32041 – HEAT POWER ENGINEERING

1. BASICS OF THERMODYNAMICS, THERMODYNAMIC PROCESSES OF PERFECT GASES

Part – A & Part - B

1. Write the types of units?
2. Give examples for fundamental & derived units?
3. State any one Newton's law of motion?
4. State the assumptions on steady flow equation?
5. Define atmospheric pressure?
6. Define absolute zero temperature?
7. Define specific heat?
8. State the types of thermodynamic system?
9. Define property of a steam?
10. Define state of a system?
11. State zeroth law of thermodynamics?
12. State Kelvin plank's statement?
13. State any one law of thermodynamics?
14. State law of perfect gases?
15. What is the equation of perfect gas?
16. What is throttling process?
17. State Joule's law?
18. State Avogadro's law?
19. State Clausius statement?
20. What is vaccum pressure?
21. What is STP?
22. What is NTP?

Part –C

1. A cylinder contains 3Kg of oxygen at 5bar pressure and temperature of 27 C. Find the cylinder volume. Molecular weight of oxygen is 32 & universal gas constant is 8.314 KJ/KgK
2. 10Kg of gas was heated from a temperature of 100 C at constant volume till its pressure become three time its original pressure. Find 1)the heat transfer 2)change in internal energy 3)change in enthalpy 4)change in entropy. Assume C_p=1KJ/KgK; $C_{v=}$0.71 KJ/KgK
3. 80L of air at 700KN/m^2 & 250 C is expanded adiabatically to 140 KN/m^2. Find the change in a)internal energy b)entropy c)enthalpy d)heat transferred e)work done.
4. 0.35m^3 of air at 22 C under atmospheric pressure is heated under constant volume to a temperature of 100 C. Determine a)mass of air b)the final pressure c)heat transfer d)change in internal energy e)work done f)change in internal energy h)change in entropy. Assume C_p=1KJ/KgK; $C_{v=}$0.71 KJ/KgK
5. Derive the equation for a steady flow energy equation
6. A gas has a mass of 3kg at initial pressure of 5x10^5 N/m^2 expands adiabatically till the pressure falls to 4x10^5 N/m^2. During the process 120KNm of work is done by the system and the temperature from 377 C to 257 C. Find the value of index of expansion & characteristic gas equation.

2. THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION

Part – A & Part - B

1. Define air standard efficiency?
2. Define cut off ratio?
3. Classify different types of fuels?
4. Write the merits of liquid fuels?
5. Define atomic weight?
6. What is atom?
7. Compare detonation with diesel knock?
8. What is meant by excess air?
9. Mention the use of orsat apparatus?
10. Write the expression for theoretical minimum air required for complete combustion of a 1Kg of fuel?
11. In a Carnot cycle, the working fluid receives heat at a temperature of 325 C & reject heat at a temperature of 25 C. Find the theoretical efficiency of the cycle?
12. The temperature limits of Carnot engine is between 700K & 300K. Find a)thermal efficiency b)heat added during the process?
13. Explain why no engine can work on Carnot cycle?
14. State the conditions of reversibility?
15. Explain gaseous fuels?
16. State the requirements of a good fuel?
17. What is the higher calorific & lower calorific value?
18. Write the methods to find the calorific value of fuel?

Part –C

1. Explain orsat apparatus?
2. Derive air standard efficiency of Otto and Diesel cycle?
3. 2Kg of air is taken through a volume ratio of 6:1, the initial pressure & temperature being 103KN/m^2 & 100 C respectively. Heat is added at constant volume until the pressure is 3450 KN/m^2 & then adiabatically to its original volume. It is cooled at constant volume to its original state. Calculate the pressure, volume & temperature at all points. For air, take R=0.287KJ/KgK γ =1.4. Also calculate air standard efficiency?
4. Explain the types of combustion chamber?
5. In an engine at the beginning of compression the pressure is 90KN/m^2 and the temperature is 40C. Air is used as the working substance. During the adiabatic compression, the volume is reduced to one sixth of its value at the beginning of compression stroke. Heat is then added at constant pressure until the temperature is 1400C. The stroke is completed by adiabatic expansion until the initial volume is reached, when the cycle is closed by a constant volume. Take γ =1.4; C_P=1.004 kJ/KgK?
   a)find the thermal efficiency of the cycle?
   b)calculate the pressure and temperature at all points of the cycle?
6. Explain about stages of combustion?

3. AIR COMPRESSORS & GAS TURBINES

Part – A & Part – B

1. Define air compressor?
2. Define volumetric efficiency of a compressor?
3. What are the effects of clearance volume in air compressor?
4. State the disadvantages of single stage reciprocating air compressor?
5. Define gas turbine?
6. State the advantages of using intercooler in gas turbines?
7. What are the effect/advantages of regenerator in gas turbine?
8. What is the purpose of a reheater in gas turbine?
9. How gas turbines are classified?
10. What is rocket propulsion?
11. State any two applications of gas turbine?
12. State the applications of rocket engine?
13. Define bipropellants?
14. What is propulsion?

