

(60)

SARDAR PATEL UNIVERSITY

M.Sc. Renewable Energy Examination (Semester –II) March -2019

Monday, 18-03-2019, Time: 10.00 to 01.00 P.M

PS02CREN01: Renewable Energy: Conversion, Storage and Environmental

Total Marks: 70

(8x1=8)

Q-1 Select most appropriate answer

1. The following is the correct order of energy conversion in thermal power plants.
 - a) chemical energy – mechanical energy – electrical energy
 - b) mechanical energy – chemical energy – electrical energy
 - c) wind energy – mechanical energy – electrical energy
 - d) heat energy – electrical energy – mechanical energy
2. In thermal power plant, turbine is placed
 - a) before boiler
 - b) in between boiler and generator
 - c) after generator
 - d) any of the above
3. All of the following are electrical mechanical storage systems except.....
 - a) pumped hydro-system
 - b) torsion bar system
 - c) super-conducting coils
 - d) kinetic flywheels.
4. Energy is stored in a flywheel in the form of
 - a) heat energy
 - b) solar energy
 - c) kinetic energy
 - d) potential energy
5. The sensible-heat storage of solar energy depends on
 - a) mass of the material
 - b) specific heat of the material
 - c) temperature difference
 - d) all of these
6. The melting point of different PCM materials
 - a) varies
 - b) is constant
 - c) is 25°C
 - d) none of these
7. The equipment installed in power plants to reduce air pollution due to smoke is
 - a) induced draft fans
 - b) de-super heaters
 - c) electrostatic precipitators
 - d) re-heaters.
- 8.0 Which of the following gases is the main cause of acid rain?
 - a) CO
 - b) NO₂
 - c) both a & b
 - d) none of the above

Q-2 Answer ANY SEVEN questions

(7x2=14)

- 1) Define plant load factor & plant use factor
- 2) Explain in brief about electrical energy route
- 3) Consider a hydropower plant reservoir with an energy storage capacity of 0.5×10^6 kWh. This energy is to be stored at an average elevation of 40 m relative to the ground level. Estimate minimum amount of water has to be pumped back to the reservoir.
- 4) Define principle of flywheel energy storage
- 5) Classify thermal energy storage. Write thermal properties of some common materials
- 6) Estimate sensible heat stored in $2m^3$ water and $2m^3$ granite heated from 20 to 40°C (density of granite 2400 kg/m^3)
- 7) What is difference between sensible and latent heat energy storage.
- 8) Classify pollutants from thermal power plants
- 9) What is FGD? Explain about scrubber technology classification.

Q-3 A) Explain working of diesel electric power plant with the help of its layout. (06)

Q-3 B) Discuss advantages & disadvantages of gas turbine power plant over steam power plant. (06)

OR

Q-3 B) Explain coal-ash circuit of coal based thermal power plant with the help of its layout. (06)

Q-4A) Describe in detailed compressed air energy storage with neat diagram. (06)

Q-4B) Describe pumped hydro energy storage plant. State its operating modes with respect to peak load and off-peak hours. (06)

OR

Q-4B) A underground cavern will be used to store the energy of compressed air. If the cavern has a volume of $29000m^3$ determine value of stored energy by compression of air from 100 to 1500 kPa at 300K at isothermal conditions with a heat loss of 55000kJ. (06)

Q-5 A) A 60 kg of octadecane is heated from $20-30^\circ\text{C}$ by a solar energy system which supplies heat at a rate of 2.0kW. Estimate total heat stored in the material. (06)

PCM	T_m $^\circ\text{C}$	ΔH_m kJ/kg	$C_{p,lav}$ kJ/kg K	$C_{p,s,av}$ kJ/kg K	k_l W/m K	k_s W/m K	ρ_l kg/m ³
Octadecane $\text{CH}_3(\text{CH}_2)_{16}\text{CH}_3$	28	243	2.2	1.8	0.15	0.42	775

Q-5 B) Describe in detailed : a) sensible heat storage b) latent heat storage (06)

OR

Q-5 B) Describe lead acid battery energy storage. (06)

Q-6 A) Explain the working of ESD with suitable diagram. (06)

Q-6B) Discuss acid rain and explain the environmental impact. (06)

OR

Q-6B) Discuss the sources & harmful effect of NO_x , SO_2 , H_2S , CO , CO_2 pollutants. (06)