Tutorial No: 01

INTRODUCTION

THEORY QUESTIONS:

1. Differentiate between system and surrounding. Explain:-(i) closed system (ii) open system (iii) Isolated system
2. What is a prime mover? Classify different prime movers. Write sources of energy used by prime movers.
3. What is energy? What are the types of energy
4. What is zeroth law of thermodynamics? What is absolute zero temperature?
5. Explain briefly, “Internal energy”.
6. Explain first law and second law of thermodynamics.
7. What is intensive properties and extensive properties.
8. Define:- a) Work b) Pressure c) Force d) Enthalpy e) Entropy f) Workdone

TUTORIAL NO: 02

ENERGY

THEORY QUESTIONS:-

1. What are the sources of energy?
2. Which are common solid fuels? Write brief about each of them.
3. List the various liquid fuels. State merits over solid fuels.
4. Explain various gaseous fuels.State the advantages of gaseous fuels over solid and liquid fuels.
5. Write short notes on:
    i) LPG
    ii) CNG
    iii) Hydrogen Gas
6. What is calorific value?Write different higher and lower calorific value.

TUTORIAL NO: 03

PROPERTIES OF GASES

THEORY QUESTIONS:-

1. What is polytrophic process? How does it differ from adiabatic process?
2. For the adiabatic process prove that $PV^{\gamma}=C$
3. With usual notation prove that $C_p - C_v = R$
4. Represent following expansion process on $P - V$ diagram with th same initial condition:
   (i) Constant volume
   (ii) Constant pressure
   (iii) Isothermal
5. Define Enthalpy. Prove that the change in enthalpy in any gas undergoing any process is given by $\Delta h = Cp\,\Delta\,T\ kJ/kg$
6. Show that in case of a perfect gas the change in internal energy $\Delta u = Cv\Delta T\ kJ/kg$
7. Prove PV=MRT
8. Explain boyl's,Charles and avegadro law .

PROBLEMS:

1. A cylinder contains 0.6 m3 of a gas at a pressure of 1 bar and 90 °C. The gas is compressed to a volume of 0.18 m3 by the law PVn = C. The pressure of gas at the end of compression is 5 bar. Calculate: (1)Mass of gas (2) value of index n (3) The change in internal energy of the gas. (4) Work done (5) The heat received or rejected by the gas during the process. Take γ =1.4 and R= 0.294 kJ/kg K.
2. One cubic meter of air at pressure of 1.5 bar and 80o C is compressed to final pressure 8 bar and volume 0.28 m3 . Determine (i) mass of air (ii) index of 'n' compression (iii) change in internal energy (iv) Heat transfer during compression. Take γ = 1.4 and R= 287 J/kgK.
3. Determine the work done in compressing one kg of air from a volume of 0.15m3 at a pressure of 1 bar to a volume of 0.05 m3 , when the compression is 1) adiabatic 2) isothermal. Take $^{\gamma}$ = 1.4.
4. One kg of gas is compressed polytropically from 160 kpa pressure and 280 K temperature to 760 KPa. The compression is according to law PV1.3 = Constant. Find: (1) Final Temperature (2) work done (3) change in internal energy (4) amount of heat transfer and (5) change in enthalpy. Take R=0.287 KJ/KgK and Cp= 1.002 KJ/KgK.
5. 1 kg of air at 9 bar pressure and 80o C temperature undergoes a non-flow work polytropic process. The law of expansion is PV1.1 = C. The pressure falls to 1.4 bar during process. Calculate (1) Final temperature (2) Work done (3) Change in internal energy (4) Heat exchange. Take R=287 J/kg and γ = 1.4 for air.

TUTORIAL NO: 04

PROPERTIES OF STEAM

THEORY QUESTIONS:

1. Distinguish between gas and vapour.
2. Define the following terms
    a. Superheated steam
    b. Dryness fraction & wetness fraction
    c. Saturation temperature
    d. Enthalpy of evaporation
    e. Degree of superheat
    f. Internal energy of steam
    g. External work done by steam
    h. Specific volume of wet & superheated steam
    i. Enthalpy of dry saturated steam
    j. Enthalpy of wet steam
    k. Enthalpy of superheated steam
    l. Wet steam
    m. Latent heat
3. What is throttling process and explain Throttling calorimeter with neat sketch
4. Explain combined calorimeter with neat sketch.

