Enrolment No/Seat No.: _____

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

(An Autonomous College U/s UGC Act 1956)

B.Tech. SEMESTER-I, SEMESTER END EXAMINATION - WINTER 2024

Subject Code: 1ME101 **Date: 16-12-2024**

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	**Objective-Type Questions**	**[05]**		
(a)	In thermodynamics, a system refers to:	**1**	**R**	**1**
	(i) The surroundings of a process			
	(ii) A specified region in space or a quantity of matter under study			
	(iii) The energy required to perform work			
	(iv) The force applied to an object			
(b)	Charles's Law states that at constant pressure:	**1**	**R**	**2**
	(i) Volume is inversely proportional to temperature			
	(ii) Volume is directly proportional to temperature			
	(iii) Volume is directly proportional to pressure			
	(iv) Pressure is independent of temperature			
(c)	Superheated steam is steam:	**1**	**U**	**2**
	(i) At a temperature higher than the boiling point at a given pressure			
	(ii) At a temperature lower than the boiling point			
	(iii) That contains water droplets			
	(iv) With zero dryness fraction			

(d) Which component of a centrifugal pump converts kinetic energy into pressure energy?	**1**	**R**	**3**

(i) Volute casing **(ii)** Impeller

(iii) Shaft **(iv)** Suction pipe

(e) The window air conditioner has all its components in one unit. Where this unit is typically installed?	**1**	**A**	**3**

(i) In the basement **(ii)** Outside the building

(iii) Through a wall or window **(iv)** In the attic

Q.2 Attempt Any Two **[10]**

(a) Define the following thermodynamics laws, (1) Zeroth law, (2) First law, (3) Both the statements of second law.	**5**	**U**	**1**
(b) Write a short on effect of global warming.	**5**	**U**	**1**
(c) Explain the separating calorimeter with its neat sketch.	**5**	**R**	**2**

Q.3 Attempt Any Two **[10]**

(a) Explain adiabatic process. Derive the expression for work done, change in internal energy, and change in enthalpy and heat transfer.	**5**	**R**	**2**
(b) 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 (1) heat supplied, (2) work done, (3) initial and final temperature of air. Assume, R=0.287 kJ/kg K, Cp = 1.005 kJ/kg K.	**5**	**A**	**2**
(c) Steam at 8 bar and dryness fraction of 0.9 expand at constant pressure until the dryness fraction is 0.6. Calculate the work done and heat removed per kg of steam during process.	**5**	**A**	**2**

Q.4 Attempt Any Two **[10]**

(a) Explain with neat sketch the construction and working of Cochran boiler.	**5**	**R**	**3**
(b) Explain the Vapour Absorption Refrigeration (VAR) system.	**5**	**U**	**3**
(c) Compare centrifugal pump and reciprocating pump.	**5**	**R**	**3**

SECTION B

		Marks	BL	CO
Q.5	**Objective-Type Questions**	**[05]**		
(a)	Pump is a_____	**1**	**U**	**3**
	(i) Power producing machine **(ii)** Power consuming machine			
	(iii) Universal machine **(iv)** All of these			
(b)	The ability of a material to resist fracture due to high impact loads is called	**1**	**R**	**5**
	(i) strength **(ii)** stiffness			
	(iii) toughness **(iv)** brittleness			
(c)	Which of the following brakes is primarily used in bicycle braking systems?	**1**	**R**	**5**
	(i) Block Brake **(ii)** Disc Brake			
	(iii) Band Brake **(iv)** Shoe Brake			
(d)	Two stroke diesel cycle is completed in_____ revolution of crank shaft.	**1**	**R**	**4**
	(i) One **(ii)** Two			
	(iii) Three **(iv)** Four			
(e)	Spark plug is used in	**1**	**R**	**4**
	(i) Petrol engine **(ii)** Diesel engine			
	(iii) Steam engine **(iv)** Boiler			
Q.6	**Attempt Any Two**	**[10]**		
(a)	Describe the working principle of a two-stroke petrol engine with neat sketch.	**5**	**U**	**4**
(b)	Explain the types of centrifugal pumps and their applications in industrial processes.	**5**	**A**	**3**
(c)	A two-stroke cycle internal combustion engine has a piston diameter of 110 mm and a stroke length pf 140 mm. The mep exerted on the head of the piston is 600 kN/m^2. If it runs at a speed of 1000 r.p.m. Find the indicated power developed.	**5**	**A**	**5**

Q.7	**Attempt Any Two**	**[10]**		
(a)	Differentiate between clutch and coupling. Describe Disc Cluth.	**5**	**N**	**5**
(b)	Differentiate between belt drive and chain drive systems with practical applications.	**5**	**N**	**5**
(c)	Analyze the differences in efficiencies between indicated power and brake power in internal combustion engines.	**5**	**N**	**4**
Q.8	**Attempt Any Two**	**[10]**		
(a)	Evaluate the advantages and limitations of ferrous and non-ferrous metals in engineering applications.	**5**	**E**	**5**
(b)	Compare the effectiveness of disc and centrifugal clutches in power transmission.	**5**	**E**	**5**
(c)	Illustrate with examples the construction and application of band brakes in mechanical systems.	**5**	**A**	**5**

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