3 hours **80 Marks**

N. B. :

1. Question No. 1 is compulsory
2. Attempt any **THREE from Q2 to Q6** questions
3. Use illustrative diagrams wherever required

Q. No.			Marks
Q1)		Attempt any **FOUR** questions	
	a)	List all the possible energy conservation measures in a lighting system?	**05**
	b)	Differentiate between commercial and non-commercial energy, primary and secondary energy.	**05**
	c)	Define specific power consumption (SPC) with an example. A compressor generates 100 cfm of air. The power drawn by the motor is 10 kW. Find its SPC.	**05**
	d)	Name the parameters measured by following energy audit instruments. 1. Fyrite 2. Ultrasonic flow meter 3. Thermal imager or IR gun 4. Stroboscope 5. Tachometer. List one application each of above instruments.	**05**
	e)	Why Sankey diagram is useful in energy balance calculations? Draw Sankey diagram for domestic gas stove.	**05**
Q2)	**a)**	In a plant, a boiler is generating saturated steam of 10 TPH at a pressure of 7 kg/cm2(g) with furnace oil (FO) as a fuel. Feed water temperature = 60°C Evaporation ratio = 14. Calorific value of FO = 10000 kcal/kg Specific gravity of FO = 0.95. Enthalpy of steam at 7 kg/cm2(g) = 660 kcal/kg Find out the efficiency of the boiler by direct method and volume of furnace oil tank (in m3) required for 120 hrs of operation.	**10**
	b)	Enlist all the possible energy conservation measures possible in furnace system?	**10**
Q3)	**a)**	List any TEN ENCON (ENergy CONservation) opportunities possible in HVAC system.	**10**
	b)	Explain the use of Non-Conventional and Renewable Energy Sources in commercial buildings like hospital, school, hotel and shopping malls.	**10**

Q4) **a)** The specifications of cooling water pump connected to boiler, are as follows: **10**
Discharge- Q = 12.5 lit/sec, head- H = 60m, Power consumption- P = 13.4 kW.
As per the boiler manufacturer, required quality is 12.5 lit/sec at 3.0 kg/cm2.
What type of energy conservation measure can be proposed and estimate the reduction in power consumption?
Assume operating efficiency of pump as 65% and motor efficiency as 90%.

b) "Steam should always be utilised at the lowest possible pressure" – What are the important aspects to be considered before fixing up the steam pressure for a particular application? **10**

Q5) **a)** Estimate and compare tonne of refrigeration from the data given below for two AHUs? **10**

Parameter	**AHU 1**	**AHU 2**
Evaporator area, m^2	8.75	0.39
Inlet velocity, m/s	1.81	11.50
Inlet air DBT, ^OC	21.5	24.5
RH (%)	75	73.5
Enthalpy (kJ/kg)	53	59.3
Outlet air DBT, ^OC	17.4	19.5
RH (%)	90	83
Enthalpy (kJ/kg)	46.4	53
Density of air, kg/m^3	1.14	1.05

b) Explain how a Variable Frequency Drive saves power in a three phase electric motor driven pumping system? What will be the reduction in power drawn by a motor by reducing the speed by half? **10**

Q6) **a)** Illustrate the main features of Energy Conservation Act-2001. **10**

b) Write short notes on **10**
1. How to convert housing society into Green Building
2. LEED rating

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