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 meant by kindling point? Explain with a suitable example. **(02)**

1B. With neat sketches, explain the effect of the engine variables on the flame propagation phase in spark ignition engines. **(05)**

1C. Asphalt pavements on hot summer days exhibit surface temperatures of approximately 65°C. Assuming the surface to be a perfect emitter, calculate the emitted radiant energy per unit surface area. Take the ambient temperature as 20°C. **(03)**

2A. Under what conditions will the Laplace equation of heat conduction become applicable? **(02)**

2B. A small electric heating application uses wire of 3 mm diameter with 0.7 mm thick insulation (k=0.16 W/m°C). The heat transfer coefficient on the insulated surface is 40 W/m^2°C. Determine the critical thickness of insulation for the wire. **(03)**

2C. Briefly explain the droplet theory in compression ignition engines with neat sketches. **(05)**

3A. A household electric iron has a cast iron base weighing 1 kg. The surface area of the base is 0.02 m^2. The iron after usage is switched off and dissipates heat from the base by convection into the ambient air at 20°C. During switching off, the iron base is at a uniform temperature of 130°C. Calculate the temperature of the base after 2 minutes. The convection coefficient between the flat base and the air can be taken as 40W/(m^2.°C). **(04)**

3B. Derive an expression for the thermal resistance due to radiation heat transfer between a non-black surface maintained at 'T_1'°C and ambient environment at 'T_2'°C. (T_1>T_2). **(03)**

3C. Derive an expression for the logarithmic mean area for hollow cylinders. **(03)**

4A. Calculate the efficiency and effectiveness of a cylindrical fin of diameter 1 cm and 0.6 m long. Its base is maintained at 150°C and is exposed to ambient air at 20°C. Assume the fin material to be copper and let the convective heat transfer coefficient with the ambient air be 30W/(m^2°C). **(03)**

4B. Show by dimensional analysis for forced convection, ***Nu=ϕ(Re,Pr)***. **(05)**

4C. What is meant by pool boiling in liquids? **(02)**

5A. A Cylinder of 300 mm diameter and 1.6 m height is kept horizontally at 36.5°C. Surrounding air is at a temperature of 13.5°C. Find the amount of heat lost by the cylinder surface in kJ/hr. **(04)**

5B. State and prove the Kirchoff's law of radiation. **(03)**

5C. Derive an expression for the efficiency of a fin having an adiabatic free tip. **(03)**

6A. Using Nusselt's method, obtain an expression for the film thickness of the condensate for film-wise condensation across a vertical plate. **(06)**

6B. With neat sketch, explain the working of parallel flow heat exchangers. **(04)**