



- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
➤ DON'T WRITE ANYTHING ON THE QUESTION PAPER

General Instruction: Steam tables permitted

COs	CO Statements
CO1	Understand various types of fuels for firing in boilers and furnaces
CO2	Select the right type of fuel based on availability, storage, handling, pollution and cost of fuel
CO3	Describe the fuel properties for efficient use
CO4	Analyse exhaust and flue gases
CO5	Explain various combustion equipment

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions
(10 X 10 = 100 Marks)

- A 0.9 g sample of coal was burnt in a bomb calorimeter. CO1 BL3

The water equivalent of the calorimeter (including water) is 2500 g, and the temperature of the water increased from 26.5°C to 29.0°C. During the experiment, the following corrections were applied:

Fuse wire correction = 10 cal
Acid correction = 50 cal
Cooling correction = -20 cal

If the hydrogen content in the coal is 5%, calculate the higher calorific value (HCV) and the lower calorific value (LCV) of the coal in kJ/kg
- Explain the principle, procedure, and significance of proximate and ultimate analysis of coal and highlight their comparative importance in evaluating coal quality. CO2 BL2
- Discuss in detail the Low-Temperature Carbonization (LTC) and High-Temperature Carbonization (HTC) of coal. CO3 BL2
- Discuss the desirable coal properties for the following purposes and justify your answer: CO1 BL3

 - Power generation
 - Steel manufacturing
 - Chemical and domestic use

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| 5. | Describe the important reactions involved during the cracking process. Additionally, discuss the impact of various parameters on the cracking process, highlighting how they affect product yield and quality. | CO3 | BL3 |
| 6. | (i) Describe the different grades of LPG available for industrial, domestic, and automotive purposes, stating their typical composition ranges. | [6] | CO2 BL2 |
| | (ii) Discuss the advantages of LPG over conventional solid and liquid fuels. | [4] | |
| 7. | Write short notes on the following gaseous fuels:
(i) Producer gas
(ii) Water gas | CO1 | BL2 |
| 8. | Describe in detail the manufacture of methanol, with the help of a neat flow diagram. | CO2 | BL2 |
| 9.a) | The following is a percentage analysis by volume of dry flue gas: CO ₂ = 11.9; CO = 0.1; O ₂ = 6.2; and N ₂ = 81.8. Calculate the actual air drawn through the furnace per kg of coal fired and the excess air supplied per kg of coal fired, if the coal contains 86.8% carbon. | CO4 | BL3 |

OR

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| 9.b) | Calculate the volume of minimum air required to burn completely 1 m ³ of a gaseous fuel having the following composition by volume: H ₂ , 14%; CH ₄ , 1%; CO, 24%; CO ₂ , 5%; O ₂ , 1%; and N ₂ , 55%. If 40% excess air is supplied, determine the actual volume of air supplied per m ³ of gas. | CO4 | BL3 |
| 10.a) | Explain the construction and principle of operation of a Circulating Fluidised Bed Combustion (CFBC) boiler with the help of a neat schematic diagram. | CO5 | BL3 |

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| 10.b) | Describe the working principle of an oil atomising burner, highlighting the role of atomization in combustion efficiency. | CO5 | BL3 |
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