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NATIONAL INSTITUTE OF TECHNOLOGY HAMIRPUR B.Tech. End Sem. Exam., May 2023	(124) ROLL NO.
Department: Mechanical Engineering	
Semester: VIII	
Subject Code: ME-461	Time: 03 hrs.
Subject Name: Renewable Sources of Energy	Max.: 50 marks
Instructions: Attempt all questions. Make suitable assumptions wherever necessary. Figures to the right indicate full marks.	

Briefly explain the following: Q1

Q2

Q3

- a) What is the source of tidal energy? What is the minimum tidal range required for a practical tidal plant?
- b) What is the basic principle of wind energy conversion? What range of wind speed is considered favourable for wind power generation?
- c) What do you understand by geothermal energy? What are geothermal fields?
- a) Describe various stages of exploration and development of geothermal [4+6] resources.
 - b) A hot dry rock (HRD) resource has a geothermal temperature gradient at $35^{\circ}K km^{-1}$. The minimum useful temperature is $125^{\circ}K$ above the surface temperature, T_{o} . Water at a flow rate of $1 m^{3} s^{-1} k m^{-2}$ is used for heat extraction. The density and specific heat capacity for water may be assumed as 1000 $kg m^{-3}$ and 4200 $J kg^{-1} K^{-1}$ respectively.

Calculate:

- Heat content per square kilometre of HRD to a depth of 8 km, assuming , i) and $\rho_r = 2700 \ kg \ m^{-3}$ and $c_r = 820 \ J \ kg^{-1} \ K^{-1}$.
- Useful average temperature, initially and after 20 years ii)
- Useful heat extraction rate per km^2 , initially and after 20 years iii)
- a) Draw a schematic layout of linked-basin tidal plant and explain its operation. [4+6]
 - b) A single-basin-type tidal power plant has a basin area of $3 km^2$. The tide has an average range of 10 m. Power is generated only during the flood cycle only. The turbine stops operating when the head on it falls below 3 m. Calculate the average power generated by the plant in single filling process of the basin if the turbine generator efficiency is 0.65. Estimate the average annual energy generation of the plant.

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[4×3]