Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **M.Tech**
HTPE205

2nd Semester Back Examination 2016-17
Theory of Combustion & Emission
BRANCH: HEAT POWER & THERMAL ENGG, HEAT POWER ENGG, THERMAL ENGG, THERMAL POWER ENGG

Time: 3 Hours
Max Marks: 70
Q.CODE: Z853

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) What three conditions define the standard reference state ?

b) Describe the effect of increasing pressure and temperature on the equilibrium composition of combustion products.

c) Determine the mass fraction of O_2 and N_2 in air, assuming the molar composition is 21 percent O_2 and 79 percent N_2.

d) Contrast combustion in compression ignition engines and spark ignition engines. What are the main differences in fuel requirements ?

e) What is the difference between 'knock' in compression ignition and spark ignition engines ? How can 'knock ' be eliminated in each case ?

f) What is a thermal energy reservoir? Explain Kelvin–Planck expression of the second law of thermodynamics.

g) Explain normal combustion and abnormal combustion.

h) Draw the schematic sketch of solid fuel ramjet and scramjet engine.

i) What is equivalence ratio? Mention its significance.

j) Explain the differences between BS III and BS IV engines with respect to emission ?

Q2 a) What is additive? What is the effect of additive on fuel economy? **(2)**

b) A fuel oil has a composition by weight of 0.865 carbon, 0.133 hydrogen and 0.002 incombustibles. Find the stoichiometric gravimetric air/fuel ratio. **(8)**

When the fuel is burnt with excess air, the dry volumetric exhaust gas analysis is: CO_2 0.121, N_2: 0.835, 0_2 0.044. Determine the actual air/Fuel ratio used and the wet volumetric exhaust gas analysis.

Consider 1 kg of fuel, and convert the gravimetric data to molar data.

Molar mass of carbon = 12, hydrogen = 1.

Q3 **a)** Compare between laminar and turbulent flame fronts for pre-mixed combustion. **(5)**

b) Explain the Combustion in SI engines. Draw the pressure diagram for the same. **(5)**

Q4 **a)** Briefly explain the sources and control of emissions in CI engines. **(5)**

b) Explain about air-breathing jet propulsion and non air-breathing jet propulsion with examples. **(5)**

Q5 **a)** Briefly explain about the pulverized coal burning systems. **(5)**

b) Mention the differences between gas and liquid type burners with proper examples. **(5)**

Q6 **a)** Differentiate between flame ignition and extinction. **(4)**

b) A liquid fuel has the composition: **(6)**

C 86.5%
H 13.0%
O 0.2%
S 0.3%

Its higher heating value is HHV = 45×10^6 J kg^{-1}. Determine an effective chemical formula and enthalpy of formation for this fuel.

Q7 Briefly explain the flame propagation and structure of: (a) Bunsen burner flame; (b) spark ignition engine; (c) diffusion flame, with proper diagram. **(10)**

Q8 **Write short answer on any TWO:** **(5 x 2)**

a) Fluidized bed combustion

b) Vapour Compression Refrigeration cycle

c) Combined power cycle

d) Solid fuel propellant system