

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-I & II EXAMINATION – WINTER 2024****Subject Code:3110006****Date:02-01-2025****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. Simple and non-programmable scientific calculators are allowed.
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6. Use of Steam Tables is permitted.

	Marks
Q.1 (a) State and explain zeroth law of thermodynamics.	03
(b) List sources of renewable energy.	04
(c) Define prime mover and classify it.	07
Q.2 (a) Derive characteristic equation of a perfect gas.	03
(b) Define following terms:	04
(i) Dryness fraction	
(ii) Degree of superheat	
(iii) Enthalpy of evaporation	
(iv) Enthalpy of superheated steam	
(c) One kg of gas is compressed polytropically from 150 kPa pressure and 290 K temperature to 750 kPa. The compression is according to law $pV^{1.3} = C$. find :	07
(i) Final temperature	
(ii) Work-done	
(iii) Change in internal energy	
(iv) Amount of heat transferred	
(v) Change in enthalpy,	
Take $R=0.287$ kJ/kg K and $c_p= 1.001$ kJ/kg K	
OR	
(c) Determine dryness fraction of steam supplied to a separating and throttling calorimeter.	07
Water separated in separating calorimeter = 0.45 kg	
Steam discharge from throttling calorimeter = 7 kg	
Steam pressure in main pipe = 1.2 MPa	
Barometer reading= 760 mm of Hg	
Manometer reading = 180 mm of Hg	
Temperature of steam after throttling = 140° C	
Take $C_{ps}=2.1$ kJ/kgK	
Q.3 (a) State limitations of Carnot gas power cycle.	03
(b) Compare 2- stroke engine with 4- stroke engine.	04
(c) Derive an expression of air standard efficiency of Otto cycle. Draw its P-V and T-S diagram.	07
OR	
Q.3 (a) State assumptions considered for analysis of air standard cycle.	03
(b) Derive an expression for thermal efficiency of rankine cycle.	04
(c) The following data is available for 2-stroke diesel engine:	07

Bore = 10 cm, stroke = 15 cm, engine speed=1000 rpm, torque developed= 58 N-m, $\eta_m = 80\%$, $\eta_{i,th} = 40\%$, calorific value of fuel =44000 kJ/kg.

Find: (i) Indicated power (ii) Mean effective pressure (iii) Brake specific fuel consumption.

- Q.4** (a) Define Compressor. State uses of compressed air. **03**
 (b) Discuss briefly location and function of the followings; **04**
 (i) Water level indicator
 (ii) Pressure Gauge
 (c) Explain with neat sketch working of Cochran boiler. **07**
OR
- Q.4** (a) Define following with reference to air compressor; **03**
 (i) Free air delivery
 (ii) Swept volume
 (iii) Volumetric efficiency
 (b) Differentiate between boiler mountings and accessories. **04**
 (c) Explain with neat sketch construction and working of split air conditioner. **07**
- Q.5** (a) State the application of following gears **03**
 (i) Helical gear, (ii) worm and worm gear (iii) rack and pinion
 (b) What is coupling? Classify it. **04**
 (c) Explain with neat sketch working of centrifugal pump. **07**
OR
- Q.5** (a) Enlist types of belt drive. **03**
 (b) Differentiate between clutch and brake. **04**
 (c) Explain following properties of materials. **07**
 (i) Elasticity, (ii) Plasticity, (iii) Ductility, (iv) Brittleness (v) Hardness (vi) Toughness, (vii) Fatigue
