

Enrollment No.....



Faculty of Engineering  
End Sem (Odd) Examination Dec-2017  
ME2CO03 Basic Thermodynamics

Programme: Diploma

Branch/Specialisation: ME

**Duration: 3 Hrs.****Maximum Marks: 60**

Note: 1. All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

2. Steam table is permitted.

- Q.1 i. A close system may refer to..... **1**  
 (a) Control Mass (b) Control Energy  
 (c) Control Volume (d) Control Temperature
- ii. Which is NOT an intensive property of thermodynamics? **1**  
 (a) Temperature (b) Heat (c) Pressure (d) Density
- iii. The first law of thermodynamics is based on which of the following principle? **1**  
 (a) Conservation of mass (b) Conservation of momentum  
 (c) Action and reaction (d) Conservation of energy
- iv. The correct representation of first law of thermodynamics is..... **1**  
 is.....  
 (a)  $dQ = dU + dW$  (b)  $\delta Q = dU + \delta W$   
 (c)  $\delta Q = \delta U + \delta W$  (d)  $dQ = dU + \delta W$
- v. In a Carnot cycle the heat is transferred at..... **1**  
 (a) Constant Volume (b) Constant Pressure  
 (c) Constant Temperature (d) Constant entropy
- vi. A thermodynamic machine which produces work continuously without any input is called..... **1**  
 (a) Heat engine (b) Refrigerator  
 (c) PMM-I (d) PMM-II
- vii. At critical point, the latent heat of vaporization is..... **1**  
 (a) 0 (b) Infinite (c) 1 (d) Unpredictable

P.T.O.

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- viii. Dryness fraction can be defined as the ratio of..... **1**  
 (a) Mass of vapour to mass of water  
 (b) Mass of water to mass of steam  
 (c) Mass of vapour to total mass  
 (d) Total mass to mass of vapour
- ix. The ratio of total volume to the clearance volume is known as..... **1**  
 (a) Cut-off ratio (b) Velocity ratio  
 (c) Compression ratio (d) Pressure ratio
- x. Otto cycle consists of following four processes- **1**  
 (a) Two isentropic and two isobaric  
 (b) Two isentropic and two isochoric  
 (c) Two isochoric and two isothermal  
 (d) Two isobaric and two isothermal
- Q.2 i. State Zeroth law of thermodynamics with the help of diagram. **2**  
 ii. Define thermodynamic system and enlist different types of system with example. **3**  
 iii. Differentiate between- **5**  
 (a) Extensive properties and intensive properties  
 (b) Point function and path function
- OR iv. Explain Quasi-static process and derive an expression for work done in an isothermal process. **5**
- Q.3 i. Define heat source and heat sink. **2**  
 ii. State first law of thermodynamics for a process and a cycle with mathematical expression. **3**  
 iii. Give any five applications of steady flow energy equation [SFEE]. **5**
- OR iv. The fluid parameters at the inlet of the nozzle are: Enthalpy = 2850 kJ/kg, velocity = 50 m/s and height from datum = 10 m. At the discharge end the enthalpy is 2650 kJ/kg and height from the nozzle is 8 m. Make calculation for the velocity of fluid at exit of the nozzle. **5**

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- Q.4 i. State Kelvin Plank and Clausius statement of second law of thermodynamics. **2**  
 ii. With neat sketch, define Heat engine and Refrigerator. **3**  
 iii. Draw the P-v and T-s curve for a Carnot cycle and derive an expression for thermal efficiency of Carnot cycle. **5**
- OR iv. A reversible heat engine receives 450 KJ of heat from a reservoir at 300 K and delivers 275 KJ of work. Make calculations for the engine efficiency and temperature of reservoir receiving heat from the engine. **5**
- Q.5 i. Define dryness fraction and wetness fraction. **2**  
 ii. Define critical point, triple point and saturation temperature. **3**  
 iii. Draw phase change curve for water on T-Q and T-V coordinates with brief discussion. **5**
- OR iv. Calculate volume, enthalpy and entropy of 1 kg of steam at 80°C and having dryness fraction of 0.85. **5**
- Q.6 Attempt any two:  
 i. Define compression ratio and draw P-v and T-s curve for diesel cycle with various processes involved. **5**  
 ii. Derive an expression for air standard efficiency of Otto cycle. **5**  
 iii. In an air standard Otto cycle engine, the temperature at the end of compression stroke is 650 K and the maximum cycle temperature is 2400 K. If the engine delivers 700 kJ/kg of work, find the thermal efficiency and compression ratio of the engine. **5**

