

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III (NEW) EXAMINATION – WINTER 2021****Subject Code:2132502****Date:04-03-2022****Subject Name:Engineering Thermodynamics & Heat transfer****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. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Explain zeroth law of Thermodynamics	03
	(b) State the second law of thermodynamics and also give the limitations of first law of thermodynamics.	04
	(c) Define thermodynamic. Explain different types of thermodynamic systems with neat sketch.	07
Q.2	(a) List out the high grade and low grade energy.	03
	(b) Explain the concept of P-V diagram for a pure substance with neat sketch.	04
	(c) Write a short note on reversed Carnot cycle with neat sketch.	07
OR		
	(c) Discuss Kelvin-planck and clausius statement of second law of thermodynamics.	07
Q.3	(a) Explain the following terms (i) Critical point (ii) Triple point (iii) Entropy	03
	(b) Discuss the concept of Exergy for steady flow system.	04
	(c) A steam pipe with I.D and O.D as 100 mm and 170 mm is covered with two layers of insulation, 35 mm and 50 mm thick. The thermal conductivities of insulating materials are 0.16 W/m-°C and 0.085 W/m-°C respectively while that of steel is 50 W/m-°C. The inner surface of the pipe is 300 °C while surface temperature of insulation is 50 °C. Determine the heat loss from pipe and layer contact temperatures.	07
OR		
Q.3	(a) Explain the concept of available and unavailable energy.	03
	(b) An insulated wall is to be constructed of common brick 20 cm thick and metal lathe with plaster 2.5 cm thick with intermediate layer of loosely packed rock-wool. The outer surfaces of the brick and plaster are to be at a temperature of 600 °C and 50 °C respectively. Calculate the thickness of insulation required in order that the heat loss per square meters shall not be exceed 600 W. The conductivities of brick, rock-wool and metal lathe plaster are 0.32, 0.045 and 0.7 W/m-K.	04
	(c) Derive the equation for the heat flow by conduction mode through hollow cylinder.	07

- Q.4** (a) Explain various mode of heat transfer with suitable example. **03**
- (b) Discuss different types of convection heat transfer. **04**
- (c) Derive the dimensionless numbers for the analysis of forced convection by using Dimensional analysis. **07**
- OR**
- Q.4** (a) Explain Fourier's law of heat conduction. **03**
- (b) Derive the equation for the heat flow by conduction through slab. **04**
- (c) Derive the equation for convective heat transfer coefficient over a plate for forced convection. **07**
- Q.5** (a) Define boiling. Explain various regimes of boiling. **03**
- (b) Define condensation. List out assumptions made for the Nusselts theory of condensation. **04**
- (c) State and derive the equation of (i) Stefan Boltzmann law of radiation (ii) Kirchoff's law of radiation. **07**
- OR**
- Q.5** (a) Define. (i) Absorptivity (ii) Emissivity (iii) Radiation **03**
- (b) Discuss different type of bodies in thermal radiation **04**
- (c) Classify different types of heat exchanger. Explain any **one** with neat sketch. **07**
