Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.TECH. (AUTOMOBILE ENGINEERING)
END SEMESTER EXAMINATIONS, NOVEMBER 2018
SUBJECT: COMBUSTION AND EMISSION [AAE 5104]
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 Combustion data hand book is permitted.

1A. A small low-emission, stationary gas turbine engine operates at full load (3950kW) at an equivalence ratio of 0.286 with an air flow rate of 15.9 kg/s. The equivalent composition of the fuel (natural gas) is $C_{1.16}H_{4.32}$. Determine the fuel mass flow rate and the operating air-fuel ratio for the engine. **(05)**

1B. Classify the types of flames and explain them in detail. **(05)**

2A. Find the adiabatic flame temperature of Bituminous coal burned with 50% excess air at 25 degree Celsius and 1 atm. The as-received ultimate analysis of the coal is 70% (wt) carbon, 5% hydrogen, 15% oxygen, 5% moisture and 5% ash. Neglect dissociation and neglect the ash. Enthalpy of formation of Bituminous coal is -1081 kJ/kg. **(05)**

2B. Explain competitive and consecutive reactions with suitable examples. **(05)**

3A. Derive an expression for equilibrium constant (K_p) in terms of mole fraction and pressure. **(05)**

3B. For the dissociation of carbon di oxide, find the mole fraction of various species at 2500 K and pressure of 1 atm. **(05)**

4A. A closed chamber initially contains 1000 ppm of CO, 3% O_2 and the reminder N_2 at 1500 K and 1 atmosphere pressure. Determine the time for 90% of the CO to react assuming only elementary reaction: $CO+O_2 \rightarrow CO_2+O$. Given the kinetic rate constant $k=2.5\times10^6$ exp(-24060/T) $mol^{-1}.m^{-3}.s^{-1}$, where T is the absolute temperature. **(05)**

4B. Explain briefly various sources of pollution in IC Engines. **(05)**

5A. List the methods that can be employed to control emission in I C Engines. With a neat sketch explain EGR and its limitations **(05)**

5B. With a neat sketch explain construction and working of thermal Conductivity detector and ionization detectors used in gas chromatography **(05)**