PROBLEMS:

1. Calculate the internal energy per kg of superheated steam at 10 bar and a temperature of 3000C. Find also change in internal energy if this steam is expanded to 1.4 bar and dryness fraction 0.8.
2. Determine the quality of steam for the following cases: (i) P= 10 bar, v = 0.180 m3 /kg (ii) P= 10 bar, t= 200o C (iii) P=25 bar , h = 2750 kJ/kg
3. 1.5 kg of steam at a pressure of 10 bar and temperature of 2500C is expanded until the pressure becomes 2.8 bar. The dryness fraction of steam is then 0.9. Calculate change in internal energy.
4. Determine enthalpy and internal energy of 1 kg of steam at a pressure of 12 bar when (i) the dryness fraction of steam is 0.8 (ii) steam is dry and saturated (iii) steam is superheated to 2800 C. Take Cps = 2.1 kJ/kg K.
5. Calculate the total amount of heat required to produce 6 kg of steam at a pressure of 6 bar and temperature of 258 °C from the water at 30 °C. Take specific heat of steam = 2.1 kJ/kg-K. and the specific heat of water = 4.187 kJ/kg-K. 04 07
6. What amount of heat is required to produce 5 kg of steam at a pressure of 5 bar and temperature of 250°C from water at 30°C, take Cps =2.1kJ/kg K

TUTORIAL NO: 05

HEAT ENGINES

THEORY QUESTIONS:-

1. Prove that the efficiency of the Carnot engine working between the temperatures limits T1 & T2 is equal to (T1-T2)/T1.
2. With usual notation derive the efficiency of Otto cycle &prove that it only depend on the compression ratio.
3. What is heat engine? State four essential elements of a heat engine.
4. Derive an expression for efficiency of diesel cycle with usual notation.
5. Derive an expression for efficiency of rankine cycle with usual notation.

PROBLEMS:

1. Calculate the air standard efficiency of the engine working on Otto cycle in which air initially at 1 bar and 20°C is compressed adiabatically to the pressure of 16 bar. Maximum pressure of cycle is 45 bar and adiabatic index γ =1.4
2. An engine working on ideal Otto cycle has a clearance volume of 0.03m3 and swept volume of 0.12m3 . The temperature and pressure at the beginning of compression are 100°C and 1 bar respectively. If the pressure at the end of heat addition is 25 bar, calculate i) ideal efficiency of the cycle. ii) Temperature at key points of the cycle. Take ᵞ = 1.4 for air
3. In an Otto cycle the compression ratio is 10. The temperature at the beginning of compression and at the end of heat supply is 300 K and 1600 K respectively. Assume, γ = 1.4 and Cv= 0.717 KJ/KgK. Find: (i) Heat supplied (ii) Efficiency of the cycle.
4. An engine operates on the air standard diesel cycle. The conditions at the start of the compression stroke are 353 K and 100 kPa , while at the end of compression stroke the pressure is 4 MPa. The energy absorbed is 700 kJ/kg of air. Calculate (1) the compression ratio (2) the cut-off ratio (3) the work done per kg air (4) the thermal efficiency.
5. An air at 150 C and 1 bar is compressed adiabatically to 15 bar by an engine working on Otto cycle. The maximum pressure of the cycle is 40 bar. Calculate air standard efficiency, mean effective pressure. Take Cv = 0.718 kJ/kg K and R = 0.287 kJ/kg K.

EXPERIMENT: 01
STEAM BOILER

THEORY QUESTIONS:

1. What is the boiler? And give the classification of boiler?
2. Explain Cochran boiler with neat sketch.
3. Explain Lancashire boiler with neat sketch.
4. Explain babcock-wilcox boiler with neat sketch.

EXPERIMENT: 02
BOILER MOUNTINGS AND ACCESSORIES

1. Give the difference between Mountings and Accessories.
2. Explain with neat sketch the function of a) Safety valve b) Water level indicator c) Steam stop valve d) Pressure Guage e) Blow-off cock f) Injector g) Economiser h) Air preheter i)Super heater j) Draught k) Antipriming pipe.

