Enrolment No/Seat No.: _____

R.N.G.PATEL INSTITUTE OF TECHNOLOGY-RNGPIT

(An Autonomous Institute U/s UGC Act 1956)

B.Tech. SEMESTER-I, SEMESTER END EXAMINATION – WINTER 2025

SUBJECT CODE: 2ME101 **DATE: 24-12-2025**

SUBJECT NAME: FUNDAMENTALS OF MECHANICAL ENGINEERING

TIME: 11:00 AM to 01:30 PM **TOTAL MARKS: 70**

Instructions

1. It is **compulsory** for students to write **Enrolment No. /Seat No.** on the question paper.
2. Write answers of **Section A** and **Section B** in **separate answer books**.
3. Attempt all questions from both **Section A** and **Section B**.
4. Each section carries **35 marks**, with a total of **70 marks** for the examination.
5. The figures to the right of each question indicate full marks, make suitable assumptions with justification.
6. BL - Cognitive Level (As per Revised Bloom's Taxonomy) (R-Remember, U-Understanding, A –Application, N –Analyze, E – Evaluate, C -Create), CO - Course Outcomes.

SECTION A

			Marks	BL	CO
Q.1	**(a)**	Define the following terms: 1. Force 2. Pressure 3. Power	**03**	**R**	**1**
	(b)	State the Zeroth Law of Thermodynamics and explain its importance.	**04**	**U**	**1**
Q.2	**(a)**	State Charles's Law and its significance.	**03**	**R**	**2**
	(b)	Explain the working of a barrel calorimeter.	**04**	**U**	**2**
	(c)	A gas whose pressure, volume and temperature are 2.75 bar, 0.09 m^3 and 185º C respectively has the state changed at constant pressure until its temperature bee 15º C. Calculate: Heat transferred and work done during the process. Take R = 0.29 kJ/kg K and Cp = 1.005 kJ/kg K.	**07**	**A**	**2**
		OR			
Q.2	**(a)**	State Boyle's Law and its significance.	**03**	**R**	**2**
	(b)	Explain an isothermal process with a P–V diagram.	**04**	**U**	**2**
	(c)	An ideal gas is heated from 30º C to 150º C. The mass of gas is 2 kg. Determine: (a) molar specific heats, (b) change in internal energy and (c) change in enthalpy. Assume R = 267 J/kg K and $\gamma = 1.2$ for the gas. Take R_0 = 8314.4 J/kg mol K.	**07**	**A**	**2**

Q.3	**(a)**	Classify steam boilers.	**03**	**R**	**3**
	(b)	Compare fire-tube boilers and water-tube boilers.	**04**	**U**	**3**
	(c)	With a neat diagram, explain the construction and working of a Babcock and Wilcox boiler.	**07**	**U**	**3**

OR

Q.3	**(a)**	What is a steam boiler? Describe its fundamental working principle.	**03**	**R**	**3**
	(b)	Differentiate between boiler mountings and boiler accessories.	**04**	**U**	**3**
	(c)	With a neat diagram, explain the construction and working of a Cochran boiler.	**07**	**U**	**3**

SECTION B

			Marks	**BL**	**CO**
Q.4	**(a)**	What are refrigerants? List desirable properties of a good refrigerant.	**03**	**R**	**4**
	(b)	Describe the working of a reciprocating pump with a neat sketch	**04**	**U**	**4**
Q.5	**(a)**	Define: 1) Stroke 2) Bore 3) Swept Volume	**03**	**R**	**5**
	(b)	Explain working of 4-stroke Diesel engine.	**04**	**U**	**5**
	(c)	A six-cylinder, gasoline engine operates on the four-stroke cycle. The bore of each cylinder is 80 mm and the stroke is 100 mm. The clearance volume per cylinder is 70 cc. At the speed of 4100 rpm, the fuel consumption is 5.5 gm/sec. [or 19.8 kg/hr.) and the torque developed is 160 Nm. Calculate : (i) Brake power, (ii) The brake mean effective pressure, (iii) Brake thermal efficiency if the calorific value of the fuel is 44000 kJ/kg and (iv) The relative efficiency on a brake power basis assuming the engine works on the constant volume cycle r = 1.4 for air.	**07**	**N**	**5**

OR

Q.5	**(a)**	What is I.C. Engine? Give classifications in detail.	**03**	**R**	**5**
	(b)	Explain working of 2-stroke Petrol engine.	**04**	**U**	**5**
	(c)	A six-cylinder 4-stroke petrol engine having a bore of 90 mm and stroke of 100 mm has a compression ratio of 7. The relative efficiency with reference to indicated thermal efficiency is 55% when indicated mean specific fuel consumption is 0.3 kg/kWh. Estimate the calorific value of the fuel and fuel consumption in kg/hr. Given that indicated mean effective pressure is 8.5 bar and speed is 2500 r.p.m.	**07**	**N**	**5**

Q.6	**(a)**	What are the differences between brake and clutch?	**03**	**R**	**6**
	(b)	Classify various types of coupling and give example of their application.	**04**	**U**	**6**
	(c)	Explain with neat sketch the working of various types of belt drives used for motion and transmission.	**07**	**U**	**6**

OR

Q.6	**(a)**	Define: 1) strength 2) elasticity 3) plasticity	**03**	**R**	**6**
	(b)	What is brake? State its function. How are they classified?	**04**	**U**	**6**
	(c)	Define a gear. Explain the classification of gears with examples.	**07**	**U**	**6**

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