QP CODE : 26149

(3 Hours) **Marks: 80**

N.B.: 1. Question No. **1** is **compulsory.**
2. Attempt **any three** questions out of remaining **five** questions.
3. Assume suitable data wherever required.
4. Assumptions made should be stated clearly.

Q.1 **a)** Derive expression for air standard efficiency of Brayton cycle in terms of pressure sratio. 05

b) Compare air cooling and water cooling systems in I.C.engines. 05

c) Explain Thermal conductivity, Convective heat transfer coefficient and overall heat transfer coefficient. 05

d) Define i) Wet bulb temperature ii) Specific humidity iii) Dew point temperature 05

Q.2 **a)** A two cylinder single acting reciprocating air compressor has 6 cm bore and 5 cm stroke in which clearance volume is 4% of swept volume. Compressor runs at 630 rpm and it is required to deliver air at 6 bar, the suction pressure is 1 bar and index of compression is 1.3. Determine
i) Volumetric efficiency
ii) Volume of air drawn at suction conditions
iii) I.P. & B.P. if mechanical efficiency is 88%. 10

b) i) Explain multistaging in compressor. What are advantages of multistaging? 10
ii) Explain combustion in C.I. engine with p-θ diagram.

Q.3 **a)** Explain with neat diagrams the methods to improve the thermal efficiency of gas turbine power plant. 10

b) A six cylinder, gasoline engine operates on the four stroke cycle. The bore of each cylinder is 80 mm and the stroke is 100 mm. The clearance volume per cylinder is 70cc. At a speed of 4000 rpm the fuel consumption is 20 kg/h and the torque developed is 150 Nm. Calculate i) the brake power ii) the brake mean effective pressure iii) brake thermal efficiency if the C.V. of fuel is 43000kJ/kg and iv) the relative efficiency on a brake power basis assuming the engine works on the constant volume cycle. 10

Q.4 **a)** i) Draw and explain in brief the port timing diagram for a four stroke Diesel engine.
ii) Define and write the physical significance of Reynolds Number and Nusselt Number. 10

b) A counter flow shell and tube type heat exchanger is used to heat water at the rate of 0.8 kg/s from 30^0C to 80^0C with hot oil entering at 120^0C and leaving at 85^0C. Overall heat transfer coefficient is 125W/m^2 ^{0}C. Calculate the size of heat exchanger required 10

Q.5 **a)** i) Explain working Two stroke engine with neat sketches.
ii) Write short note on psychrometric chart. 10

b) A refrigerating plant works between the temperature limits of -5^0C and 25^0C. The working fluid ammonia has a dryness fraction of 0.62 at entry to compressor. If the machine has a relative efficiency of 55%, calculate the amount of ice formed during a period of 24 hours. The ice is to be formed at 0^0C from water at 15^0C and 6.4 kg of ammonia is circulated per minute. Specific heat of water is 4.187 kJ/kg and latent heat of ice is 335kj/kg. The properties of refrigerant are tabulated as.

Temperature, (^{0}C)	Liquid heat (kJ/kg)	Latent heat (kJ/kg)	Entropy of liquid (kJ/kg K)
25	298.9	1167.1	1.124
-5	158.2	1280.8	0.630

10

Q.6 **a)** Define i) Ton of refrigeration ii) C.O.P. of refrigerator iii) Saturated air iv) Wet bulb depression. 10

b) i) State and explain Stefan Boltzmann's law and Kirchhoff's law. 10
ii) Explain i) Sensible heat factor ii)Heating and humidification

---