Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI EXAMINATION – WINTER 2025

Subject Code:3161910 Date:02-12-2025

Subject Name:Applied Thermodynamics

Time:02:30 PM TO 05:00 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)**	Define brake power, indicated power and brake specific fuel consumption.	**03**
	(b)	Derive equation of constants employed in Vander Waal's equation.	**04**
	(c)	Prove that velocity of sound wave is the square root of the ratio of the change in pressure to the change in density of a fluid due to disturbance in compressible flow.	**07**
Q.2	**(a)**	Enlist various desirable properties of good refrigerant.	**03**
	(b)	Give classification of compressors.	**04**
	(c)	Explain construction and working of Li-Br Vapour Absorption System with neat sketch.	**07**
		OR	
	(c)	In a cooling application, air at 32°C DBT and 20°C WBT is passed through a cooling coil maintained at 5°C. The heat removed by the cooling coil from air is 14 kW and air flow rate is 42.5 m^3/min. Determine (i) DBT and WBT of the air leaving the coil, (ii) coil by-pass factor.	**07**
Q.3	**(a)**	Give difference between Euro norms Bharat stage emission norms.	**03**
	(b)	Explain chemical dehumidification process.	**04**
	(c)	What is loss due to dissociation? Explain effect of dissociation on temperature and power in engine.	**07**
		OR	
Q.3	**(a)**	The COP of a refrigerator is 6, when it maintains the temperature of -3°C in the evaporator. Determine the condenser temperature and refrigerating effect if the power required to run the refrigerator is 7.5 kW.	**03**
	(b)	Explain actual cycle for SI engine with p-v diagram.	**04**
	(c)	Write short note on heat balance sheet.	**07**
Q.4	**(a)**	What is the need of multi-staging in reciprocating compressor?	**03**
	(b)	Explain Exhaust Gas Recirculation System with neat Sketch.	**04**

	(c)	The following details were noted in a test on a 4-cylinder, 4-stroke engine: cylinder diameter = 100 mm ; stroke length = 120 mm ; speed of the engine = 1600 rpm ; fuel consumption = 0.2 kg/min ; CV of the fuel = 44000 kJ/kg ; difference in tension tension on either side of the brake pulley = 40 kg ; brake circumference is 300 cm. If the mechanical efficiency is 80 % calculate, brake and indicated thermal efficiency , indicated mep, brake specific fuel consumption.	**07**

OR

Q.4	**(a)**	Define compressible and incompressible flow.	**03**
	(b)	Explain the phenomenon of surging and stalling in an axial flow compressor.	**04**
	(c)	Explain various losses in centrifugal compressor.	**07**
Q.5	**(a)**	Explain effect of pre- whirl in centrifugal compressor.	**03**
	(b)	Explain Propagation of Pressure Waves Distribution in a Compressible Fluid with neat Sketch.	**04**
	(c)	Explain with neat Sketch Effect of Impeller Blade Shape on Performance in Centrifugal Compressor.	**07**

OR

Q.5	**(a)**	Explain Mach angle and Mach cone.	**03**
	(b)	Explain designation system of refrigerants.	**04**
	(c)	Explain the use of aerofoil blading in axial flow compressor.	**07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2024

Subject Code:3161910 Date:20-11-2024

Subject Name:Applied Thermodynamics

Time:02:30 PM TO 05:00 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)**	State and explain Avogadro's law.	**03**
	(b)	What is the Vander Waal's equation of state? What is the significance of the various constants involved in this equation? What are the limitations?	**04**
	(c)	Explain the following terms briefly: (i) Dew point temperature (ii) Cooling and Dehumidification (iii) Comfort Air conditioning (iv) Wet bulb temperature (v) Psychrometry (vi) Relative humidity (vii) Dry bulb temperature.	**07**
Q.2	**(a)**	What is the effect of sub-cooling on the performance of vapour compression refrigeration system?	**03**
	(b)	Explain with neat sketch about working and construction of the sling psychrometer.	**04**
	(c)	Define following terms related with engine: (1) Indicated power (2) Brake power (3) Friction power (4) Mechanical efficiency (5) Thermal efficiency (6) Volumetric efficiency (7) Brake specific fuel consumption.	**07**
		OR	
	(c)	Explain with neat sketch, two stage compression system with flash intercooler.	**07**
Q.3	**(a)**	Explain why the specific heats of gases increase with increases in temperature?	**03**
	(b)	Explain adiabatic saturation process with neat sketch.	**04**
	(c)	Mention the limitations of simple vapour compression refrigeration cycle. Briefly explain the working of two stage compression with water intercooler and liquid sub-cooler employed for vapour compression system.	**07**
		OR	
Q.3	**(a)**	State the important uses of compressed air for engineering purpose.	**03**
	(b)	How will you assign number to the refrigerants: dichloro difluoro methane and dichloro tetra fluoro ethane?	**04**
	(c)	Explain various methods of obtaining friction power and explain any one of them in detail.	**07**
Q.4	**(a)**	Differentiate compressible and incompressible flow.	**03**
	(b)	Prove that velocity of a sound wave in a compressible fluid is given by $C = \sqrt{\gamma RT}$.	**04**
	(c)	Explain with neat sketch the working of a simple ammonia water absorption refrigeration system.	**07**

