

R. N. G. PATEL INSTITUTE OF TECHNOLOGY-RNGPIT
(An Autonomous College U/s UGC Act 1956)

B.TECH SEMESTER- I, SEMESTER END EXAMINATION – SUMMER 2025

Subject Code: 1ME101**Date: 06-06-2025****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 - Bloom's Taxonomy Levels (R-Remember, U-Understanding, A –Application, N –Analyze, E – Evaluate, C -Create), CO - Course Outcomes.

SECTION A

	Marks	BL	CO
Q.1 Multiple-Choice Questions	[05]		
(a) Prime mover is a device which converts natural resources into _____energy.	1	R	1
(i) nuclear energy			
(ii) mechanical energy			
(iii) potential energy			
(iv) kinetic energy			
(b) The unit of energy is _____	1	R	1
(i) Watt			
(ii) Joule			
(iii) Joule-meter			
(iv) none of these			
(c) A Solar cell is an electrical device that converts the energy of light directly into electricity by the	1	R	1
(i) photovoltaic effect			
(ii) chemical effect			
(iii) atmospheric effect			
(iv) physical effect			
(d) The internal energy of a gas is a function of _____	1	R	2
(i) enthalpy			
(ii) pressure			
(iii) pressure and volume			
(iv) temperature			
(e) Dryness fraction (x) of dry-saturated steam is	1	R	2
(i) equal to 0			
(ii) greater than 1			
(iii) less than 1			
(iv) equal to 1			

Q.2 Attempt Any Two	[10]		
(a) Explain Open system, Close system and Isolated system.	5	U	1
(b) State Boyle's law and Charle's law.	5	R	2
(c) Explain isothermal process. Derive the expression for work done, change in internal energy, change in enthalpy and heat transfer.	5	U	2
Q.3 Attempt Any Two	[10]		
(a) Explain with usual notations prove that $C_p - C_v = R$.	5	A	2
(b) Define the following terms: (1) Degree of superheat (2) Critical point (3) Latent Heat (4) Dryness fraction (5) Sensible heat	5	R	2
(c) Determine enthalpy and internal energy of 1 kg of steam at a pressure 12 bar when (i) the dryness fraction of steam is 0.8 (ii) steam is dry and saturated (ii) steam is superheated to 280 °C. Take $C_{ps} = 2.1 \text{ kJ/kg K}$.	5	A	2
Q.4 Attempt Any Two	[10]		
(a) Explain with neat sketch Vapour Compression Refrigeration (VCR) system. Also draw p-h and T-s diagram for the same.	5	U	3
(b) Give Comparison between Fire Tube Boilers and Water Tube Boiler.	5	U	3
(c) Explain with schematic diagram Babcock and Wilcox boiler.	5	U	3

SECTION B

		Marks	BL	CO
Q.5 Multiple-Choice Questions		[05]		
(a) Which of the following pumps requires priming before starting?		1	R	3
(i) Reciprocating pump	(ii) Centrifugal pump			
(iii) Rotary pump	(iv) Gear pump			
(b) Which stroke in a four-stroke engine is responsible for fuel combustion?		1	R	4
(i) Suction	(ii) Compression			
(iii) Power	(iv) Exhaust			
(c) Which of the following couplings is used for transmitting torque between shafts with angular misalignment?		1	R	5
(i) Muff	(ii) Flange			
(iii) Universal	(iv) Rigid			
(d) Which material is commonly used in making brake shoes?		1	R	5
(i) Copper	(ii) Cast Iron			
(iii) Glass	(iv) Polymer			
(e) Which of the following is a non-ferrous material?		1	R	5
(i) Mild Steel	(ii) Wrought Iron			
(iii) Aluminum	(iv) Cast Iron			
Q.6 Attempt Any Two		[10]		
(a) Explain the working principle of a centrifugal pump with a neat sketch.		5	U	3
(b) Differentiate between reciprocating and rotary pumps with at least three points.		5	U	3
(c) Define priming. Why is it necessary for some pumps?		5	U	3
Q.7 Attempt Any Two		[10]		
(a) Compare four-stroke petrol engine with two-stroke diesel engine based on construction and working.		5	A	4

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|---|---|---|---|
| (b) Define Indicated Power and Brake Power. Derive the relation for mechanical efficiency. | 5 | N | 4 |
| (c) The following data is available for 2 stroke diesel engines: Bore = 10 cm, stroke = 15 cm, engine speed = 1000 RPM, Torque developed = 58 N-m, Mechanical efficiency = 80%, indicated thermal efficiency = 40%, Calorific value of fuel = 44000 kJ/kg. Find a) Indicated power b) Mean effective pressure c) Break Specific Fuel Consumption. | 5 | A | 4 |

Q.8 Attempt Any Two [10]

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| (a) Describe different types of gear drives with their applications. | 5 | U | 5 |
| (b) Explain the construction and application of any two types of clutches. | 5 | A | 5 |
| (c) Write short notes on: | 5 | U | 5 |
| (i) Ferrous vs. Nonferrous materials | | | |
| (ii) Properties of polymers and their applications | | | |
