MPE

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Program: B. Sc. in ME
Semester: 1st

Date: 8 April, 2026
Time: 2:30 pm – 4:30 pm

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Semester Final Examination
Course Number: ME 4101
Course Title: *Introduction to Mechanical Engineering*

Winter Semester: 2024 - 2025
Full Marks: 120
Time : 2 Hours

There are 04 (Four) Questions. Answer all of them.

Marks in the Margin indicate full marks. Don't write on this question paper. Symbols carry their usual meanings. **Assume reasonable values for any missing data**. Programmable calculators are not allowed.

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1. **(a)** Describe a four-stroke gasoline engine with an illustration of each stroke and a schematic of the valve timing diagram. **[10+8+12]**

(CO3)
(PO1)
WK1-WP1

(b) Discuss the primary differences between gasoline and diesel engines.

(c) Draw a schematic of an internal combustion engine, label key components and terminologies and explain their functions.

2. **(a)** Describe the working principle of the Vapor Compression Refrigeration System (VCRS). Also explain the role and function of the main components involved in the refrigeration cycle and support your explanation with appropriate diagrams. **[15+15]**

(CO2)
(PO1)
WK1-WP1

(b) On a cold winter morning, a student walking across the IUT campus notices several everyday phenomena: the skin on their hands becomes dry and cracked during the winter season, sweat seems to cool the body much better on dry days than on humid days and tiny water droplets appear on the grass in the early morning. These common observations can be understood using the principles of psychrometric processes.
Using the concepts of psychrometry, discuss the reasoning behind the following phenomena:

i. Dryness and cracking of human skin during winter.
ii. More effective cooling of the human body by sweating in dry weather compared to humid weather.
iii. Formation of dew on grass during the early morning.

3. **(a)** In a gear transmission system, maintaining a constant velocity ratio between the driving and driven gears is essential for smooth power transmission. **[10+5+15]**

i. Based on this requirement, state the law of gearing that ensures constant velocity ratio between two meshing gears. **(CO4) (PO1) WK1-WP1**

ii. Using this concept, explain the principle of gear overdrive and gear reduction and discuss situations where each of them is practically applied in mechanical systems.

(b) A helical gear is mounted on a rotating shaft that must be properly supported during operation. Considering the forces generated by the gear, identify the suitable type of bearing to support the shaft and explain the justification for its selection.

(c) Differentiate between lower pair and higher pair. Explain the degrees of freedom for various lower pairs and determine the degrees of freedom of ***Figure 1***.

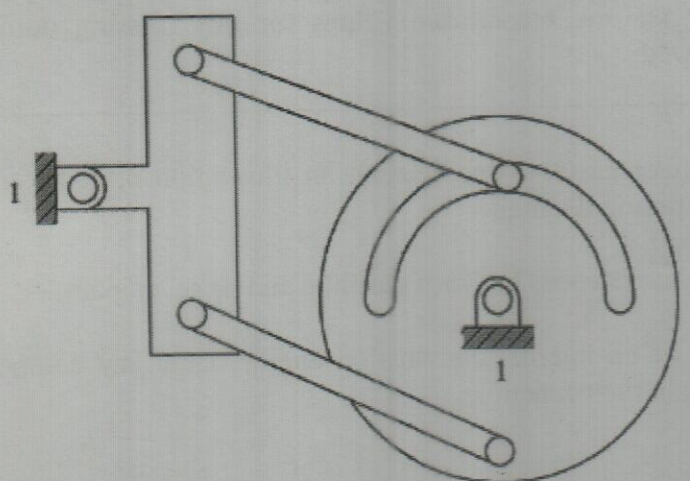


Figure 1

4. **(a)** Explain the pressure and velocity distribution graph of both Impulse and Reaction Turbine. **[8+10+12]**

(CO2) (PO1) WK1-WP1

(b) Describe the working mechanism of different positive displacement pumps.

(c) Discuss the onset of cavitation and the role of NPSHr to prevent cavitation.