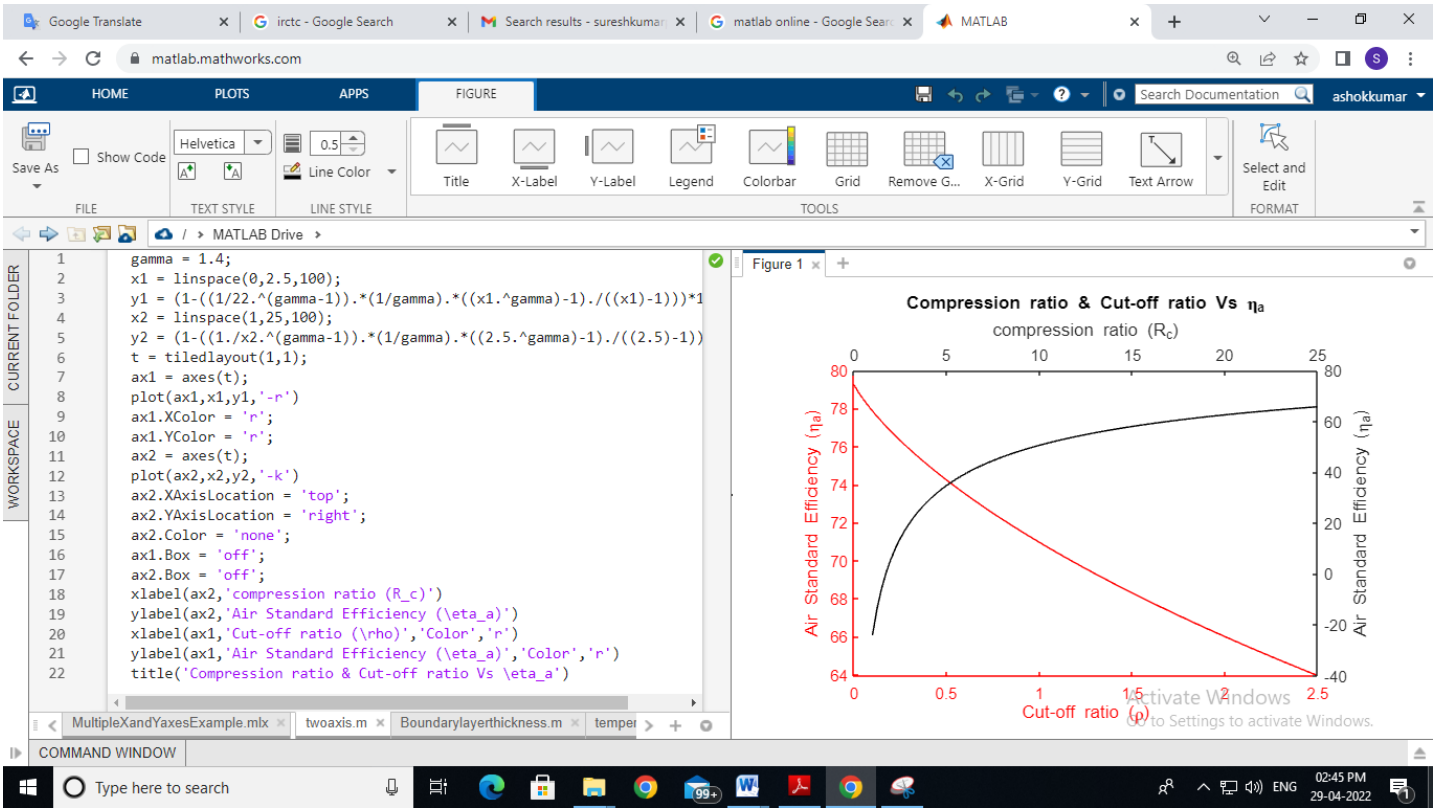
(1 – Low 2 – Moderate 3 – High)

CO – PO / PSO mapping:

CO	PO1	PO2	PO5	PO9	PSO3
CO1	3	3	1	1	3

(1 – Low 2 – Moderate 3 – High)

- **Images / Screenshot of the practice:**



Reflective Critique:

- ***Feedback of practice from students and other stakeholders:*** *(samples to be enclosed)*
  Feedback received from students and the sample is enclosed

- ***Benefit of the practice:*** The students can be easily visualize the change in thermal efficiency with respect to change in influence parameter in Otto and Diesel cycle.

- ***Whether the practice is adopted in any of the courses early: Yes***
  (If yes provide the details and the modifications you have adopted)

A new program is developed by using the command linspace and plot in MATLAB and the change in efficiency with respect to the different parameter fit in one graph is not adopted in other courses which is adopted in this course thermal engineering – I first time.

