32141 –THERMAL ENGINEERING

1. THERMODYNAMICS, PROPERTIES OF PERFECT GASES, THERMODYNAMIC PROCESS 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. Define mass & weight?
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. A gas has a density of 1.95Kg/m^3 at 1bar & 18 C. 0.8Kg of this gas is heated from 20 C to 225 C at constant pressure by adding 180 KJ of heat. Calculate specific heat at constant volume and constant pressure. Also calculate work done and internal energy during this process.
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. AIR CYCLES, 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 calorific value of a fuel?
6. Write Dulong's formula for finding out higher calorific value of a fuel?
7. What are the applications of bomb calorimeter?
8. Define atomic weight?
9. What is atom?
10. what is meant by excess air?
11. Mention the use of orsat apparatus?
12. Write the expression for theoretical minimum air required for complete combustion of a 1Kg of fuel?
13. 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?
14. The temperature limits of Carnot engine is between 700K & 300K. Find a)thermal efficiency b)heat added during the process?
15. Explain why no engine can work on Carnot cycle?
16. State the conditions of reversibility?
17. Explain gaseous fuels?
18. State the requirements of a good fuel?
19. What is the higher calorific & lower calorific value?
20. Write the methods to find the calorific value of fuel?

Part –C

1. Explain bomb calorimeter and Junker's gas calorimeter
2. Explain orsat apparatus
3. Derive air standard efficiency of Otto and Diesel cycle
4. 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.
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. A fuel oil consists of the following percentage analysis by mass 0.82% of C, 12% of H_2, 2% of O_2, 1% of S & 3% of N_2. Determine the stoichiometric mass of air required to completely burn the fuel & also determine the products of combustion by mass as a percentage

3. PROPERTIES OF STEAM, STEAM BOILER, STEAM ENGINE, STEAM CONDENSER

Part – A & Part - B

1. Define wet steam?
2. Define superheated steam?
3. Define dryness fraction?
4. Define wetness fraction?
5. Write the expression for enthalpy of wet steam?
6. Define entropy of steam?
7. Define internal energy of steam?
8. What are the merits of superheated steam?
9. State the uses of steam table?
10. What is a boiler?
11. What are fire tube boiler?
12. Compare fire tube & water tube boiler?
13. Write the factors to be considered in the selection of steam boiler?
14. What are the essential requirements of good steam boiler?
15. What is steam engine?
16. What is the function of piston and connecting rod?
17. What is steam condenser?
18. How steam condensers are classified?
19. Write the merits of fitting a condenser in a steam power plant?
20. What are the types of condensers?

Part – C

1. Explain BHEL and Lamont boiler?
2. Explain single acting reciprocating steam engine?
3. Explain jet and surface condenser?
4. Determine the dryness fraction of steam in a main from the following results of a test using combined separating and throttling calorimeter. Pressure in the steam main =10bar, mass of water collected in the separator =1.5Kg, mass of steam condensed after throttling =26Kg, pressure of steam after throttling =1.4bar, temperature of steam after throttling =115C for superheated steam?
5. Determine the quality of steam given in the following data
   - **i.** P=6bar, specific enthalpy =2690 KJ/KgK
   - **ii.** P=8bar, specific volume =0.2m^3/Kg
   - **iii.** P=10bar, temperature =200C
6. Calculate the external work done during evaporation & internal energy per Kg of steam at a pressure of 10bar, when the steam is a)90% dry b)dry saturated c)superheated at 200C?

4. IC ENGINES, PERFORMANCE OF IC ENGINES, AIR COMPRESSORS

Part – A & Part - B

1. Give examples for IC engines?
2. Mention the four stroke in a petrol/diesel engine?
3. What are the performance parameters for the testing of IC engines?
4. Define brake power?
5. What are the various tests conducted on an IC engine?
6. Define air compressor?
7. What is imperfect cooling?
8. What are the uses of compressed air?
9. Mention any two rotary air compressors?
10. State the advantages of multi-stage air compressor?
11. Explain the working of axial flow compressor with neat sketch?
12. Compare petrol and diesel engine?
13. Compare reciprocating and rotary compressor?
14. Compare centrifugal and axial flow compressors?
15. Define mechanical efficiency?
16. Define relative efficiency?
17. Define Indicated power?
18. Define indicated thermal efficiency?

Part – B

1. Explain four stroke petrol engine with a neat sketch?
2. Explain four stroke diesel engine with a neat sketch?
3. Explain two stroke petrol and diesel engine with a neat sketch?
4. The following observations were taken during a test on four stroke cycle single cylinder oil engine. Bore-30cm; stroke-45cm; total fuel consumption-11.4Kg/hr; calorific value of oil- 42000KJ/Kg; speed-300r.p.m; indicated mean effective pressure-6bar; net brake load-1.5KN; brake drum diameter-1.8m; rope diameter-2cm; quantity of jacket cooling water- 660Kg/hr; temperature of entering cooling water- 20C; temperature of leaving cooling water-75C; quantity of air measured- 250Kg/hr; specific heat of exhaust gases -1KJ/KgK; exhaust gas temperature-420C; engine room temperature- 20C. Calculate 1)Indicated power 2)brake power 3)mechanical efficiency 4)indicated thermal efficiency. Draw up a heat balance sheet
5. In a test with a four cylinder, four stroke petrol engine the following results were obtained at a particular setting and speed.
   Brake power with all cylinder working=26KW
   Brake power with cylinder 1 cutout=17.3 KW
   Brake power with cylinder 2 cutout=17.8KW
   Brake power with cylinder 3 cutout=18KW
   Brake power with cylinder 4 cutout=18.4KW

   Estimate the indicated power of the engine and its mechanical efficiency?
6. Explain the single stage reciprocating air compressor?
7. Explain any two rotary air compressor with a neat sketch?

5. REFRIGERATION AND AIR CONDITIONING

Part – A & Part - B

1. A machine working on a Carnot cycle as refrigerating machines operates between 30C and -15C. Determine the C.O.P?
2. Define refrigeration?
3. Define refrigerant?
4. List the different types of refrigerators?
5. Explain the physical properties required for a refrigerant?
6. Distinguish between vapor compression system and vapor absorption system?
7. A refrigerating cycle working on reversed carnot cycle has a C.O.P of 4 and work done on compressor is 10KJ/s. Find the refrigerating effect?
8. Define dry air?
9. Define moist air?
10. Define dry bulb temperature?
11. Define dew point?
12. Define a psychometric chart?
13. What is sensible heating?
14. Compare humidification and dehumidification?
15. State the application of air conditioning?
16. What are the different types of air conditioning system?

Part – C

1. Explain the factors to be considered in air conditioning and also briefly discuss about the loads encountered in air conditioning system?
2. Briefly explain the principles of working of a room air conditioner with a neat sketch?
3. State the differences between comfort and industrial air conditioning?
4. Explain vapor compression system with a neat sketch?
5. Explain vapor absorption system with a sketch?
6. Find the least KW required by a perfect reversed heat engine that will make 450Kg of ice per hour at -3Cfrom water at 20.5C. take latent heat of ice=340kJ/Kg and specific heat =2KJ/KgK