Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, MAY/JUNE 2016

SUBJECT: COMBUSTION AND HEAT TRANSFER [AAE 352]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Use of Heat and Mass transfer Data Hand Book is allowed.
- Missing data may be suitable assumed.

1A. What is a steady state flame? **(02)**

1B. With a neat sketch, explain the various stages of combustion in spark ignition engines. **(05)**

1C. Two solid cylinders of identical lengths are made of Titanium and Tin respectively. Assuming one-dimensional axial heat conduction across the cylinders, find out the ratio of their diameters when the thermal resistances of conduction for both the cylinders are equal. **(03)**

2A. Explain the chemical delay in compression ignition engines. **(02)**

2B. A copper rod of diameter 25 mm and length 155 mm extends horizontally from a plane heated wall at 120°C. The temperature of the surrounding air is 25°C. If the convective heat transfer coefficient is 9 W/(m^2 °C), determine the rate of heat loss from the base of the fin and the temperature at the free tip of the fin. **(04)**

2C. With suitable assumptions, derive an expression for the temperature distribution across a hollow cylinder made of a material having a constant thermal conductivity 'K'. **(04)**

3A. With appropriate assumptions, obtain an expression for the heat transfer at the base of a uniform straight fin having an isothermal tip. **(06)**

3B. Calculate the thermal resistance of conduction for a pane of window glass of unit area and thickness 5 mm. The outer surface temperature is 24°C and inner surface temperature is 24.5°C. Assume the thermal conductivity of glass to be 0.8 W/(m°C).? **(02)**

3C. What is meant by diesel knock? How is the diesel knock rating for a fuel determined? **(02)**

4A. Explain the concept of boundary layer separation with a neat sketch. **(04)**

4B. Castor oil at 36°C flows over a 6 m long and 1 m wide heated plate at 0.06m/s. For a surface temperature of 96°C, Determine the rate of heat transfer from the entire plate. Assume following properties of castor oil: $\mu=5.76*10^{-5}$ kg/ms; K=0.21 W/(m°C); $\rho=838$ kg/m^3; $c_p=1.9$ kJ/(kg.K). **(04)**

4C. With a neat sketch, describe dropwise condensation. **(02)**

5A. Explain the nucleate boiling regime with help of a neat sketch. **(04)**

5B. A vertical plate 2.8m high is maintained at 54°C, in the presence of saturated steam at one atmospheric pressure. Calculate the heat transfer rate per unit width of the plate. **(03)**

5C. Describe the concept of fouling factor in heat exchangers. **(03)**

6A. A counter-flow heat exchanger is used to cool a hot oil (c=1.9 kJ/(kg.K)) from 120 to 95°C. The oil flows inside the tubes over which cooling water performs the cooling process. The water enters the exchanger at 20°C and leaves the exchanger at 50°C. The overall heat transfer coefficient is 55W/(m^2.°C). What size exchanger will be required to cool 3700 kg/h of oil? What flow rate of water is necessary to achieve the cooling of the hot oil? Assume the specific heat of water, $c_w=4.18$ kJ/(kg.K). **(04)**

6B. What is the significance of no-slip zone in convection heat transfer? **(02)**