



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  $33^{\circ}\text{C}$  and  $27^{\circ}\text{C}$  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. CO-1 [4]  
(C2)
- Determine:**
- 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  $0.18\text{ MPa}$ ,  $35^{\circ}\text{C}$ . The heat added is  $1.75\text{ MJ/kg}$  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)

- i. the rate of heat removal from the refrigerated space and the power input to the compressor,
- ii. the rate of heat rejection to the environment, and
- iii. the COP of the refrigerator.