**IARTH INSTITUTE OF ENGINEERING & TECHNOLOGY :: PUTTUR**
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**QUESTION BANK (DESCRIPTIVE)**

**Subject with Code :** T & C (19ME3101) **Course & Branch**: M.Tech - TE
**Year & Sem:** I-M.Tech & I-Sem **Regulation:** R18

## UNIT –I

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| 1. | Derive an energy balance relation for a reacting closed system undergoing a quasi-equilibrium constant pressure expansion or compression process. | 12M |
| 2. | What is enthalpy of combustion? How does it differ from the enthalpy of reaction? When does enthalpy of formation and the enthalpy of combustion identical? What is enthalpy of formation? How does it differ from the enthalpy of combustion? | 12M |
| 3. | 1gram sample of a certain fuel is burned in a bomb calorimeter that contains 2kg of water in the presence of 100gram of air in the reaction chamber. If the water temperature rises by 2.5 degree when equilibrium is established determine the heating value of the fuel in kj/kg. | 12M |
| 4. | An insulated gas cylinder of volume 0.1 m3 contains air (an ideal gas) at 5000 kPa and 300 K. The valve of the cylinder is opened allowing the air to escape till the air pressure in the cylinder reaches 3000 kPa. Determine the temperature of the air left in the cylinder and the mass of the air that escaped from the cylinder. | 12M |
| 5. | A fuel at 25 degree C is burned in a well insulated steady flow combustion chamber with air that is also at 25 degree C. under what condition will the adiabatic flame temperature of the combustion process be a maximum. | 12M |
| 6. | Air at 5000 kPa and 300 K is flowing through a pipeline. An evacuated and insulated cylinder of volume 0.1 m3 is connected to the pipeline through a valve. The valve is opened and the cylinder is filled with air till the pressure in the cylinder reaches the line pressure. The valve is then closed. Assuming that the air behaves like an ideal gas with k = 1.4, determine the temperature of the air in the cylinder at the end of the filling operation and the mass of air that is filled in the cylinder. | 12M |
| 7. | A 2 m3 tank with perfectly insulated walls contains saturated steam at a pressure of 1 MPa. This tank is connected through a valve to a steam line through which flows superheated steam at a pressure of 4 MPa and 400C. The valve is opened and steam is admitted rapidly into the tank until the pressure in the tank is 4 MPa. Estimate the | 12M |

mass of steam that enters the tank.

8. Steam at a pressure of 2000 kPa and 500 C is flowing in a pipe. An evacuated tank is connected to this pipe through a valve. The valve is opened and the tank is filled with steam until the pressure is 2000 kPa (line pressure), and then the valve is closed. The process takes place adiabatically and the kinetic energy and potential energy changes can be assumed negligible. Determine the temperature of the steam in the tank at the end of the filling operation. 12M

9. What are the higher and the lower heating value of a fuel? How do they differ? How is the heating value of a fuel related to the enthalpy of combustion of that fuel. 12M

10. Define 12M

i) Principle of conservation of mass,
ii) State first law of thermodynamics
iii) Define entropy
iv) Explain availability and irreversibility
v) Define thermodynamic equilibrium.

## UNIT-II

1. a What are the approximate chemical composition of gasoline, LPG, diesel, natural gas & methanol? How presence of moisture in air does affects the outcome of a combustion process. 6M

b. Methane $CH_4$ is burned with stoichiometric amount of air during a combustion process. Assuming complete combustion, determine the air-fuel and fuel-air ratios. 6M

2. a One kmol of octane $C_8H_{18}$ is burned with air that contains 20kmol of $O_2$.assuming the product contains only $CO_2$, $H_20$, $0_2$and $N_2$, determine the mol number of each gas in the products and the air-fuel ratio for this combustion process. 6M

b. How the presence of N2 in air does affects the outcome of a combustion process. What does the dew point temperature of the product gases represent? How it is determined? 6M

3. a A certain natural gas has following volumetric analysis: 65 percent $CH_4$, 8 percent $H_2$, 18 percent $N_2$, 3 percent $O_2$, and 6 percent $CO_2$. This gas is now burnt completely with the stoichiometric amount of dry air. What is the air-fuel ratio for this combustion process? 6M

b. Ethane C2H6 is burned with 20% excess air during a combustion process. Assuming complete combustion and a total pressure of 100 kpa, determine air-fuel ratio, dew 6M

point temperature of the product.

4. a Propane$C_3H_8$ is burned with 75 percent excess air during a combustion process. Assuming complete combustion find air- fuel ratio. 6M

   b Octane c8h18 is burned with 250% theoretical air, which enters the combustion chamber at 25 degree C, assuming complete combustion and a total pressure of 1atm, determine air-fuel ratio and dew point temperature of the product. 6M

5. Aceteylene $C_2H_2$ is burned with stoichiometric amount of air during a combustion process, assume complete combustion determine air-fuel ratio on a mass basis and on a mole basis. 12M

6. One kmol of octane $C_8H_{18}$ is burned with air that contains 20kmol of $O_2$.assuming the product contains only $CO_2$, $H_20$, $0_2$ and $N_2$, determine the mol number of each gas in the products and the air-fuel ratio for this combustion process. 12M

7. What are the causes of incomplete combustion and what the difference between complete and incomplete combustion. 12M

   What is the air-fuel ratio?. How is it related to the fuel air ratio?

