Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.TECH. (AUTOMOBILE ENGINEERING)
END SEMESTER EXAMINATIONS, NOVEMBER 2019
SUBJECT: COMBUSTION AND EMISSION [AAE 5173]
REVISED CREDIT SYSTEM
(23/11/2019)

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. With P-θ diagram explain combustion Stages in SI engine. (05)

1B. A truck fuel (D2 grade) has a specific gravity of 0.81 and a 50% distillation temperature of 524 K. Calculate the Cetane Index for this fuel. (05)

2A. With a neat sketch explain working of Non-dispersive Infrared Detectors and dilution tunnels. (05)

2B. Explain first, second and third order 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 2000 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: Given, the kinetic rate constant $k=2.5\times10^{6}\exp(-24060/T)$ $gmol^{-1}.m^{-3}.s^{-1}$, where T is the absolute temperature. (05)

4B. Briefly describe the formation of NOx in internal combustion engines. (05)

5A. List the methods employed to control emission in I C Engines. With a neat sketch explain i)Exhaust manifold reactor ii) Catalytic Converters (05)

5B. 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)