

Questionnaire of NPTEL course “Fuel and Combustion Technology” by Prof. J.K. Basu and Prof. S. Sengupta

Module 1:

1. Describe the process of coalification. State the rank of coal with a block diagram.
2. Name the different theories behind the coal forming process? Describe any one of them.
4. How do the moisture content and carbon content vary with the rank of coal?
5. What is sedimentary rock? How petroleum oil is formed in this rock? What is the difference between sedimentary rock and reservoir rock? Draw a picture of reservoir rock where oil and gas are reserved.
6. State the different types of deformation seen within the sedimentary rock where there is a probable oil accumulation obtained.
7. What is the composition of LPG? Write two uses of natural gas in industry.
9. Why API gravity is used instead of specific gravity for petroleum fuels?
10. What is viscosity index? Which type of lubricating oil is more preferable, high VI or low VI?
11. Which one is more important between the two and why:
(a) Flash point and Fire point, (b) Pour point and cloud point
12. Define octane number and cetane number. Name the fuels for which they are used. Write the names of some octane number improvers.
13. Describe different types of drives used for drilling of petroleum oil and gas from underground.
14. Define Micum index. What is the purpose of Micum test and how it is done?
15. Why the pour point is reported by adding 2.8°C with the experimentally determined pour point?

Module 2

1. Define the “dry and mineral matter free” and “as received” basis for coal.
2. What is the broad classification of coal mining? Describe in brief the Float and Sink test.
3. Describe devolatilisation of coal at different temperature range. What is the composition of volatile matter.
4. What are factors which affects the coal combustion technology? Define different feeding arrangements of furnace for coal combustion.
5. What are the advantages of using pulverised coal in coal combustion. Write the main application of oxy-fuel combustion process.
6. What are the main objectives of Tar Distillation Plant? Write different sections of the plant.
7. Draw a block diagram of different routes of coal to liquid fuel manufacture.
8. Describe briefly H-coal process. What is the advantage of using ebulated bed reactor instead of fixed bed one?
9. What is the difference between the hydrocarbon products obtained as liquid fuel from Fischer Tropsch process and MTG process? Write the chemistry involved in MTG process.
10. What are the types of reactor used for coal gasification?

Module 3

1. How seismic survey is done in exploration of petroleum.
2. What is drilling mud and what are the functions of it in drilling?
3. What is Characterisation factor? How does it vary for different types of crude oil?
4. Draw a comparison curve of TBP, ASTM and EFV for a petroleum cut and also compare their slopes.
5. What is the concept of mid-percent curve?
6. What are the different types of reflux systems used in atmospheric distillation? Illustrate them.
7. What is the difference between the operations of vacuum distillation of Lube-type and Fuel-type crude oils?
8. What is the purpose of Hydrocracking? Draw a process flow diagram of Hydrocracking unit.
9. What is the main difference in the operation of Fluid coking and Delayed coking? Why the name "Delayed" is used? How the product coke is separated from coke drum?
10. What is the main purpose of reforming? Write the names of the major reactions involved in this process. State the reactor arrangements in CCR process.
11. Why hydrotreatment is a necessary step in petroleum fuel processing? What is de-oiling? Describe briefly the de-oiling process.
12. What is the major furnace used in the refinery to heat the crude oil? How does it heat the oil?

Module 4

1. What important parameters are used to determine the quality of a gaseous fuel?
2. Write different types of Gas-Oil contact in a reservoir.
3. What is natural gas hydrate? State the composition of LPG.
4. What are the main advantages of steam blast over air blast for producer gas manufacture?
5. Define blast saturation temperature. Write briefly about different types of gas producers.
6. What are the purposes of dividing the water gas manufacturing process into two stages?
7. Write the short description of steam reforming process for manufacturing hydrogen gas. In which respect partial oxidation is useful than steam reforming?
8. How acetylene is produced from natural gas? Write some important uses of acetylene.
9. What is the main constituent of coal gas? How this gas is purified after its manufacture?
10. What are refinery gases and what is its use? How synthesis gas is produced by oil gasification?

Module 5

1. Define the standard enthalpy of reaction and standard enthalpy of formation.
2. What is Hess's Law ? Explain the law with an example.
3. The enthalpy of combustion for H_2 , C and CH_4 are -285.8, -393.5, and -891 kJ/mol respectively. Calculate the standard enthalpy of formation for CH_4 .
4. Calculate the heat of reaction for $\text{CS}_2(\text{l}) + 2 \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2 \text{SO}_2(\text{g})$ using the enthalpies of formation data. The enthalpies of formation (ΔH_f) for $\text{CO}_2(\text{g})$, $\text{SO}_2(\text{g})$ and $\text{CS}_2(\text{l})$ are -393.5, -296.6 and 87.9 kJ/mol respectively.
5. What is the stoichiometric air and stoichiometric ratio? In a combustion process 30% excess air is used. Calculate the air-fuel ratio in the combustion.
6. What is difference between gross calorific value and net calorific value?
7. Define constant pressure adiabatic flame temperature.
8. Describe the different consecutive steps for the mechanism of combustion.
9. How the flame will be formed in burning of a fuel vapor ?
10. Explain the formation of premixed flame and non-premixed flame.
11. Describe the laminar premixed flame structure with a neat sketch. What is the velocity of flame propagation? What is flammability limit?
12. Describe the principles of Swirl Oil Burner and Rotary Cup Burner.
13. What is Atmospheric Gas Burner ? How does it operate?
14. With a sketch, explain the operation of Natural gas fired cupola.
15. What are the various reactions occur in Blast Furnace according to different temperature range?