(55) No. Of Printed Pages: 3 Sc

SARDAR PATEL UNIVERSITY

M.Sc. (Renewable Energy)

Second: Semester

Day and Date: Wednesday, 13.04.2016

Time: 10:30 AM to 1:30 PM

Subject/ Course Code: PS02EREN01 / Paper No. 4

Subject/ Course Title: Alternate Energy Sources

Total Marks: 70

Note: 1. All the questions are compulsory

2. Figures on the right bracket indicated marks

Q-1: Choose the correct answer **(12)**

(i) Magneto Hydro Dynamic power generation principle is based on .....

a. Joule law b. Faraday law

c. Thomson law d. Peltier law

(ii) Gas conductivity required in MHD is .....

a. > 8 mhos/m b. > 10 mhos

c. > 9 mhos/m d. > 6 mhos

(iii) Minimum temperature of emitter required in thermionic convertor should be .....

a. 900 °C b. 800 °C

c. 1000 °C d. 500 °C

(iv) Maximum efficiency attainable in thermoionic generator increasing temperature is .....

a. 15 % b. 35 %

c. 40 % d. 20 %

(v) When an electric current flows through on material having temperature gradient, there is an evolution or absorption heat is known as .....

a. Seebeck Effect b. Joule Effect

c. Peltier Effect d. Thomson Effect

(vi) The process accompanied with release of energy as well as neutrons called

a. Emission b. Reduction

c. Fission d. Fusion

(vii) Thermocouple is an example of .....

a. Thermionic generator b. Thermoelectric generator

c. Thermonuclear fusion d. Thermo chemical conversion

(viii)..... is naturally available radioactive substance used for nuclear fission

a. Plutonium-239 b. Uranium- 235

c. Uranium- 233 d. Tritium

Q-2: Answer **any Six** short questions **(18)**

i. Give the advantages of the MHD systems

ii. Explain in brief what is Seebeck thermoelectric effect

iii. Explain in brief what is fusion reaction?

iv. State the advantages of nuclear fusion.

v. Explain in brief what is thermionic emission

vi. Explain in brief what is work function in thermionic emission

vii. The seabeck coefficient of a junction is 55 $\mu V/^oK$ at 373 K and 50 $\mu V/^oK$ at 273 K. Find the Peltier heats absorbed and rejected when the thermocouple is operating between these heat reservoirs and supplying a current of 10 mA.

viii. A MHD generator has following specification.
Plate area: 0.25 m^2,
Distance between plates: 0.50 m,
Flux density: 2 Wb/ m^2,
Avg. gas velocity: 10^3 m/sec,
Gas conductivity; 10 Mho/m.
Calculate- open circuit voltage and maximum power output.

ix. Find a Thomson heat transferred to the surroundings from a wire whose end points are maintained at 373 and 273 K. A current of 10 mA is flowing in the wire and its absolute thermoelectric power increases linearly with temperature at rate $(d\alpha S_l/dT)=5.4 \times 10^{-9}$ $V/^oK^2$

Q-3: A. Derive an expression for the voltage and power output of MHD generator **(5)**

B. Explain closed cycle MHD system with suitable diagram **(5)**

OR

Explain principle working of magneto hydro dynamic power generation with suitable figure **(5)**

Q-4: A. Derive an expression for the efficiency of thermoelectric generator **(5)**

B. Explain basic principle of thermoelectric power generation with suitable figures **(5)**

OR

A 100 kW, 115 volt, thermoelectric generator operates between 1500 and 1000 °K. The material properties are **(5)**

αSAB at 1250 oK= 0.0012 volt/ oK

κA= 0.02 watt/cm oK κB= 0.03 watt/cm oK

ρA= 0.01 ohm cm ρB= 0.012 ohm cm

For optimum design

AA= 43.5 cm2; AB= 48.6 cm2

LA= LB= 0.49 cm, and the current density in the element is limited to 20 amps/cm^2;

Calculate Maximum efficiency of thermoelectric power generator

Q-5: A) Describe the principle of working and constructional details of a basic thermionic generator (basic diode) with suitable figures **(5)**

B) Derive expression for power and efficiency for thermionic generator **(5)**

OR

Following are the data are given for thermionic generator **(5)**

Cathode work function ϕ_c=2.5 volt

Anode work function ϕ_a=2.0 volt

Temperature of cathode T_c=2000 °K

Temperature of surrounding Ts=1000 °K

Plasma potential drop ϕ_p=0.1 volt

Charge of electrons $\hat{e}=1.6 \times 10^{-19}$ Coulomb
Boltzmann Constant $\kappa=1.38 \times 10^{-23}$ J/°K
Emissivity $\varepsilon = 0.2$ for electrode material used. Calculate the efficiency of the generator.

Q-6: A. Describe Tokamak system with suitable figure **(5)**

B. Explain different methods of plasma heating in magnetic confinement fusion **(5)**

OR

Explain in brief

i. Characteristic of D-T reaction in nuclear fusion **(2.5)**
ii. Advantages of nuclear fusion **(2.5)**

(3)

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