Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2018

SUBJECT: COMBUSTION & HEAT TRANSFER. [AAE-4151]

REVISED CREDIT SYSTEM
(27/11/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- Use of Data Hand Book is permitted.

1A. Explain with figure various types of combustion chamber used in CI engines. **(04)**

1B. Explain various factors that influence the flame speed. **(04)**

1C. How is the contact resistance affected by the roughness of adjoining surfaces? **(02)**

2A. The temperature distribution across a wall 1 m thick at a certain instant of time is given as: $T(x)= a+bx+cx^2$ .Where T is in degrees Celsius and x is in meters, while a =900 ˚C, b= - 300 ˚C/m, and c= - 50 ˚C/m^2. A uniform heat generation, q = 1000 W/m^3, is present in the wall of area 10m^2 having the properties ρ=1600 kg/m^3, k =40 W/m K, and C_p = 4 kJ/kg- K **(05)**

(a) Determine the rate of heat transfer entering the wall (x =0) and leaving the wall (x =1 m).

(b) Determine the rate of change of energy storage in the wall.

(c) Determine the time rate of temperature change at x =0, 0.25, and 0.5m.

2B. The engine cylinder of a motorcycle is constructed of 2024-T6 aluminum alloy and is of height H =0.15 m and outside diameter D =50 mm. Under typical operating conditions the outer surface of the cylinder is at a temperature of 500 K and is exposed to ambient air at 300 K, with a convection coefficient of 50 W/m^2-K. Annular fins are integrally cast with the cylinder to increase heat transfer to the surroundings. Consider five such fins, which are of thickness t =6 mm, length L =20 mm, and equally spaced. What is the increase in heat transfer due to use of the fins? **(05)**

3A. Derive an expression for temperature distribution under one dimensional steady state heat conduction for a sphere. **(05)**

3B. Water is boiled at a rate of 25kg/h in a polished copper pan, 280mm in diameter at atmospheric pressure. Assuming nucleate boiling conditions, calculate the temperature of the bottom surface of the pan. **(05)**

4A. Define the following terms **(a)** Boundary layer thickness **(b)** Displacement thickness **(c)** Momentum thickness. **(03)**

4B. Enumerate four factors on which the rate of emission of radiation by a body depend**.** **(02)**

4C. In a Straight tube of 60mm diameter water is flowing at a velocity of 12m/s .The tube surface is maintained at 70˚C and flowing water is heated from the inlet temperature of 15˚C to an outlet temperature of 45˚C.Taking Physical properties of water at its bulk mean temperature. Calculate the following: **(a)** The heat transfer coefficient from the tube surface to water. **(b)** The total heat Transferred. **(c)** The length of the tube. **(05)**

5A. Water Enters a counter flow double pipe heat exchanger at 15 ˚C flowing at the rate of 1300 kg/h. It is heated by oil (C_p=2000 J/Kg-K) flowing at the rate of 550 Kg/h form an inlet temperature of 94˚C . For an area of 1m^2 and over all heat transfer co-efficient of 1075 W/m^2-K.Determine the total heat transfer and outlet temperature of oil .Take C_{pwater}=4186 J/Kg-K. **(04)**

5B. Write the classification of heat Exchanger. State the difference between Regenerator and recuperator type heat exchanger. **(03)**

5C. State and Prove Wien's displacement law. **(03)**