OR

Q.4 **(a)** Give advantages and disadvantages of multistage reciprocating air compressor over Single stage air compressor. **03**

(b) Explain with a neat sketch the construction and working of a single stage single acting reciprocating air compressor. **04**

(c) A refrigerating machine working on reversed Carnot cycle consumes 5.5 kW for producing refrigerating effect of 940 kJ/min for maintaining a region at -38°C. Determine: **07**
(i)COP of refrigerating machine;
(ii)Highest temperature of cycle;
(iii)Amount of heat delivered in kJ/min, when this device is used as a heat pump.

Q.5 **(a)** What is the effect of clearance volume on the performance of air compressor? **03**

(b) How are air compressor classified? **04**

(c) A two stroke diesel engine was motored when the meter reading was 1.5 kW. Then the test on the engine was carried out for one hour and the following observations were recorded: **07**
Brake torque = 120 Nm;
Speed = 600 rpm;
Fuel used = 2.5 kg;
calorific value of fuel = 40.3 MJ/kg;
Cooling water used = 818 kg;
Rise in temperature of cooling water = 10°C.
Exhaust gas temperature = 345°C.
Room temperature = 25°C;
A/F = 32:1;
Determine: (i) bp, (ii) ip, (iii) mechanical efficiency, (iv) indicated thermal efficiency, and (v) Draw heat balance sheet on *minute basis* and also on *percentage basis*.

OR

Q.5 **(a)** What are the major pollutants comes out from the IC engine? **03**

(b) State the advantages and disadvantages of vapour absorption refrigeration system over vapor compression refrigeration system. **04**

(c) Explain with schematic diagram of simple vapor compression cycle. Draw the p-h and T-S diagram simple vapor compression cycle. **07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – WINTER 2023

Subject Code:3161910 Date:02-12-2023

Subject Name:Applied Thermodynamics

Time:02:30 PM TO 05:00 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)**	Define Avogadro's law, equation of state, Indicated Power.	**03**
	(b)	Define Mach Number and state its significance in compressible fluid flow.	**04**
	(c)	Derive the Vander walls equation.	**07**
Q.2	**(a)**	What are the different regions of compressible flow?	**03**
	(b)	Define Mach cone, Mach angle, zone of action and zone of silence.	**04**
	(c)	Explain Fundamental equations for compressible flow.	**07**
		OR	
	(c)	Differentiate between centrifugal and axial flow air compressor.	**07**
Q.3	**(a)**	What is Psychometry? Define sensible heat factor.	**03**
	(b)	Explain Dalton's law of partial pressure. How evaporation happens in atmosphere?	**04**
	(c)	Explain chemical and dehumidification with neat sketch.	**07**
		OR	
Q.3	**(a)**	Discuss briefly secondary refrigerants.	**03**
	(b)	Explain properties of moist air.	**04**
	(c)	Explain the cooling and dehumidification with neat sketch.	**07**
Q.4	**(a)**	Define. Brake power, Friction Power, Brake specific fuel consumption.	**03**
	(b)	Write short note on "Heat Balance Sheet".	**04**
	(c)	What is variable compression Ratio (VCR) engine? Explain methods of obtaining VCR and performance of VCR engine.	**07**
		OR	
Q.4	**(a)**	Write down Bharat stages of emission norms.	**03**
	(b)	Define EURO and INDIAN (Bharat) norms.	**04**
	(c)	What is catalytic converter? Describe with neat sketch the catalytic converter for exhaust emission control for SI engine.	**07**
Q.5	**(a)**	Define the phenomenon of surging and choking in centrifugal compressor.	**03**

