MANIPAL INSTITUTE OF TECHNOLOGY



(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2019

SUBJECT: COMBUSTION AND HEAT TRANSFER [AAE 4151]

REVISED CREDIT SYSTEM (23/11/2019)

Time: 3 Hours

MAX. MARKS: 50

(02)

(02)

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitable assumed.
- Use of Heat and Mass transfer Data Hand Book is allowed.
- 1A. A rectangular plate 0.2 m × 0.4 m is maintained at a uniform temperature of (05) 80 °C. It is placed in atmospheric air at 24 °C. Compare the heat transfer rate from the plate for the cases when vertical height is (a) 0.2 m (b) 0.4 m.
- 1B. State and Prove Kirchhoff's Law of radiation heat transfer. (03)

1C. What is flow separation? What Causes it?

- 2A. A 3 mm diameter and 5 m long electric wire is tightly wrapped with a 2 mm (05) thick plastic cover whose thermal conductivity is k=0.15 W/m-k. Electrical measurement indicate that a current of 10 A passes through the wire and there is a voltage drop of 8 V along the wire. If the insulated wire is exposed to a medium at T_∞ =30 °C with h=12 W/m²K.Determine the temperature at interface of wire and plastic cover in steady state. Also determine whether doubling the thickness of the plastic cover will increase or decrease the interface temperature.
- 2B. Calculate the efficiency and effectiveness of a cylindrical fin of diameter 1 cm (03) and 0.6 m long. Its base is maintained at 150 °C and is exposed to ambient air at 20 °C. Assume fin material to be copper and let the convective heat transfer coefficient with the ambient air be 30 W/m² °C
- 2C. What is meant by fouling factor? (02)
- 3A. What are the effects of different Engine variables on Flame propagation (05) phase in combustion of spark ignition engines?
- 3B. Explain the phenomenon of bubble dynamics during boiling process. (03)
- 3C. What are the primary requisites for combustion?
- 4A. With a neat Sketch, Explain thermal contact resistance. (03)
- 4B. State the difference in drop wise and film wise Condensation. (02)
- 4C. State relevant assumption and Derive the expression for the temperature (05) distribution across fins with insulated tip.

- 5A. Derive expression for effectiveness by NTU (number of transfer Units) (05) method for the Counter flow heat Exchanger.
- 5B. Water is boiled at the rate of 25 Kg/h in a polished copper pan, 280 mm in (05) diameter at atmospheric pressure. Assuming nucleate boiling conditions. Calculate the temperature of the bottom surface of the pan. Surface fluid constant for polished copper pan is 0.013.