Code No: **R1631242**   **R16**   SET - 1

III B. Tech I Semester Supplementary Examinations, August - 2021
FUELS AND COMBUSTION
(Automobile Engineering)

Time: 3 hours   Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**
Data Books and Tables allowed
*****

PART –A   (14 Marks)

1 a) Differentiate between conventional and unconventional fuels. [2M]
  b) Describe the following related to petroleum:(i)Derivation;(ii) Classification [2M]
  c) Define following modes of combustion: (i) Flame combustion (ii) Flameless combustion. [2M]
  d) Elucidate importance of thermo-chemistry in combustion. [3M]
  e) Define and distinguish between 'Deflagration' and 'Detonation' modes of combustion. [3M]
  f) Differentiate droplet- and spray- combustion with neat sketches by highlighting their relative merits and demerits. [2M]

PART –B   (56 Marks)

2 a) With schematic explain working methodology involved in liquefied petroleum gas (LPG) cylinder stating thermodynamic properties essential for its storage. [7M]
  b) Enlighten about following in detail related to solid fuels: [7M]
        i) Handling; (ii) Combustion; (iii) Storage.

3 a) Explain in detail the following related to coal combustion: [7M]
        (i) Carburization   (ii) Gasification and Liquefaction
        (iii) Action of heat   (iv) Hydrogenation.
  b) Discuss briefly about following related to petroleum: [7M]
        (i) Composition   (ii) Properties
        (iii) Various products and   (iv) Testing procedures.

4 a) Explain the significance of the following with necessary illustrations and mathematical correlations: [7M]
        (i) Stoichiometry relations; (ii) Theoretical air required for combustion
        (iii) Chemical kinetics;   (iv) Rate of reaction
        (v) Reaction order;   (vi) Dissociation;   (vii) Half-time.
  b) A vessel contains 10^{-6} mol/cm^3 of nitrogen dioxide (NO_2) at 648 K which is decomposed by the following reactions: $2NO_2 \xrightarrow{k_f} 2NO + O_2$. Determine the reaction rate (RR) of NO_2 assuming k_f to be 765 cm^3/mol-s. [7M]

5 a) Hydrogen gas is burned with air in stoichiometric proportions. The [7M] pressure is 1 atm. Assuming the products of combustion contains O_2, H_2O, and N_2 in their gaseous states and all the species involved follow perfect-gas equation of state, Calculate: (i) Adiabatic flame temperature for the reaction, and (ii) Specific heat ratio for products of combustion. Assume the composition of atmospheric air is 79% of N_2 and 21% O_2, by volume.

   b) Determine the standard free-energy change for the following reaction [7M] between methane (CH_4) and oxygen (O_2) at 25^0C and 1 atm pressure.

6 a) List ten important assumptions to perform one-dimensional laminar [7M] flame analysis and sketch its flame structure for a simplified model.

   b) List two 'Stationary Methods' available for experimental characterization [7M] of Burning Velocity [S_L] and explain flat flame burner working with a sketch.

7 a) Distinguish between Entrained- and Fluidized bed- combustion with [7M] suitable sketch and highlight their relative merits and demerits.

   b) Explain about following processes involved within solid fuel combustion: [7M]
   (i) Pyrolysis   (ii) Devolatilization
   (iii) Char combustion   (iv) Gasification.

*****

2 of 2

|'|'|'|||'|'|'|||'|