

1ANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

I SEMESTER M.TECH. (AUTOMOBILE ENGINEERING) **PROCTORED ONLINE END SEMESTER EXAMINATIONS, FEBRUARY 2022** SUBJECT: COMBUSTION AND EMISSION [AAE 5173] **REVISED CREDIT SYSTEM** (14/02/2022)

Time: 75 MINUTES

MAX. MARKS: 20

Instructions to Candidates:

- Answer ALL the questions, Missing data if any may be suitably assumed.
- Use of Combustion data hand book is permitted.
- 1A. 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% (05)ash. Neglect dissociation and neglect the ash. Enthalpy of formation of Bituminous coal is -1081 kJ/kg.
- 1B. With a neat sketch explain EGR and its limitations (03)
- 1C With a neat sketch explain working of ionization detectors used in gas (02)chromatography.
- 2A. A closed chamber initially contains 1000 ppm of CO, $3\% O_2$ and the reminder (04) N₂ 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.
- 2B. Classify and explain various types of flames. (03)
- 2C (03) Briefly describe the formation of NOx in internal combustion engines.