Part – C

1. A compressor is required to deliver $30m^3$/hr of free air at 1bar and 32C at a pressure of 5bar. The law of compression is $PV^{1.3}$=constant. Determine the power required?
2. Explain single stage single acting reciprocating air compressor?
3. A single acting single cylinder air compressor has a cylinder diameter of 150mm and a stroke of 200mm. Air is drawn into the cylinder at a pressure of $100KN/m^2$ and a temperature of 20C. It is then compressed according to the law is $PV^{1.3}$=C to a pressure of $600KN/m^2$. Find the theoretical power required to drive the compressor, if the speed is 110rpm. Also calculate the mass of air compressed per minute. R=0.287 KJ/KgK?
4. With a P-V diagram derive the work input equation in a two stage compressor with perfect/imperfect intercooling?
5. Explain roots and vane blower?
6. A two stage compressors work between 1bar and 16bar. The inlet temperature is 30C. Determine the exit temperature, if intercooling is perfect and compression is isentropic. Also find the work done per Kg of air with & without intercooling?

4. FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETERS

Part – A & Part – B

1. What is phase diagram?
2. What is steam?
3. Define enthalpy of water?
4. Define dry and saturated steam?
5. Define superheated steam?
6. Write the expression for enthalpy of superheated steam?
7. Define internal energy of steam?
8. Write the expression for entropy of wet steam?
9. State the uses of steam tables?
10. Define internal latent heat?
11. What is a steam table?
12. Mention the value of critical temperature and critical pressure of water?
13. What is the use of steam calorimeter?
14. Distinguish between wet steam and dry steam?
15. The specific volume of steam at 10bar is recorded as 0.1749m^3/Kg. Determine the quality of steam, enthalpy and its entropy?

Part – C

1. Steam is existing at a pressure of 10bar and 0.8 dry is undergoing adiabatic expansion to a pressure of 5bar abs. Find the work done and change in internal energy?
2. Steam initially at 15bar and 250C expands isentropically to 1.5 bar. Determine the end conditions and the work done. Mass in the system is 0.9Kg?
3. Explain bucket/barrel calorimeter?
4. Steam at a pressure of 5bar and dry saturated expands isentropically in a turbine nozzle to the condenser back pressure of 0.2bar. find the condition of the steam at entry to condenser after expansion and find also the ideal power developed for a steam flow of 2Kg/s?
5. Explain the polytropic process on P-V and T-S diagrams?
6. Explain the formation of steam by T-h diagram, P-V diagram, T-s diagram with a neat sketch?
7. With a neat sketch explain mollier chart?

5. STEAM BOILERS AND PERFORMANCE OF BOILERS

Part – A & Part - B

1. What is steam boiler?
2. What is fire tube boiler?
3. What are boiler mountings?
4. What is equivalent evaporation?
5. What is boiler efficiency?
6. What do you mean by boiler performance?
7. Define boiler power?
8. Mention the impurities present in the boiler feed water?
9. What is the function of safety valve?
10. What is the function of economizer?
11. What is a man hole?
12. Differentiate between fire tube and water tube boilers?
13. Define economizer efficiency?
14. State the advantages of high pressure boilers?
15. Define superheater efficiency?
16. Define economizer efficiency?
17. State the function of fusible plug in a steam boiler?
18. What are the effects of impurities present in the boiler feed water?
19. Distinguish between boiler mountings and accessories?
20. List the boiler mountings as per the Indian boiler act?

Part – C

1. In a boiler test the following date were recorded mean temperature of feed water 50C, mean boiler pressure 5bar, dryness fraction of steam 0.95, coal consumption 600Kg/hr. Calorific value of coal is 30400 KJ/Kg, feed water supplied to boiler is 4800Kg/hr. Taking boiler house temperature as 20C, draw up energy balance sheet per Kg of steam produced. Assume that 25% of heat energy by supplied a coal is being carried away by flue gases. Determine also the equivalent evaporation from and at 100C and boiler efficiency?
2. The following data were obtained in a boiler trial. Feed water supplied per hour 690Kg at 28C steam produced 0.97 dry at 8bar coal fired per hour. 91Kg of calorific value 27200KJ/Kg. Ash and unburnt coal collected beneath the bars 7.5Kg/hr of calorific value 2700KJ/Kg.
   Mass of flue gases per Kg of cal burnt =17.4 Kg
   Temperature of flue gases =325C
   Room temperature =17C
   Specific heat of flue gases 1.005KJ/KgK
   Estimate boiler efficiency and draw up a heat balance sheet?
3. Explain the working of a superheater, economizer with a neat sketch?
4. State the various heat boiler in a boiler?
5. List important clauses in a boiler?
6. Explain feed water treatment in boiler?