

**Total Pages—4**

**(Set-P)**

**B.Tech - 4th(Chem. Engg)**  
**Fuel and Combustion**

*Full Marks : 70*

*Time : 3 hours*

**Answer any six questions including Q. No. 1  
which is compulsory**

*The figures in the right-hand margin indicate marks*

**Symbols carry usual meaning**

1. Answer *all* questions : 2 × 10
- (a) Define the term fuel with its classification.
  - (b) Define calorific value.
  - (c) Explain higher and lower calorific value.
  - (d) What is the significance of pre-heating furnace oil before burning ?
  - (e) Name two liquid fuels, solid fuels and gaseous fuels used in boilers.

*( Turn Over )*

- (f) How the gaseous fuels are superior to all other fuels ?
  - (g) What is the typical stoichiometric air fuel ratio for furnace oil ?
  - (h) What is knocking ? How is it rectified ?
  - (i) Mention the significance of flue gas analysis.
  - (j) What is octane number ? How is it improved ?
2. (a) Explain proximate analysis. Give its significance. 5
- (b) What do you mean by the term coke ? How Metallurgical coke is manufactured ? 5
3. (a) Explain producer gas with a neat diagram. 5
- (b) Explain why natural gas requires least amount of excess air ? 5
4. (a) Explain Water gas with manufacture process reactions. 5

- (b) Explain the following : 5
- (i) Compressed natural gas(CNG)
  - (ii) Liquid petroleum gas.(LPG)
5. (a) The measured  $\text{CO}_2$  is 8% in an oil fired boiler flue gas. Theoretical  $\text{CO}_2$  content for the fuel fired is 16%. Estimate the % excess air level ? 6
- (b) What is crude oil ? What are the various fractions obtained by the fractional distillation of crude oil ? Mention the composition and uses ? 4
6. (a) The proximate analysis of coal is : Moisture 2.4%, Volatile Matter 29.4%, Fixed Carbon 58%, Ash 9.7% and sulphur 0.5%. Its gross calorific value is 7650 Kcal/kg. Calculate proximate analysis and calorific value on
- (i) Moisture free basis
  - (ii) Dry ash free basis. 6
- (b) With a neat diagram, describe the manufacture of water gas. 4

7. (a) Calculate the percentage excess air for methane burning. The flow rate of methane and air are 25 and 290 m<sup>3</sup>/h respectively. 6
- (b) Explain ultimate analysis. Give its significance. 4
8. (a) In combustion of pure methane gas with 5% of excess air, determine the gas composition of flue gas in volume%. 5
- (b) How synthetic petrol is obtained by Bergius and fischer-Tropsche method? 5
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