

Code No: 5221AN

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech II Semester Examinations, August - 2017

COMBUSTION AND ENVIRONMENT

(Thermal Engineering)

Time: 3hrs

Max.Marks:75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10-marks and may have a, b, c as sub-questions.

PART - A**5 × 5 Marks = 25**

- 1.a) What do you know about the origin of coal? What changes occur in the series from wood to anthracite? [5]
- b) What you understand by the 'activation energy' of a reaction? Explain. [5]
- c) Distinguish between the enthalpy of combustion and the internal energy of reaction. How are they related? [5]
- d) Briefly describe the mode of combustion of fuel droplets in sprays. [5]
- e) What do you understand by air pollution from the combustion of fossil fuels? [5]

PART - B**5 × 10 Marks = 50**

- 2.a) Explain the fractional distillation method of refining petroleum products with suitable diagram.
 - b) Discuss the problems associated with very low calorific value gaseous fuels. [5+5]
- OR**
- 3.a) Compare and contrast the solid fuels, liquid fuels and gaseous fuels in terms of chemical properties.
 - b) Discuss the various alternative energy resources which are likely to make a significant contribution towards the energy demand in future. [5+5]
- 4.a) A fuel gas has the following percentage volumetric analysis: H₂: 48, CH₄: 26, CO₂: 11, CO: 5, N₂: 10. The percentage volumetric analysis of the dry exhaust gases is CO₂: 8.8, O₂: 5.5, N₂:85.7
Determine the air/fuel ratio by volume if air contains 21% O₂ by volume.
 - b) Discuss the law of Arrhenius for the effect of temperature on the reaction rate constant. Show how the value of E can be determined experimentally. [5+5]
- OR**
- 5.a) Calculate the composition of dry flue gases in the combustion of C₇H₁₆ for stoichiometric combustion, 30% excess air and 20% deficit air.
 - b) A first order reaction is 30 percent complete at the end of 140 s. What is the value of the reaction rate constant in s⁻¹? In how many seconds will the reaction be 60 percent complete? [5+5]

6. Determine the enthalpy of combustion and internal energy of reaction for C_2H_2 . [10]

OR

7. Calculate the adiabatic flame temperature of gaseous propane liquid burns at $500^\circ C$ with 300% theoretical air. [10]

8.a) Enumerate the various assumptions made in the derivation of the Semenov equation for the determination of burning velocity of a combustible mixture.

b) Describe with the help of a suitable sketch a turbulent flame model showing the boundaries of flame brush and the mean surface, [5+5]

OR

9.a) Describe the different methods of flame stabilization in gas streams.

b) What are the effects of oxygen concentration, pressure and flame radius on the mass burning rate of a fuel droplet with and without natural convection? [5+5]

10.a) Describe the exhaust gas recirculation(EGR) device for the control of NO_x emission from SI engine.

b) What are catalytic converters? How are they helpful in reducing HC, CO and NO_x emissions? [5+5]

OR

11.a) What is the role of public health department for the utilization of municipal solid waste?

b) What are the sources of HC formation in petrol engine? Explain different factors which affect HC formation. [5+5]