Department of Mechanical Engineering

BM 7103 FUELS AND COMBUSTION

QUESTION BANK

UNIT-1-FUELS

PART-A (2 Marks)

1. Define the term fuels.
2. What are fossil fuels? Give examples.
3. Define primary fuels. Give examples.
4. What are secondary fuels? Give examples.
5. Describe solid fuels.
6. Write a short note on liquid fuels.
7. What are gaseous fuels and give examples.
8. What are the types of fuels?
9. Define density of fuels.
10. What is viscosity of fuels?
11. What do you mean by flash point?
12. Define fire point.
13. Define calorific value.
14. What do you mean by treatment of fuels?
15. What is cracking of petroleum?
16. Define fractional distillation.
17. List out the fuels derived from petroleum oil.
18. What are the important properties of fuels?
19. What is octane number?
20. Define cetane number.

PART-B (6 Marks)

1. Classify fuels and give examples.
2. Explain the physical properties of fuel.
3. Describe the chemical properties of fuels.
4. Explain the significance of maintaining the correct viscosity for fuels.
5. Write a brief note on cracking of petroleum.
6. What is the significance of treatment of fuels?
7. Explain how the engine performance is influenced by the quality of fuel.

8. Write a note on fossil fuels.
9. Explain primary fuels with examples.
10. Discuss about secondary fuels with examples.
11. Write a note on solid fuels.
12. Explain about liquid fuels.
13. Discuss about gaseous fuels with examples.
14. Write a note on refining of petroleum.
15. Explain about the by-products of petroleum.

PART-C (10 Marks)

1. Explain about treatment of fuels for combustion in IC Engines.
2. Describe the fractional distillation process with a neat sketch.
3. Explain any two tests to determine change in physical properties of fuels.
4. Describe any two tests to determine the change in chemical properties of fuels.
5. What are the effects of fuel quality on engine performance? Explain them briefly.
6. What are fuels? Explain the classification of fuels with examples.

UNIT-2-COMBUSTION

PART-A (2 Marks)

1. Define combustion of fuels.
2. What is flame?
3. Classify flames.
4. Define premixed flame.
5. What is diffusion flame?
6. What do you understand by laminar flame?
7. Define turbulent flame.
8. State first law of thermodynamics.
9. Define reactants.
10. What do you mean by product of combustion?
11. What is combustion stoichiometry?
12. Define enthalpy.
13. What is entropy?
14. State second law of thermodynamics.
15. Give the expression of Gibb's function.
16. What is Bunsen burner?
17. What do you mean by flame front?
18. Define flame cone.
19. What is steady flame?

20. What is unsteady flame?

PART-B (6 Marks)

1. Explain the importance of complete combustion of fuels.
2. What is flame? What are the types of flames?
3. Explain premixed flame with a neat sketch.
4. Write a note on diffusion flame with a neat sketch.
5. Distinguish laminar flame and turbulent flame.
6. State first law and second law of thermodynamics.
7. Explain reactants and products with an example.
8. Explain combustion stoichiometry with an example.
9. Distinguish enthalpy and entropy.
10. Explain Gibb's function.
11. Write a brief note on Bunsen burner.
12. Draw a neat sketch of a flame front and explain its components.
13. Write a short note on the following. (i) burning velocity (ii) velocity of flame propagation
14. Define the following. (i) steady flame (ii) unsteady flame
15. Define the following. (i) Heat (ii) Temperature (iii) Enthalpy and (iv) Entropy

PART-C (10 Marks)

1. What is stoichiometry? Discuss in detail about combustion stoichiometry with a example.
2. Classify flames and explain them with necessary sketches.
3. Draw neat diagram of Bunsen burner and explain its operation.
4. Derive the expression for Gibb's function.
5. Explain enthalpy of combustion and heating.
6. Discuss about flame propagation and derive an expression for velocity of flame propagation.

UNIT-3-KINEMATICS OF COMBUSTION

PART-A (2 Marks)

1. Define the term chemical kinetics.
2. What is reaction mechanism?
3. What do you mean by reaction rate?
4. Define rate law.
5. What do exponents indicate in rate law?
6. Define reaction order.

7. Give an example for first order reaction.
8. State the relationship between temperature and reaction rate.
9. What is molecular collision?
10. Define activation energy.
11. State Arrhenius equation.
12. What is frequency factor?
13. Define reaction mechanism.
14. What do you mean by elementary reaction?
15. What is a catalyst?
16. Define unimolecular reaction.
17. What is bimolecular reaction?
18. What is chain branching reaction?
19. Define chain reactions.
20. What is explosion?

PART-B (6 Marks)

1. Explain how the physical states of reactants affect reaction rates.
2. Discuss about the influence of concentration of reactants on reaction rates.
3. Explain how temperature does affect the reaction rates.
4. Discuss about the presence of a catalyst that influences reaction rates.
5. Write a short note on the following. (i) Chemical kinetics (ii) Reaction rates
6. How would you calculate rate constant? Give an example.
7. Explain first order process with an example.
8. Write a short note on the following. (i) Half life (ii) Activation energy
9. With a neat sketch explain a collision model.
10. Write a note on catalyst and its types.
11. Differentiate unimolecular and bimolecular reactions.
12. Explain the following. (i) chain reactions (ii) chain branching reactions.
13. Write a brief note on H_2-O_2 chemical mechanisms.
14. Explain the term explosion limits.
15. Define the following terms. (i) Global reaction (ii) Elementary reaction.

