Program: B. Sc. in Electrical & Electronic Engineering
Semester: 3rd

Date: 6 October, 2023
Time: 2:30 pm – 4:00 pm

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid Semester Examination
Course Number: MCE 4391
Course Title: Basic Mechanical Engineering (EEE)

Winter Semester: 2022 - 2023
Full Marks: 75
Time: 1 Hour 30 Minutes

There are **three** questions. Answer **all the** questions. The symbols have their usual meanings. Marks of each question and the corresponding CO and PO are written on the right side. Assume a reasonable value of missing data.

1.	a.	Differentiate between point and path functions by providing suitable examples. Provide a mathematical justification of 'Energy' being a point function.	5	CO2 PO1 PO2
	b.	Mathematically prove that the heat transfer in the constant pressure process is equal to the change of enthalpy.	5	CO2 PO1 PO2
	c.	A piston-cylinder contains 0.15 kg of air at an initial 2 MPa and 350^{0}C state. The air is first expanded isothermally until the pressure drops to 500 KPa. Then it is compressed again using the general law ($PV^{1.2}$=Constant) up to the initial pressure level. Finally, the system is brought back to its original state by compressing it in constant pressure. (i) Illustrate the corresponding P-V diagram showing all three state points and processes. **(4 marks)** (ii) Determine P, V, and T at each state. **(6 marks)** (iii)Calculate the total work done. **(5 marks)**	15	CO2 PO1 PO2
2.	a.	Illustrate 'Bomb Calorimeter' and explain how to calculate HCV and LCV by using the device. (10 marks) The following data were recorded during an experiment to find the calorific value of a coal sample. a. Mass of coal burnt = 1000 mg b. Mass of water in the calorimeter = 1.020 kg c. Water equivalent of the calorimeter = 170 g d. Initial temperature of water = 25.3^{0}C e. Final temperature of water = 28.2^{0}C	15	CO1 PO2

f. **Cooling correction = -0.015**

Determine the higher calorific value of the sample of the coal. If the fuel used contains 8% of hydrogen, calculate its lower calorific value as well. **(5 marks)**

b.	A sample of coal has the following composition by mass: Carbon 75%; hydrogen 6%; oxygen 8%; nitrogen 2.5%; Sulphur 1.5%: and ash 7%. Calculate its higher and lower calorific values per kg of coal using Dulong's formula.	**5** **CO1** **PO2**
c.	State the merits and demerits of gaseous fuel.	**5** **CO1** **PO2**
3. a.	Illustrate the sequence of operation of four stroke SI engine and identify the key differences of this type of engine with CI engine. **(5 marks)** Demonstrate a side-by-side comparison of the indicator diagram of SI and CI engine. **(5 marks)**	**10** **CO3** **PO1**
b.	Graphically represent the non-uniformity of force and fluctuating nature of power with time in a single cylinder four stroke engine. State how this problem is solved in a four-cylinder four stroke engine.	**7.5** **CO3** **PO1**
c.	Evaluate the necessity of firing order in a four-cylinder engine with a firing order of **1-3-4-2**. **(5 marks)** Analyze what will happen when Diesel is given gasoline engine and vice-versa. **(2.5 marks)**	**7.5** **CO3** **PO1**