

Exam. No: _____

GANPAT UNIVERSITY
B.TECH SEM. IIIRD MECHATRONICS ENGINEERING
REGULAR EXAMINATION NOV / DEC. - 2011
2MC-306: THERMAL ENGINEERING

TIME: - 2 HOURS

TOTAL MARKS-50

- INSTRUCTIONS:** (1) All questions are compulsory.
(2) Assume suitable data if necessary.
(3) Figure to the right indicates full marks.
(4) Scientific calculator, steam table is allowed.

SECTION - I

- Que.-1** **a** Compare the Otto, Diesel and Dual cycle 04
 (i) For same compression ratio and same heat input.
 (ii) For constant maximum pressure and same heat input.
- b** Derive air standard efficiency equation of constant volume cycle with P-V and T-S diagram. 04
- OR**
- Que.-1** **a** Compare the Brayton cycle and Diesel cycle. Why Brayton cycle is suitable for a gas turbine plant and not suitable for a reciprocating engine. 03
- b** An air standard diesel cycle has a compression ratio of 14. The pressure at the beginning of the compression stroke is 1 bar and temperature is 27 °C. The maximum temperature is 2500 °C. Determine thermal efficiency and mean effective pressure. 05
- Que.-2** **a** Derive the heat transfer equation in case of conduction through composite wall. 04
- b** Define three modes of heat transfer and explain each with example. 05
- OR**
- Que.-2** **a** A furnace wall made of 7.5 cm thick fire clay and mild steel plates of 6.5 mm inside and outside also. The inside surface temperature is 650 °C and outside surface temperature is 40 °C. Find (i) The heat loss per m² area of the wall (ii) If 16 steel bolts each of 2 cm diameter per m² area are used for fixing the plates to the brick wall, find the percentage increase in the heat flow per m² area of wall. 06
 Take $K_{\text{brick}} = 1.2 \text{ W/m}^\circ\text{C}$, $K_{\text{steel}} = 40 \text{ W/m}^\circ\text{C}$
- b** Give the concept of Black body. 03
- Que.-3** **Attempt Any Two.** 08
- a** Derive the equation of LMTD for parallel flow heat exchanger.
- b** Give the details classification of the heat exchangers.
- c** Explain critical thickness of insulation.

SECTION-II

- Que.-4 a Define thermodynamics. Explain the Macroscopic and Microscopic point of view thermodynamics. 04
 b Give the following comparisons: 04
 (i) Heat and Work (ii) Extensive property and Intensive property
- OR
- Que.-4 a Explain the concept of continuity. 03
 b Explain the types of thermodynamics systems with examples. 05
- Que.-5 a Define internal energy and prove it is a property of system. 04
 b Write down the general SFEE equation and derive the simplify forms when used for the following systems: 05
 (i) Nozzle (ii) Diffuser
- OR
- Que.-5 a A certain mass of air is initially at 267 C and 7 bar occupies 0.21 m³. The air is expanded at constant pressure such that volume becomes three times the initial volume. A polytropic process with $n = 1.3$ is then carried out, followed by an isothermal process which completes the cycle. Considering all the processes reversible, find. 06
 (i) The heat rejected and received during each process.
 (ii) Net work done during the cycle.
 b Explain the free expansion process with diagram. 03
- Que.-6 Attempt Any Two. 08
 a Give the equivalence between Kelvin Plank and Clausius statements of second law of thermodynamic.
 b Explain the Limitations of First Law of Thermodynamics with examples.
 c Explain then Clausius Inequality.

End of Paper