PART-C (10 Marks)

1. What are the factors affecting reaction rates? Discuss them in detail.
2. Explain Maxwell-Boltsmann distributions.
3. With suitable examples, explain unimolecular and bimolecular reactions.
4. Describe chain and chain branching reactions with examples.
5. Discuss in detail about explosion limits.

6. How would you determine the rates of reaction by change in concentration experimentally?

UNIT-4-PREMIXED FLAMES

PART-A (2 Marks)

1. Define premixed flame.
2. What is premixed laminar flame?
3. What do you mean by flame velocity?
4. Define flame thickness.
5. What is equivalence ratio?
6. Write a brief note on flame quenching.
7. Define ignition.
8. What is flammability?
9. Write a short note on flammability limit.
10. Define diffusion flame.
11. What is laminar diffusion flame?
12. Write a brief note on laminar jets.
13. Define flame speed.
14. What is the difference between premixed laminar flame and premixed turbulent flame?
15. Distinguish laminar flame with laminar jet.
16. Draw a neat diagram of a laminar flame.
17. Draw a neat sketch of a turbulent flame.
18. Give some practical examples of premixed laminar flames.
19. What are the examples of premixed turbulent flames?
20. Write a short note on structure of flame.

PART-B (6 Marks)

1. Describe in detail about premixed laminar flame.
2. Explain the structure of premixed laminar flame.
3. Write short notes on (i) flame velocity (ii) flame thickness.
4. What is the effect of equivalence ratio on flame speed?
5. Discuss about the effect of equivalence ratio on flame thickness.
6. Explain flame quenching and ignition.
7. Describe in detail about flammability limits.
8. What is the structure of diffusion flame from laminar jets?
9. Draw neat sketches of the following (i) laminar flame (ii) turbulent flame.
10. Define the following. (i) flammability (ii) flammability limits.
11. Write a brief note on the following. (i) laminar flame (ii) laminar jets.

12. Define the following. (i) flame speed (ii) equivalence ratio.
13. Describe in detail about premixed turbulent flame.
14. Differentiate laminar premixed laminar flame and premixed turbulent flame.
15. Write short note on flame colors.

PART-C (10 Marks)

1. Explain in detail about the analysis laminar flame.
2. Discuss in detail about the effect of equivalence ratio on flame speed and flame thickness.
3. Explain the structure of different premixed flames with neat sketches.
4. Describe the structure of diffusion flame from laminar jets.
5. Write detailed notes on the following.(i) Flame quenching (ii) Ignition.
6. Describe flammability limits in detail.

UNIT-5-TURBULENT FLAMES

PART-A (2 Marks)

1. Define turbulent flame.
2. What are the types of turbulent flame?
3. Define droplet combustion.
4. What is evaporation of droplet?
5. List out any two effects of pollutants.
6. What do you mean by burning droplet?
7. What are pollutant emissions in combustion?
8. What are the pollutant emissions?
9. What is emission index?
10. State D^2 law.
11. Draw a neat sketch of a turbulent flame.
12. List out some pollutants of combustion.
13. Differentiate premixed turbulent flame and diffusion turbulent flame.
14. Write a short note on NO_x emissions.
15. What do you mean by $SO_{x?}$
16. What is the effect of Sulphur in the atmosphere?
17. Write a short note on emission norms in India.
18. Give some applications of turbulent flames.
19. Write any two applications of droplet combustion.
20. Give some examples of turbulent flames.

PART-B (6 Marks)

1. Define turbulent flame. What are the types of turbulent flame?
2. Define droplet combustion. What is evaporation of droplet?
3. What are the characteristics of turbulent flames?
4. Write a note on pollutant emissions in combustion?
5. Define the following. (i) emission index (ii) D^2 law
6. Draw a neat sketch of a turbulent flame and indicate the different zones.
7. What are the differences between premixed turbulent flame and diffusion turbulent flame?
8. Explain the effects of NO_x emissions.
9. Discuss in detail about SO_x emissions.
10. What is the relationship between incomplete combustion and the atmosphere?
11. Write a note on applications of droplet combustion.
12. Discuss about effects of pollutants.
13. Write a note on burning of droplets.
14. What are the ways to control emissions in vehicles?
15. Write a note on Bharath stage-IV.

PART-C (10 Marks)

1. What is turbulent flame? Mention the types, characteristics and applications of turbulent flames.
2. Explain the structure of turbulent flames with neat sketches.
3. Discuss in detail about droplet combustion and its applications.
4. Describe a simple model for evaporating and burning droplet.
5. Explain the effects of pollutants.
6. Discuss in detail about various emissions in combustion of fuels.
