Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - 1/2 EXAMINATION - WINTER 2025

Subject Code: BE01000081/BE01R00081 **Date: 29-12-2025**

Subject Name: Basic Mechanical Engineering

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. **Use of Steam Tables is permitted.**

			Marks
Q.1	**(a)**	Classify the Babcock-Wilcox boiler. What is the function of a superheater?	**03**
	(b)	Describe advantages and disadvantages of solar energy.	**04**
	(c)	(i) A 3-kg plastic tank that has a volume of 0.2 m^3 is filled with liquid water. Determine the weight of the combined system. (ii) A pressure gage connected to a tank reads 500 kPa at a location where the atmospheric pressure is 94 kPa. Determine the absolute pressure in the tank. (iii) What is the characteristic of a steady-flow process?	**07**
Q.2	**(a)**	State the function of any three accessories in boilers.	**03**
	(b)	What is the difference between elasticity and plasticity? What do you understand by resilience?	**04**
	(c)	Air enters a compressor at 1.013 bar and 27^oC having a volume of 5 m^3/kg and it is compressed to 12 bar isothermally. Determine: (i) work done, (ii) heat transfer, and (iii) change in internal energy.	**07**
		OR	
	(c)	Five kg of air is heated from an initial volume of 0.5 m^3 to final volume of 1.3 m^3 at constant pressure 4 bar. Determine: (i) heat supplied, (ii) work done, and (iii) initial and final temperature of air. C_p = 1.005 kJ/kg K, R = 0.287 kJ/kg K.	**07**
Q.3	**(a)**	Draw a schematic diagram of a differential bank brake.	**03**
	(b)	Show the vapour compression refrigeration cycle on T-s and p-h diagram. Name each process in the cycle.	**04**
	(c)	Steam at 5 bar and dryness fraction of 0.85 expands reversibly at constant pressure until the temperature is 220^oC. Determine the work and heat transfer per kg of steam during the process. Take specific heat for superheated steam as 2.1 kJ/kg K.	**07**
		OR	

(a) Answer in one word: **03**

(i) Which coupling is used to connect engine shaft to driven shaft in automobile?

(ii) Energy absorbed by a brake is released into the environment in the form of which energy?

(iii) What causes the outward movement of a shoe in centrifugal clutch?

(b) A classroom has a window air conditioner of 2 TR capacity. Its COP is 3. How much electrical energy (in kWhr) will be consumed in one month if the unit runs for 6 hours per day? **04**

(c) During a test of steam with throttling calorimeter, sample is taken from main pipe at 15 bar, pressure and temperature after throttling are 1.2 bar and 150^{o}C respectively. Determine dryness fraction of steam. Take specific heat of superheated steam as 2.1 kJ/kg K. **07**

Q.4 **(a)** What is a flexible coupling? What are its types? **03**

(b) Draw a diagram of vortex-type centrifugal pump. **04**

(c) A steam plant works on ideal Rankine cycle. Steam is supplied at 25 bar and 290^{o}C. The steam exhausts into a condenser at 15 kN/m^2 with 0.9 dry. Determine the cycle efficiency. **07**

OR

(a) Give similarities and differences between a friction clutch and a positive-contact clutch. **03**

(b) Describe in short the parts of a reciprocating pump. **04**

(c) An oil engine working on diesel cycle has cylinder bore of 190 mm and piston stroke of 230 mm. The clearance volume is 290 cm^3. The fuel injection takes place at a constant pressure for 6% of the stroke. Determine the air-standard efficiency. **07**

Q.5 **(a)** Answer in short: **03**

(i) Name the different types of belt drives.

(ii) Enlist different gear types.

(iii) Give one benefit of using a V-belt.

(b) What do you understand by positive displacement compressor? How it differs from rotodynamic compressor? **04**

(c) Explain following terms of I.C. engine: (i) brake power, (ii) indicated power, (iii) specific fuel consumption, (iv) clearance volume. **07**

OR

(a) State one disadvantage of rope drive, chain drive and gear drive. **03**

(b) Define with regard to compressors: double-acting compressor, multistage compressor, displacement (swept) volume, pressure ratio. **04**

(c) A 6-cylinder 4-stroke I.C. engine is used to produce 95 kW brake power at 800 rpm. The stroke to bore ratio is 1.25. Mean effective pressure is 7 bar. Determine the bore and stroke of the engine. Assume mechanical efficiency as 80%. **07**

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