

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-I & II (NEW) EXAMINATION – SUMMER-2019

Subject Code: 3110006

Date: 04/06/2019

Subject Name: Basic Mechanical Engineering

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of steam table is permitted.

	Marks
Q.1 (a) Define Melting point, Boiling point and Trippl point of water using p-v diagram.	03
(b) Derive an expression for internal energy for a closed system.	04
(c) Define specific heat at Constant volume, constant pressure and Adiabatic index. Also derive relationship between specific heats in form of Characteristic gas constant.	07
Q.2 (a) Discuss the factors responsible for global warming and Ozone depletion	03
(b) Explain Equivalent evaporation and factor of evaporation	04
(c) Determine the value of final dryness fraction of steam	07
1. After losing 125 kJ from the steam at constant pressure.	
2. After expansion to 3 bar pressure in a turbine stage and work equivalent of 20 kJ/kg done	
Initially steam is available at 7 bar pressure and 0.9 dryness fraction.	
OR	
(c) Three kg of steam at a pressure of 10 bar exists in the following conditions. Calculate its enthalpy and internal energy in each of the cases.	07
1. Steam with $x = 0.91$	
2. Steam at temperature 200°C	
Q.3 (a) Explain the construction and function of Steam Trap with neat sketch. Also mention its specific location in the system.	03
(b) Derive the equation for efficiency of Carnot	04
(c) A double acting reciprocating pump has piston diameter of 150 mm and stroke length of 225 mm. the suction and delivery heads are 4 m and 12 m respectively. If the speed of the pump is 80 rpm and the actual quantity of water discharged is $0.61\text{ m}^3/\text{min}$. find the percentage slip, the coefficient of discharge and the power required to drive the pump if the efficiency of the pump is 80%.	07
OR	
Q.3 (a) Explain the construction and function of Steam separator with neat sketch. Also mention its specific location in the system.	03
(b) Prove that the efficiency of Otto cycle is greater than that of Diesel cycle for the same compression ratio.	04
(c) Air is to be compressed in a single stage reciprocating compressor from 1.013 bar and 15°C to 7 bar. Calculate the indicated power required for free air delivery of $0.3\text{ m}^3/\text{min}$ when the compression process is	07
1. Isentropic	
2. Reversible isothermal	
3. Polytropic with $n = 1.25$.	

- Q.4 (a)** Draw a neat sketch of p-v diagram for single stage compressor with clearance. **03**
- (b)** It is required to produce ice from 36° water. The capacity of the ice plant is 6 ton and specific heat of the water is 4.18 KJ/kg.K. Determine the amount of ice produced in 3 hours. **04**
- (c)** In an ideal Otto cycle the air at the beginning of isentropic compression is at 1 bar and 15°C. The ratio of compression is 8. If the heat added during the constant volume process is 1000 kJ/kg, determine (a) the maximum temperature in the cycle, (b) the air standard efficiency (C) work done per kg of air. **07**

OR

- Q.4 (a)** Draw a neat sketch of p-v diagram showing Free Air Delivery for air compressor. **03**
- (b)** Calculate the energy consumed in one month for following conditions: **04**
COP of air-conditioning unit : 5
Capacity of air conditioner : 2 TR
No of air conditioners : 8
All air conditioners run for 4 hours/day.
- (c)** A petrol engine with a stroke length of 200 mm and diameter of 150 mm has a clearance volume of $7 \times 10^5 \text{ mm}^3$. If the indicated thermal efficiency is 0.30, find the relation efficiency. If the effective pressure is 5 bar and engine runs at 1000 rpm. Find the IP of the engine. take $\gamma=1.4$ **07**

- Q.5 (a)** Discuss the operational difference between Vapour compression and Vapour absorption refrigeration cycle **03**
- (b)** Define velocity ratio of pulleys and discuss effect of slip and creep on motion transmission, **04**
- (c)** Using neat sketch explain the working of Cone clutch and Centrifugal clutch **07**

OR

- Q.5 (a)** Define following material properties. **03**
1. Ductility
2. Plasticity
3. Malleability
- (b)** Define pitch circle, diametral pitch, addendum and dedendum using neat sketch. **04**
- (c)** Using neat sketch explain the working of Block brake and Internal expanding shoe brake. **07**
