THERMAL ENGINEERING-I

QUESTION BANK

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1. Short questions (2 marks)
    a) State Boyle's law and Charle's law.
    b) Write down the relationship between Celsius scale and Kelvin scale.
    c) Define latent heat of vaporization
    d) Define latent heat and specific heat.
    e) Define COP of refrigerator and heat pump.
    f) Define perfect gas.
    g) Write down the relationship between Celsius scale and Fahrenheit scale.
    h) Define specific fuel consumption
    i) State first law of thermodynamics.
    j) Define point function and path function.
    k) Define temperature. Establish relation between Celsius and kelvin scales
    l) What are the various modes of heat transfer
    m) State zeroth law of thermodynamics
    n) Write the limitations of 1^{st} law of thermodynamics
    o) Draw P-V and T-S diagram for carnot cycle
    p) Classify various types of fuel with example
    q) What is mechanical equivalent of heat?
    r) What do you mean by PMM2 ?
    s) Define reversible process
    t) What are the secondary fuels ? list some examples.
    u) Define entropy
    v) State Dalton's law of partial pressure
    w) Define thermodynamic state and process
    x) Define intensive and extensive property with example
2. Questions (5 Marks)
    a) Differentiate between Heat engine, Heat pump and Refrigerator
    b) Explain quasi-static process.
    c) A cyclic heat engine operates between source of 800°C and sink 30°C. Find heat rejection rate per KW net output of engine.
    d) Prove $C_p - C_v = R$.
    e) Differentiate between CI and SI engine.
    f) Explain the modes of heat transfer.
    g) Derive workdone during polytropic process.
    h) A quantity of air has volume of 0.4 m3 at a pressure of 5bar and a temperature of 80°C. It is expanded in a cylinder at a constant temperature to a pressure of 1 bar. Determine the amount of workdone by the air during expansion..

i) List out the merits and demerits of liquid fuels over solid fuels.

j) Prove $\frac{PV}{T} = C$.

k) A gas occupies a volume of 0.1 m3 at temperature 20°C and pressure 1.5 bar. Find final temperature of gas if it is compressed to 7.5 bar and 0.04 m3.

l) Explain Clausius inequality.

m) Derive work done during Isothermal process.

n) Deduce the formula for workdone of polytropic process

o) Prove $PV^{\gamma} = C$

3. Questions (10 marks)

a) Define thermodynamic system. Explain briefly different types of thermodynamic system.

b) Air at pressure 1 bar and temperature 70°C is compressed reversibly and adiabatically until the pressure is 7 bar in an otto cycle engine. 460KJ of heat per kg of air is now added at constant volume. Determine: 1. Compression ratio of the engine, 2. Temperature at the end of compression and 3. Temperatutre at the end of heat addition. Take Cp= 1 kJ/kgK, Cv= 0.707 kJ/kgK.

c) Explain working principle of 4-Stroke petrol engine with neat sketch.

d) With the help of P-V and T-S diagram derive the air standard efficiency of Diesel cycle.

e) A quantity of gas has a volume of 0.14 m3, pressure 1.5 bar and a temperature 100°C. If the gas is compressed at a constant pressure , until its volume becomes 0.112 m3, determine: 1. The temperature at the end of compression, 2. Workdone in compressing the gas, 3. Decrease in internal energy and 4. Heat given out by the gas. Assume Cp= 1.005 kj/kg K and Cv=0.712 kj/kg K.

f) The pressure of steam inside a boiler as measured by pressure gauge is 1 N/mm2. The barometric pressure of atmosphere is 765 mm Hg. Find absolute pressure of steam in N/m2, Kpa, bar and N/mm2.

g) A closed vessel contains 2kg of carbon dioxide at temperature 20°C and pressure 0.7 bar. Heat is supplied to the vessel till the gas acquires a pressure of 1.4 bar. Calculate 1. Final temperature; 2. Work done by the gas; 3. Heat added; and 4. Change in internal energy. Cv=0.657 KJ/Kgk

h) State Kelvin-plank and clausius statement. Explain the equivalence between the two statements.

i) Explain working principle of 2-Stroke petrol engine with neat sketch.

j) With the help of P-V and T-S diagram derive the air standard efficiency of Otto cycle.