

M.Sc. (2nd Semester) Class Test 2018

Paper: ENVC – 24

Subject : Energy and Environment

Full Marks – 24 (8 x 3)

Time : 1 hour

1. Calculate the amount of mineral matter in coal, if percentage ash and sulphur is 13.2 and 0.1 respectively. If the percentage moisture in coal is 6.8, what percentage of oxygen is present ?
2. What is the mean life and half life of a nuclide? Activity of certain radioactive nuclide decreases by 15% from its initial value in 10 days. Find out the half life of the nuclide.
3. A problematic pacemaker Lithium-Iodine battery is artificially inserted in a human's body. The label reads correct power Usage of $60\mu\text{W}$, but the capacity is misprinted as 1.4Wh instead of 2.4Wh. Estimate on how many years this battery can work without malfunction. Given, 1 year $\sim$ 8000 hours.
4. Write the expression for maximum power that can be converted into electricity from air current and explain the symbols. Suppose diameter of the circle swept by the blades of wind turbine is 7.5 meter and normal wind velocity is 8.5 meter/sec. Calculate the maximum power delivered by the turbine. Density of air is 1.26 kg/m^3 .
5. Name the the working substance and the mechanism by which a Geothermal power plant works. By rough diagrams, explain the different mechanisms through which Geothermal energy is harnessed. Briefly mention on the Geothermal energy landscape in India.
6. Show that the differential attraction at antipodal points on the Earth due to Moon is 2.2 times more than that of Sun. Given, $R/D_M = 1/60$, $M_S/M_M = 2.68 \times 10^7$, $D_S/D_M = 390$ where R is Radius of Earth = 6371km, D's are the distance between Earth to Sun (S) and Moon (M) and M's are the respective masses of Sun (S) and Moon (M).
7. What do you mean by Solar constant and Solar declination? Find out the Solar declination on your examination date at Asutosh College. Interpret on the sign of angle that you obtained.
8. Explain what you mean by efficiency of a heat engine. Two Carnot engines X and Y are operating in series. X receives heat at 1200K and rejects to a reservoir at temperature TK. The second engine Y receives the heat rejected by X and inturn rejects to a heat reservoir at 300K. Calculate the temperature T for the situation when (i) the work output of two engines are equal, (ii) the efficiency of two engines are equal.