



Daffodil International University
Department of Electrical and Electronic Engineering
Faculty of Engineering
Final Examination, Spring-2025

Course Code: 0715-121
Section: A, B, C, D, E, F
Full Marks: 40

Course Title: Basic Mechanical Engineering
Level-Term: L1-T2
Exam Date: June 18, 2025
Teacher's Initial: SS
Time: 2 Hours

[Notes: All of the questions are Compulsory]

- Q1.** (a) **Discuss** the comparative advantages and disadvantages of Split-type and Window-type air conditioners. CO-3 [3]
(C1)
- (b) On a certain day, the dry and wet bulb temperatures are measured 33 °C and 27 °C respectively. **Determine** using the Psychrometric Chart: CO-3 [5]
(C2)
- (i) The absolute humidity
(ii) The relative humidity, and
(iii) The dew point temperature of air.
- Q2.** (a) **Define:** CO-1 [2]
(C1)
- i) Clearance Volume
ii) Valve Overlap
- (b) **Draw** (i) the Actual Indicator Diagram and (i) the Valve Timing Diagram of a 4-stroke CI Engine with proper identifications. **Show** the valve overlap position on the Valve Timing Diagram. CO-1 [6]
(C2)
- With the help of the diagrams, **Illustrate** the working principle of a 4-stroke CI Engine.
- Q3.** (a) We know that theoretically the efficiency of IC engines increases when the compression ratio is increased, why don't we increase this ratio too much? **Explain.** CO-1 [4]
(C2)
- (b) A four-cylinder two-stroke engine with a compression ratio $r = 8$ produces a torque of 1000 Nm at a speed of 1200 rpm. It has a square cylinder with a bore of 160 mm. **Determine:** CO-1 [4]
(C2)
- i. The displacement volume and the clearance volume of one cylinder.
ii. The engine brake work, and mean piston speed.
- Q4.** (a) **Describe** the factors that affect knocking in SI engines. CO-1 [2]
(C1)
- (b) In a Diesel cycle, Compression begins at 0.18 MPa, 35° C. The heat added is 1.75 MJ/kg and the compression ratio is 17. **Determine:** CO-1 [6]
(C2)
- (i) the maximum temperature in the cycle,
(ii) work done per kg of air
(iii) the cycle efficiency
(iii) the temperature at the end of the isentropic expansion

(iv) the cut-off ratio, and

(v) the MEP of the cycle.

(C_p and C_v of air are 1.005 and 0.718 kJ/kg.K, respectively, and Gas Constant of Air, $R = 287$ J/kg. K)

- Q5.** (a) **Describe** the working principle of the Vapor Compression Refrigeration Cycle with proper diagram. CO-3 [3]
(C1)
- (b) A simple vapor compression refrigeration cycle uses refrigerant-134a as the working fluid and operates between 0.16 and 1 MPa. If the mass flow rate of the refrigerant is 0.07 kg/s, **Determine:** CO-3 [5]
(C2)
- the rate of heat removal from the refrigerated space and the power input to the compressor,
 - the rate of heat rejection to the environment, and
 - the COP of the refrigerator.