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**ME2CO03 Basic Thermodynamics**  
**Marking Scheme**

Q.1	i.	A close system may refer to..... (a) Control	<b>1</b>	Q.3	i.	Difference between heat and work. Minimum 2 differences – 2 marks	<b>2</b>		
	ii.	Which is NOT an intensive property of thermodynamics? (b) Heat	<b>1</b>		ii.	Statement for process – 1 mark Statement for cycle – 1 mark Mathematical expression – 1 mark	<b>3</b>		
	iii.	The first law of thermodynamics is based on which of the following principle? (d) conservation of energy	<b>1</b>		iii.	Five applications of steady flow energy equation [SFEE]. 1 mark for each application (minimum 5 applications) (1 mark * 5 = 5 marks)	<b>5</b>		
	iv.	The correct representation of first law of thermodynamics is..... (b) $\delta Q = dU + \delta W$	<b>1</b>		OR	iv.	Given data – 1 mark Diagram – 1 mark Step wise solution – 2 marks Final answer – 1 mark	<b>5</b>	
	v.	In a Carnot cycle the heat is transferred at..... (c) Constant Temperature	<b>1</b>		Q.4	i.	State Kelvin Plank and Clausius statement of second law of thermodynamics. Kelvin Plank statement – 1 mark Clausius statement – 1 mark	<b>2</b>	
	vi.	A thermodynamic machine which produces work continuously without any input is called..... (c) PMM-I	<b>1</b>			ii.	With neat sketch, define Heat engine and Refrigerator. Definition of heat engine – 1 mark Diagram - 0.5 marks Definition of refrigerator – 1 mark Diagram - 0.5 marks	<b>3</b>	
	vii.	At critical point, the latent heat of vaporization is..... (a) 0	<b>1</b>			iii.	P-v and T-s diagram – 1 mark Name of processes involved – 1 mark Derivation – 2 marks Final expression – 1 mark	<b>5</b>	
	viii.	Dryness fraction can be defined as the ratio of..... (c) Mass of vapour to total mass	<b>1</b>			OR	iv.	Diagram – 1 mark Step wise solution – 2 marks Final answer efficiency – 1 mark Final answer temperature – 1 mark	<b>5</b>
	ix.	The ratio of total volume to the clearance volume is known as..... (c) Compression ratio	<b>1</b>			Q.5	i.	Definition of dryness fraction – 1 mark Definition of wetness fraction – 1 mark	<b>2</b>
	x.	Otto cycle consists of following four processes- (c) Two isochoric and two isothermal	<b>1</b>				ii.	Definition of critical point – 1 mark Definition of triple point – 1 mark Definition of saturation temperature – 1 mark	<b>3</b>
Q.2	i.	Statement – 1 mark Diagram – 1 mark	<b>2</b>	iii.			T-Q curve - 1.5 marks Discussion – 1 mark T-V curve - 1.5 marks Discussion – 1 mark	<b>5</b>	
	ii.	Definition thermodynamic system – 1 mark Types of system – 1 mark Example – 1 mark	<b>3</b>						
	iii.	(a) Extensive properties and intensive properties Minimum 2 differences – 2 marks (b) Point function and path function Minimum 3 differences - 3 marks	<b>5</b>						
OR	iv.	Definition – 1 mark P-v and T-s diagram – 1 mark Derivation – 2 marks Final expression – 1 mark	<b>5</b>						

OR iv. Steam table data – 2 marks **5**  
Volume formula - 0.5 mark  
Answer - 0.5 mark  
Enthalpy formula - 0.5 mark  
Answer - 0.5 mark  
Entropy formula - 0.5 mark  
Answer - 0.5 mark

Q.6 Attempt any two:  
i. Definition of compression ratio – 1 mark **5**  
P-v and T-s diagram – 2 marks  
Name of processes involved – 2 marks  
ii. P-v and T-s diagram – 1 mark **5**  
Name of processes involved – 1 mark  
Derivation – 2 marks  
Final expression – 1 mark  
iii. Given data – 1 mark **5**  
P-v and T-s diagram – 1 mark  
Efficiency formula -- 1 mark  
Answer - 0.5 mark  
Compression ratio formula -- 1 mark  
Answer - 0.5 mark

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