Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY/ JUNE 2025

Date: 04-06-2025 **Time:** 01:00 pm – 04:00 pm

School: SOE	**Program:** B.Tech.	
Course Code: MEC4003	**Course Name:** Applied Thermodynamics	
Semester: IV	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	24	24	26	26	--

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Define Compression Ratio.	**2 Marks**	**L1**	**CO1**
2.	What is explosion ratio? Explain.	**2 Marks**	**L1**	**CO1**
3.	Define work ratio.	**2 Marks**	**L1**	**CO2**
4.	Write the expression for thermal efficiency of a gas turbine cycle.	**2 Marks**	**L1**	**CO2**
5.	Define dry steam.	**2 Marks**	**L1**	**CO3**
6.	Draw the P-v and T-s diagrams of Rankine cycle.	**2 Marks**	**L1**	**CO3**
7.	What is a regeneration cycle/ Explain.	**2 Marks**	**L1**	**CO3**
8.	Define Psychrometry.	**2 Marks**	**L1**	**CO4**
9.	Define COP.	**2 Marks**	**L1**	**CO4**
10.	Define Ton of Refrigeration.	**2 Marks**	**L1**	**CO4**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Derive an expression for air standard efficiency of a Diesel Cycle in terms of compression ratio and cutoff ratio.	**10 Marks**	**L2**	**CO1**
	b.	An engine of 250 mm bore and 375 mm stroke works on constant volume cycle. The clearance volume is 0.00263 m^3. The initial pressure and temperature are 1 bar and 50°C respectively. If the maximum pressure is 25 bar, find air standard efficiency of cycle and mean effective pressure if the work done is 2000 kJ.	**10 Marks**	**L3**	**CO1**
		Or			
12.	**a.**	State the important differences between Carnot, Otto, Diesel, and Dual cycles with proper P-V diagrams.	**10 Marks**	**L2**	**CO1**
	b.	An air standard Diesel cycle has compression ratio of 16. At the beginning of isentropic compression, the temperature is 15°C and the pressure is 0.1 MPa. Heat is added until the temperature at the end of the constant pressure process is 1480°C. Calculate, (i) cut off ratio, (ii) heat supplied per kg of air and (iii) cycle efficiency.	**10 Marks**	**L3**	**CO1**

13.	**a.**	Derive an expression for thermal efficiency of a gas turbine power plant working on closed cycle.	**10 Marks**	**L2**	**CO2**
	b.	Air enters the compressor of a turbine plant operating on Brayton cycle at 101.325 kPa and 27°C. The pressure ratio in the cycle is 6. If the turbine work equals 2.5 times the compressor work, determine the maximum temperature in the cycle and the cycle efficiency.	**10 Marks**	**L3**	**CO2**
		Or			
14.	**a.**	List and explain the methods used to improve thermal efficiency of an open cycle gas turbine plant.	**10 Marks**	**L2**	**CO2**
	b.	A gas turbine working on Brayton cycle takes air into the compressor at 1 bar pressure and 300 K temperature. The pressure ratio is 5 and the maximum temperature in the cycle is limited to 1075 K. If the efficiencies of compressor and turbine are 80% and 85% respectively, calculate the net work output, cycle efficiency and work ratio. Take $\gamma = 1.4$ and $C_p = 1.005$ kJ/kg° K	**10 Marks**	**L3**	**CO2**

15.	**a.**	What is feed water heater? Draw a single feed water heater system and explain with the help of a T-S diagram.	**10 Marks**	**L2**	**CO3**
	b.	In a Rankine cycle, the steam at inlet to the turbine is saturated at a pressure of 35 bar and exhaust pressure is 0.2 bar. Calculate,	**10 Marks**	**L3**	**CO3**

		(i) the pump work (ii) the turbine work (iii) Rankine efficiency (iv) Condenser heat flow and (v) dryness fraction at the end of expansion. Assume mass flow rate of steam as 9.5 kg / sec.			
		Or			
16.	**a.**	With neat P-V and T-S diagrams explain a simple Rankine cycle and obtain an expression for its efficiency.	**10 Marks**	**L2**	**CO3**
	b.	A steam turbine is supplied with steam at 32 bar and a temperature of 410°C. The steam then expands isentropically to a pressure of 0.08 bar. Find the dryness fraction at the end of expansion and thermal efficiency of the cycle. If the steam is reheated to at 5.5 bar to a temperature of 400°C and then expanded isentropically to the same pressure, what will be the dryness fraction and thermal efficiency of the cycle?	**10 Marks**	**L3**	**CO3**

17.	**a.**	Explain Vapor compression refrigeration with block diagram.	1**0 Marks**	**L2**	**CO4**
	b.	An air refrigeration unit working on Bell-Coleman cycle operates between 1MPa & 100 kPa to produce a cooling effect of 2000 kJ/min. The temperature of air leaving the cold chamber is -5°C and leaving the cooler is 30°C. Neglecting losses and clearance in the compressor and expander, determine (i) mass of air circulated per hour (ii) Works of compressor, expander and cycle (iii) COP and (iv) power required to run the machine. Assume C_p = 1.0 kJ/kg-K.	**10 Marks**	**L3**	**CO4**
		Or			
18.	**a.**	Explain the psychrometric processes with proper diagrams, sensible cooling, sensible heating, humidification and dehumidification and mixing of two air streams.	**10 Marks**	**L2**	**CO4**
	b.	200 m^3 of air/min at 15°C DBT and 75% RH is heated until its temperature is 25°C. Locate the process on the Psychrometric chart and determine (i) RH of heated air (ii) WBT of heated air and (III) heat added to air per minute.	**10 Marks**	**L3**	**CO4**