EXPERIMENT: 03
INTERNAL COMBUTION ENGINE

THEORY QUESTIONS:-

1. Differentiate I.C engine & E.C engine by given example.
2. Classify the I.C engine in various ways.
3. With neat sketch explain working of four stroke petrol engine.
4. With neat sketch explain working of four stroke diesel engine.
5. Explain with neat sketch Two stroke petrol engine.
6. Expalin with neat sketch Teo stroke diesel engine.
7. Discuss the difference between S.I & C.I engine .
8. Short note:-
    - Connecting road
    - Valve mechanism
    - Fuel injector
    - Flywheel
    - Spark plug
    - Carburetor
    - Crystal road
    - Crank shaft
    - Piston

PROBLEMS:-

1. The following readings were recorded during the test on single cylinder four stroke diesel engine. (1)Cylinder diameter = 250 mm (2) Stroke length = 350 mm (3) Mean effective pressure = 6.7 bar (4) Speed of engine = 250 r.p.m. (5) Net brake load = 1070 N (6) Effective brake drum diameter = 1.5 m (7) Fuel consumption rate = 10 kg per hour. (8) C.V. of the fuel = 44300 kJ/kg. Calculate: (1) Indicated Power (2) Brake Power (3) Mechanical efficiency. (4) Brake thermal efficiency.
2. The following data refers to a single cylinder 4 strokes petrol engine. Cylinder diameter = 30 cm, piston stroke = 40 cm, engine speed= 1400 r.p.m, indicated mean effective pressure = 5 bar, fuel consumption= 17.568 kg per hour, calorific value of the fuel is 45000 kJ/Kg; specific gravity of the fuel is 0.8. Determine the indicated thermal efficiency.
3. During testing of single cylinder two stroke petrol engine, following data is obtained: Brake torque 640 Nm, cylinder diameter 21 cm, Speed 350 rpm, stroke 28 cm, mean effective pressure 5.6 bar, oil consumption 8.16 kg/hr, C.V = 42705 kJ/kg. Find, i) Mechanical Efficiency, ii) Indicated thermal efficiency iii) brake thermal efficiency iv) brake specific fuel consumption.

4. A four cylinder two stroke petrol engine with stroke to bore ratio 1.2 develops 35 kW brake power at 2200 rpm. The mean effective pressure in each cylinder is 9 bar and mechanical efficiency is 78 %. Determine (1) Diameter and stroke of each cylinder (2) Brake thermal efficiency (3) indicated thermal efficiency. If fuel consumption 8 kg / hr having C.V=43000 kJ/kg.
5. During testing of single cylinder two stroke petrol engine following data were obtained. Brake torque 640Nm, cylinder diameter 21cm, speed 350 rpm, stroke length 28 cm, mean effective pressure 5.6 bar, oil consumption 8.16 kg/hr, CV 42705 kJ/kg. Determine (i) mechanical efficiency (ii) Indicated thermal efficiency (iii) Brake thermal efficiency (iv) brake specific fuel consumption.

TUTORIAL NO:06

PUMPS

THEORY QUESTIONS:

1.What are the function of air vessel in a reciprocating pump? Where its is fitted in reciprocating pump.?

2.State main components of centrifugal pump. Draw line diagram of centrifugal pump.

3.Classified centrifugal pump and explain with sketch the vortex type centrifugal pump.

4.What is priming? Why priming is required in centrifugal pump? Explain any one method of priming.

5.Write short notes on: i) Gear Pump ii)Vane pump

6.Write down the difference between reciprocating pump and rotary pump.

TUTORIAL NO:07

AIR COMPRESSOR

THEORY QUESTON:

1. Mention used of compressed air.
2. How the air compressors are classified based on different criteria
3. Differentiate between Reciprocating and Rotodynamic air compressor.
4. Why multi-stage compression is required? Write advantages of the multistaging compression.
5. What is compressor? Explain working of double acting reciprocating pump and bucket pump with neat sketch.

EXPERIMENT: 04

REFRIGERATION AND AIR CONDITIONING

THEORY QUESTIONS:

1. What is refrigeration? What is refrigerating effect?
2. What is 1 ton of refrigeration?
3. What is refrigerant? Write characteristics of a refrigerant.
4. What is air conditioning?
5. Explain with neat sketch the working of Vapour compression Refrigerator(VCR).
6. Explain with neat sketch the working of Vapour compression Refrigerator(VAR).
7. Explain with neat sketch the working of Vapour compression Refrigerator(VAR) with its advantages and disadvantages.