Mark Scored:

KATHMANDU UNIVERSITY
End Semester Examination
August/September, 2017

Level : B. E.
Year : III
Course : MEEG 316
Semester : II
Exam Roll No. :
Time: 30 min
F. M. : 20
Registration No.:
Date SEP 10 2017

SECTION "A"
[8 Q × 1 = 8 marks]

Choose the most appropriate answer/s.

1. A reacting system considers the
   a. sensible internal energy
   b. chemical internal energy
   c. latent internal energy
   d. all of the energies

2. The first gas turbine engine that was developed during second world war was
   a. turbojet b. turbofan c. turboprop d. turboshaft

3. Moisture, ash content, volatile matter and fixed carbon are measured for coal as part of:
   a. proximate analysis
   b. ultimate analysis
   c. both proximate and ultimate analysis
   d. general analysis

4. LPG is predominantly a mixture of propane and
   a. methane b. butane c. isopropane d. ethane

5. In the Rankine Cycle, the heat is added
   a. isothermally
   b. at constant pressure
   c. at constant volume
   d. adiabatically

6. With reheat Rankine Cycle, the
   a. quality of exhausted steam is improved
   b. net work output of cycle increases
   c. specific steam consumption decreases
   d. the quality of the steam improves, work output increases and specific steam consumption decreases.

7. The limit of air-fuel mixture strength that defines the ignitability of the mixture is called
   a. equivalence ratio
   b. flammability limit
   c. ignition energy
   d. flash point

8. Actual flame temperature is always lower than the adiabatic flame temperature, because there is
   a. incomplete combustion, heat loss and dissociation
   b. incomplete combustion at high temperature
   c. always loss of heat from the flame
   d. dissociation effects

SECTION "B"

[10 Q. × 1 = 10 marks]

9. The type of gas turbine used for passenger jet engine is _____

10. Adiabatic flame temperature attains maximum value when _____

11. The minimum amount of air that supplies just sufficient oxygen for the complete combustion of all the carbon, hydrogen and sulphur present in the fuel is called _____

12. _____ gives yellow flame.

13. Bunsen burner is an example of _____ flame.

14. The relative air/fuel ratio is defined as _____

15. In a combustion process the amount of carbon dioxide in the combustion product is maximum at _____ air fuel ratio.

16. When the energy gain of the working fluid (water and steam) is compared with the energy content of the boiler fuel, the method is called _____

17. _____ produces lot more soot particle than _____ flame.

18. Instead of a fixed boiling point, a normal hydrocarbon fuel like petrol and diesel have _____

SECTION "C"

19. Sketch *P-v* and *T-s* diagram of Brayton Cycle and write the expression for the isentropic efficiency of compressor and turbine. [2]

KATHMANDU UNIVERSITY
End Semester Examination
August/September, 2017

SEP 10 2017

Level : B.E. | Course : MEEG 316
Year : III | Semester : II
Time : 2 hrs. 30 mins. | F.M. : 55

SECTION "D"
(Long answer questions)

Attempt *ALL* the questions. Required table has to be brought by the students and should not have anything written on it other than the original print.

1. Methane (CH_4) is burned with dry air. The volumetric analysis of the products on a dry basis is 5.20 percent CO_2, 0.33 percent CO, 11.24 percent O_2, and 83.23 percent N_2. Determine (*a*) the air–fuel ratio and (*b*) the percentage of theoretical air used. [7]

2. Consider a steam power plant operating on the ideal Rankine cycle. Steam enters the turbine at 3 MPa and 350°C and is condensed in the condenser at a pressure of 10 kPa. Determine (a) the thermal efficiency of this power plant, (b) the thermal efficiency if steam is superheated to 600°C instead of 350°C, and (c) the thermal efficiency if the boiler pressure is raised to 15 MPa while the turbine inlet temperature is maintained at 600°C. [8]

   OR

   Liquid octane (C_8H_{18}) enters the combustion chamber of a gas turbine steadily at 1 atm and 25°C, and it is burned with air that enters the combustion chamber at the same state. Determine the adiabatic flame temperature for (a) complete combustion with 100 percent theoretical air, (b) complete combustion with 300 percent theoretical air, and (c) incomplete combustion (some CO in the products) with 80 percent theoretical air. [8]

3. Explain the steps for the evaluation of boiler efficiency measurement using indirect method. [7]

4. Explain how you would design a simple turbo jet engine from a turbocharger of a diesel truck. Explain in detail the known parameters, the design parameters, and the assumptions you make for the design. [7]

5. Explain with suitable sketch the working of turbofan engines. How does a turbofan engine differ from a turbojet engine? What is bypass ratio? What are the basic advantages of using high bypass ratio in turbofan engine? [6]

SECTION "E"
(Short answer questions)

Attempt *ALL* the questions.

6. Explain with sketch, a boiler system. [3]

7. Write an EES (tentative) program for computing adiabatic flame temperature of methane in stoichiometric combustion. [5]

8. What are the additional systems that are used to make modern gas turbine more efficient? [4]

9. Explain the working of fluidized bed boiler. [4]

10. What are the several impracticalities in ideal Rankine Cycle? [2]

11. Explain the basic difference between premixed and diffusion flames. [2]