Enrollment No.....................................

Faculty of Engineering
End Sem (Odd) Examination Dec-2022
RA3CO25 Basic of Thermal Engineering
Programme: B.Tech.   Branch/Specialisation: RA

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1   i.   In an isolated system, _____ can be transferred between the   **1**
            system and its surrounding.
            (a) Only energy   (b) Only mass
            (c) Both (a) and (b)   (d) Neither (a) nor (b)

      ii.   Which of the following is an intensive property of a thermodynamic   **1**
            system?
            (a) Volume   (b) Temperature
            (c) Mass   (d) Energy

      iii. Kelvin-planck's law deals with-   **1**
            (a) Conservation of work   (b) Conservation of heat
            (c) Conservation of mass   (d) Conversion of heat into work

      iv.   Efficiency of Carnot cycle may be increased by-   **1**
            (a) Increasing the higher temperature
            (b) Decreasing the highest temperature
            (c) Increasing the lowest temperature
            (d) Decreasing the lowest temperature

      v.   For the same compression ratio, the efficiency of diesel cycle is   **1**
            _____ otto cycle.
            (a) Greater then   (b) Less then
            (c) Equal to   (d) None of these

      vi.   The Rankine cycle, as compared to Carnot cycle, has _____ work   **1**
            ratio-
            (a) High   (b) Low   (c) Equal   (d) None of these

P.T.O.

vii. The thermal efficiency of a two stroke cycle engine is _____ a four stroke cycle engine. **1**
(a) Equal to   (b) Less then
(c) Greater then   (d) None of these

viii. The power actually developed by the engine cylinder of an I.C. engine is known as- **1**
(a) Brake power
(b) Indicated power
(c) Actual power
(d) Friction power

ix. A closed cycle gas turbine works on- **1**
(a) Joule cycle   (b) Ericsson cycle
(c) Rankine cycle   (d) Carnot cycle

x. Reheating in a gas turbine- **1**
(a) Increases the thermal efficiency
(b) Increases the compressor work
(c) Increases the turbine work
(d) Decreases the thermal efficiency

Q.2   i. Define a thermodynamic system. **2**
ii. What do you understand by property of a system? Distinguish between extensive and intensive properties of a system. **3**
iii. Explain the non-equilibrium and quasi-static process. Is the quasi-static process a reversible process? **5**
OR   iv. In what respects the heat and work interactions are similar and dissimilar? **5**

Q.3   i. Define zeroth law of thermodynamics. **3**
ii. What is perpetual motion machine of second kind? Why such a machine cannot be constructed in actual practice? **7**
OR   iii. State and explain the second law of thermodynamics. **7**

Q.4   i. Define compression ratio? How does it affect the air standard efficiency of an otto cycle? **2**

ii. Derive an expression for the air standard efficiency of the diesel cycle in terms of the compression ratio, cut off ratio and the adiabatic index. **8**
OR   iii. Show rankine cycle on p-v and T-s diagrams and explain the processes involved. Also draw the mechanical system to show different processes of the rankine cycle. **8**

Q.5   i. How the internal combustion engines are classified? **2**
ii. Point out the different stages of combustion in CI engine. **3**
iii. Explain, with neat sketches, the sequence of events in the working of a two-stroke petrol engine. **5**
OR   iv. What is meant by overlap in a valve timing diagram? Give reasons for its use and mention any possible disadvantage. **5**

Q.6   i. What are the essential components of a simple open cycle gas turbine plant? **4**
ii. Draw the layout of a gas turbine plant which has two stage compression with complete intercooling. Indicate and explain the ideal process of this plant on a T-s diagram. **6**
OR   iii. List the methods of improving the efficiency and specific output of a simple gas turbine. **6**

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Marking Scheme

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1	i.	In an isolated system, _____ can be transferred between the system and its surrounding. d. neither energy nor mass	1
	ii	Which of the following is an intensive property of a thermodynamic system? b. Temperature	1
	iii	Kelvin-Planck's law deals with d. Conversion of heat into work	1
	iv	Efficiency of Carnot cycle may be increased by b. Decreasing the highest temperature	1
	v.	For the same compression ratio, the efficiency of Diesel cycle is..... Otto cycle. b. Less then	1
	vi	The Rankine cycle, as compared to Carnot cycle, has .... Work ratio, a. High	1
	vii	The thermal efficiency of a two stroke cycle engine is ....a four stroke cycle engine. b. Less then	1
	viii	The power actually developed by the engine cylinder of an I.C. engine is known as b. Indicated power	1
	ix	A closed cycle gas turbine works on a. Joule cycle	1
	x	Reheating in a gas turbine a. Increases the thermal efficiency	1

Q.2	i	Define a thermodynamic system. – **02 Marks**	2
	ii	What do you understand by property of a system?– **01 Mark** Distinguish between extensive and intensive properties of a system?– **02 Mark**	3
	iii	Explain the non-equilibrium and quasi-static process. Is the quasi-static process a reversible process? **the non-equilibrium process - 02 Marks** **quasi-static process – 02 Marks.** **Is the quasi-static process a reversible process? – 01 Mark**	5
OR	iv	In what respects are the heat and work interactions a. similar, and b. dissimilar? **b. Similarities – 03 Marks** **c. Dissimilarities – 02 Marks**	5
Q.3	i.	Define Zeroth law of Thermodynamics.– **03 Marks**	3
	ii.	What is Perpetual Motion Machine of second kind? - **04 Marks** Why such a machine cannot be constructed in actual practice? -03 Marks	7
OR	iii.	State and explain the second law of thermodynamics. **Statement – 04 Marks** **Explanation – 03 Marks**	7
Q.4	i	Define compression ratio?– **01 Marks** How does it affect the air standard efficiency of an Otto cycle?– **01 Marks**	2
	ii	Derive an expression for the air standard efficiency of the Diesel cycle in terms of the compression ratio, cut off ratio and the adiabatic index.– **08 Marks**	8
OR	iii	Show Rankine cycle on p-v and T-s diagrams and explain the processes involved. Also draw the mechanical system to show different processes of the Rankine cycle. – **02 Marks each part of question**	8
Q.5	i	How the internal combustion engines are classified?– **02 Marks**	2
	ii	Point out the different stages of combustion in CI engine.– **03 Marks**	3
	iii	Explain, with neat sketches, the sequence of events in the working of a two-stroke petrol engine. **Sketch – 02 marks** **Working – 03 marks**	5
OR	iv	What is meant by overlap in a valve timing diagram?– **02 Marks**	5

		Give reasons for its use and mention any possible disadvantage. – **03 Marks**	
Q.6	ii.	What are the essential components of a simple open cycle gas turbine plant?– **04 Marks**	4
	iii.	Draw the layout of a gas turbine plant which has two stage compression with complete intercooling. Indicate and explain the ideal process of this plant on a T-s diagram.– **02 Marks to each part of the question**	6
OR	iv.	List the methods of improving the efficiency and specific output of a simple gas turbine.– **06 Marks**	6

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