8. Explain with neat sketch about pulverized fuel furnaces and its types. 12M

9. Explain the concept of FBC. Discuss in detail about fixed, entrained and FBC systems 12M

10. i) Principle of conservation of mass, 12M
    ii) Air-fuel ratio,
    iii) Ignition temperature
    iv) Complete and incomplete combustion
    iv) Use of ORSAT apparatus

## UNIT-III

1. How are the absolute entropy values of ideal gases at pressure different from 1 atm determined? Express the increase of entropy principle for chemically reacting system. 12M

2. A gases fuel with 80% $CH_4$, 15 percent N2 and 5 percent O2 is burned with dry air that enters the combustion chamber at 25 degree and 100 kpa. The volumetric analysis of the product on a dry basis is 3.36%CO2,0.09%CO,14.91%O2,and 81.64%N2.detremine the air-fuel ratio, percent theoretical air used, volume flow rate and air used to burn fuel at a rate of 1.4kg/min. 12M

3. Liquid propane $C_3H_8$ enters a steady-flow combustion chamber at 25 deg C and 1 atm at a rate of 0.4 kg/min where it is mixed and burned with 150 percent excess air that enters the combustion chamber at 12 deg C. if the combustion leave at 1200k and 1 12M

atm, determine a) the mass flow rate of air, b) the rate of heat transfer from the combustion chamber, and c) the rate of entropy generation during this process. Assume $T_o$=25deg C

4. Derive an equation to measure the burning velocity of gaseous fuel. 12M

5. Octane c8h18 is burnt with dry air. The volumetric analysis of the product on a dry basis is 9.21 percent CO2, 0.61 percent co, 7.06 percent o2 and 83.12 percent n2. Determine air-fuel ratio and the percentage of theoretical air used. 12M

6. A gases fuel with 70% $CH_4$, 15 percent N2 and 5 percent O2 is burned with dry air that enters the combustion chamber at 25 degree and 100 kpa. The volumetric analysis of the product on a dry basis is 3.36%CO2,0.09%CO,14.91%O2,and 81.64%N2.detremine the air-fuel ratio, percent theoretical air used, volume flow rate and air used to burn fuel at a rate of 1.4kg/min. 12M

7. Two kmol of octane $C_8H_{18}$ is burned with air that contains 20kmol of $O_2$.assuming the product contains only $CO_2$,$H_20$,$0_2$ and $N_2$, determine the mol number of each gas in the products and the air-fuel ratio for this combustion process. 12M

8. Octane c8h18 is burned with 250% theoretical air, which enters the combustion chamber at 25 degree C, assuming complete combustion and a total pressure of 1atm, determine air-fuel ratio and dew point temperature of the product. 12M

9. A gases fuel with 80% $CH_4$, 15 percent N2 and 5 percent O2 is burned with dry air that enters the combustion chamber at 25 degree and 100 kpa. The volumetric analysis of the product on a dry basis is 3.36%CO2,0.09%CO,14.91%O2,and 81.64%N2.detremine the air-fuel ratio, percent theoretical air used, volume flow rate and air used to burn fuel at a rate of 1.4kg/min. 12M

10. 1gram sample of a certain fuel is burned in a bomb calorimeter that contains 2kg of water in the presence of 100gram of air in the reaction chamber. If the water temperature rises by 2.5 degree when equilibrium is established determine the heating value of the fuel in kj/kg. 12M

## UNIT-IV

1 a How the flames are classified according to their structure explain in detail. 6M

b List out types of burners and their function with neat sketch 6M

2 What are the factors affects the burner efficiency and give remedial action to overcome those effects. 12M

3 Explain with neat sketch of air aspiration gas burner. 12M

4 Design an burner which uses oil as a fuel and the flow rate of oil is 12.5 ml per 12M

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| | | minute. | |
| 5 | | List out the advantages and dis advantages of gas burner. Oil burner and atmospheric burner. | 12M |
| 6. | | What is mean by vaporizing burner? Explain its working with neat sketch | 12M |
| 7 | | What is mean by gas burner? Explain its working with neat sketch | 12M |
| 8 | | Design an burner which uses gas as a fuel and the flow rate of oil is 20cc per minute. | 12M |
| 9 | | Formulate the procedure to design a burner. | 12M |
| 10 | | What is mean by atomizing burner? Explain its working with neat sketch | 12M |

**UNIT-V**

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| 1 | | Define the principle of magneto Hydro Dynamic Generator and explain the working of closed power cycle with neat sketch | 12M |
| 2 | | Describe about see back effect and explain with neat sketch about thermo-electric energy system. | 12M |
| 3 | | Explain with neat sketch the working of nuclear combined magneto Hydro Dynamic Generator. | 12M |
| 4 | | Describe thermo-ionic energy system with neat sketch and list out the materials use in it. | 12M |
| 5 | | Explain with required equations for nitrogen fuel cell working and its advantages | 12M |
| 6 | a | What is mean by direct energy conversion method and classify it according to their sources. | 6M |
| | b | Discuss in detail about PV CELL energy system and their classification. | 6M |
| 7 | | Differentiate between thermo-ionic and thermo-electric energy systems | 12M |
| 8 | | Differentiate hydrogen fuel cell with nitrogen fuel cell. Also list advantage and disadvantages. | 12M |
| 9 | | Design an solar power panal using PV CELL to operate an pump motor of capacity 7HP runs continuously for 4 hours at full load condition and the s total ead id 20m. | 12M |
| 10 | | Discuss in detail about contribution of direct energy conversion system in the field power sector with their advantage and disadvantages. | 12M |

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