	(b)	State the important use of compressed air for engineering purposes.	**04**
	(c)	With a suitable sketch explain the working principle of an axial flow compressor. What is meant by a stage and explain the stage velocity triangles.	**07**

OR

Q.5	**(a)**	What is centrifugal compressor and what are it advantages?	**03**
	(b)	What are the various losses occurring in a centrifugal compressor?	**04**
	(c)	Explain with a neat sketch the construction and working of a single stage single acting reciprocating air compressor.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI(NEW) EXAMINATION – WINTER 2022

Subject Code:3161910 Date:13-12-2022

Subject Name:Applied Thermodynamics

Time:02:30 PM TO 05:00 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.**
5. **Students can use Steam tables and P-H chart(R-717).**

			MARKS
Q.1	**(a)**	Define 1)Dry bulb temperature 2)Wet bulb temperature 3)Dew point temperature	**03**
	(b)	Explain Compressibility Chart and Compressibility Factor with neat Sketch.	**04**
	(c)	What is Psychometric chart? Explain the measurement of different lines on it.	**07**
Q.2	**(a)**	State the Dalton's law of partial pressure.	**03**
	(b)	Differentiate Between Vapour Compression System and Vapour Absorption System.	**04**
	(c)	What are desirable characteristics of refrigerant? Explain how refrigerants are designated.	**07**
		OR	
	(c)	Explain Vander Waal's Equation of State. Derive an expression for Evaluation of Constant 'a' and 'b'	**07**
Q.3	**(a)**	Justify the need for multistaging.	**03**
	(b)	Explain Li-Br Vapour Absorption System.	**04**
	(c)	Explain Thermodynamic , Physical and Chemical Properties of Refrigerants	**07**
		OR	
Q.3	**(a)**	Differentiate Centrifugal and Axial Flow Compressor.	**03**
	(b)	Explain the phenomenon of surging and choking in centrifugal Compressor.	**04**
	(c)	An ammonia compound compression of refrigeration system consists of two evaporators of capacities 20TR at -10^0C, and10TR at 10^0C.Thevapours leaving the evaporators are dry and saturated. The condenser temperature is 40^0C.the system is provided with multiple expansion valves and flash intercooler. Calculate 1) mass of refrigerant passing through each compressor, and 2) COP of the system.	**07**
Q.4	**(a)**	Explain with neat sketch Catalytic Converter used in SI Engines	**03**
	(b)	Write short note on "Heat balance sheet".	**04**

	(c)	A single cylinder, four stroke gas engine has bore and stroke are 225mm and 325mm respectively. the clearance volume is 1.8ltrs. The gas consumption is 12.1 m^3 /hr when the engine runs at 500rpm with imep 700KN/m^2 .The calorific value of fuel is 40,000kJ/m^3 .Find : indicated power, thermal efficiency, air standard efficiency, relative efficiency, take Υ=1.4.	**07**

OR

Q.4	**(a)**	Explain Exhaust Gas Recirculation System with neat Sketch.	**03**
	(b)	What are the different Losses in Actual Cycle? Explain any two with neat sketch.	**04**
	(c)	Define Following terms related with engine. 1. Indicated power 2. Brake power 3. Friction power 4. Mechanical efficiency 5. Thermal efficiency 6. Volumetric efficiency 7. Brake specific fuel consumption.	**07**
Q.5	**(a)**	Define compressible and incompressible flow.	**03**
	(b)	What is the effect of clearance on the performance of air compressor?	**04**
	(c)	Derive an expression for velocity of sound in usual notations as $\mathbf{C=\sqrt{\frac{dP}{d\rho}}}$.	**07**

OR

Q.5	**(a)**	Give a Comparison between Air- Standard Cycle, Fuel- Air Cycle and Actual Cycle.	**03**
	(b)	Explain Ozone Depletion Potential (ODP) and Global Warning Potential (GWP).	**04**
	(c)	What are the stagnation Properties? Derive an equation for Stagnation Pressure and Stagnation Density.	**07**

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