- **Challenges faced in implementation:** Nil

- **References:**

  - Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V., "A course in thermal Engineering", Fifth Edition, "Dhanpat Rai & sons , 2016.

  - Rao V. Dukkipati., "MATLAB for Mechanical Engineers", First edition, New Age International Publishers, 2008.

CO1: Student will be able to apply thermodynamic concepts of different air standard cycles and solve problems.

Signature of Faculty Member **HOD**

Thermal Engineering - I - Student feedback on Innovative Practice

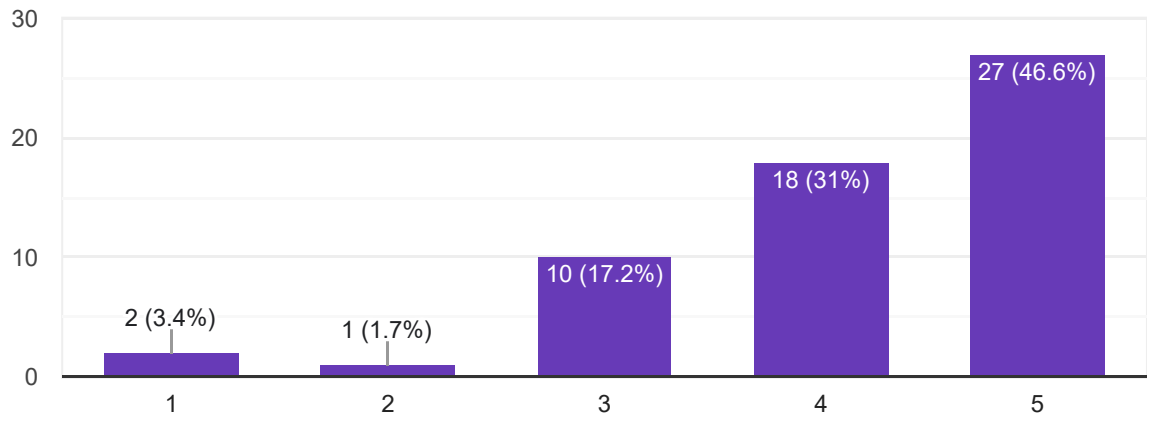
58 responses

Publish analytics

Instructor clarifies difficult aspects of this innovative activity

Copy

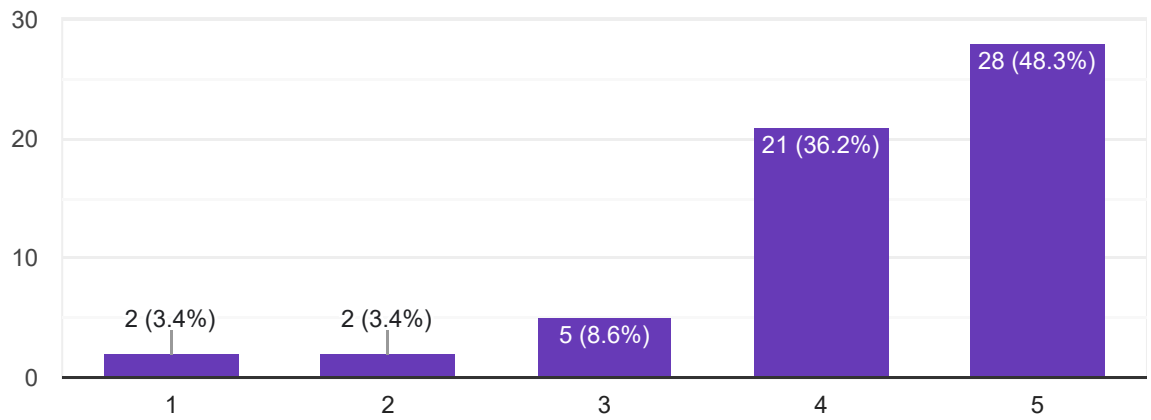
58 responses



This innovative activity improves my opinion about the content of the subject

Copy

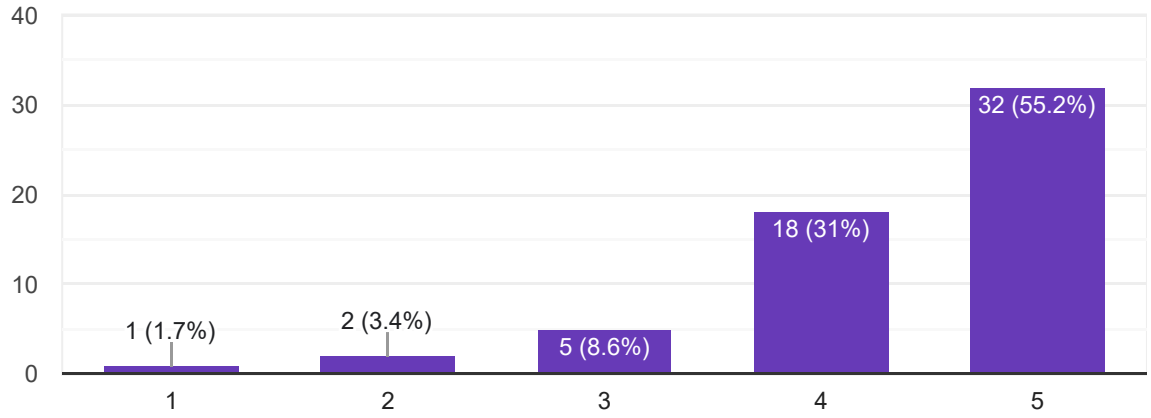
58 responses



I find new information about the topics and subjects using new technologies.

Copy

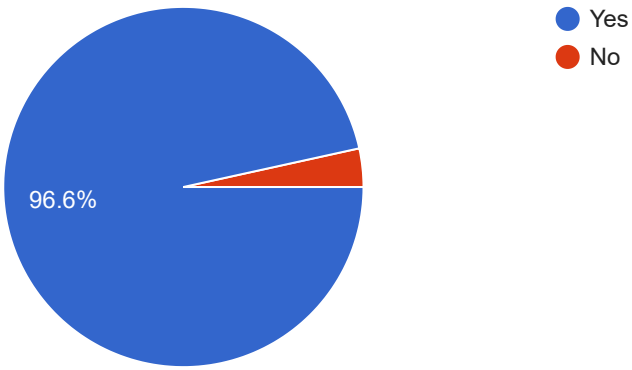
58 responses



I suggest this innovative practice to teach the topic for forthcoming students

Copy

58 responses



This innovative activity builds any self-confidence to understand the content of the delivery.

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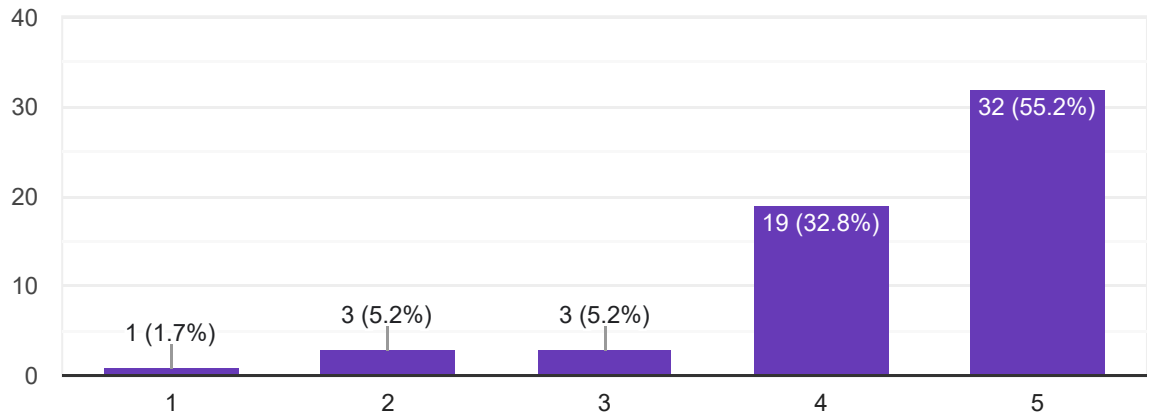
58 responses



The most useful thing/skill I learned from this activity was…

58 responses

Good

To solve problems

Thermal relative knowledge

Useful

Boiler

Study

.

Yes

Self practice

Thermal relations.basic concepts

We'll and good

Actual pv diagram

Well and good

Innovative practice

Some basics

Proceed the problems without fear

Very good

INTERPULATION

Very use fully

To gather knowledge about tha thermal power engines

Basics

I have gathered some knowledge about termal engines

It's very useful

Basics

90% understand

i can solve problems in thermal engineering 1

Nill

Learning the basics of engine and parts

It is used to develop our imagination during study

Electric vehicles

New innovative ideas

I learn some practical knowledge before studying theory thermal engineering

Communication is must

I learn practical knowledge before studying theory thermal engineering

I can realise the actual work conditions of engines and compressor

Impriving our knowledge

I can learn visually in lab it useful us

New innovitie

I learned lot of mechanical components &engine works.

I am able to learn well better in the lab than the class

I learned about mechanical compound of engine working

More

I learned about 4 & 2 stroke engine working clearly

This innovative activity builds any self-confidence to understand the content of the delivery

Very nice

Inovative topics

Basic of engine