ESCUELA SUPERIOR POLITECNICA DEL LITORAL "ESPOL"

FIRST EXAMEN

Guayaquil, July 04, 2024

Name of Student: _____

1. ¿ What is the most used material in the manufacture of solar cells?
   a) Germanium
   b) Silicon
   c) Cadmium
   d) Gallium

2. Which of the following turbines does NOT have cavitation problems:
   a) Francis
   b) Kaplan;
   c) Pelton;
   d) Helice;

3. What is measured in watt-peak (Wp) in a solar cell?
   a) The efficiency of the cell
   b) The nominal power
   c) The nominal current
   d) The nominal voltage

4. In what month does an equinox occur:
   a) June
   b) December
   c) March
   d) August

5. If we have several batteries of 24 Volts and 6 Amps each, in what combination could we obtain 72V and 6 A.
   a) 3 batteries in parallel
   b) 2 batteries in series
   c) 3 batteries in series
   d) 2 batteries in parallel

6. What does open circuit voltage (Voc) mean in a solar panel?
   a) The voltage when the panel is short-circuited
   b) The maximum voltage when there is no current
   c) The maximum current when there is no voltage
   d) The maximum power of the panel

7. What effect does the variation in solar radiation have on the short circuit current of a solar panel?
   a) The current decreases with radiation
   b) The current remains constant
   c) The current increases with radiation
   d) The current is not affected

8. 8. What is meant by solar tracking capture?
   a) Increase the number of solar cells in the panel
   b) Adjust the position of the panel according to the time of day and season of the year
   c) Increase the output voltage of the panel
   d) Use higher efficiency solar cells

9. The coriolis force is produced:
   a) Due to the appearance of water compression that generates overpressure in the penstock, as a result of suddenly closing the pipe valve.
   b) Due to corrosion of the forced pipe.
   c) By the movement of the earth
   d) All of the above

10. If in a river the average flow recorded in 40 years is 50.5 m3/s, how much should the ecological flow value be?
    a) 50.5 m3/s
    b) 24.25 m3/s
    c) 5.05 m3/s
    d) 2,425 m3/s

11. Calcule la declinación Solar para el 28 de febrero

$$\delta = 23.45 * sen\left(\frac{360*(284+n)}{365}\right)$$

12. From the Energy vs flow graph, indicate what the design flow should be, if you want to make the most of the hydrological resource of the place.
    a) 32
    b) 38
    c) 40
    d) 48

13. If an electrical generating plant delivers 800MWH to the system and it is known that its installed power is 500kW, how much are the annual equivalent hours:
    a) 8760 H
    b) 1.6 H
    c) 800 H
    d) 1600H

If a house has the following characteristics, calculate:

Aparatos	Cant.	Pot. Unitaria (W)	Pot. Total (kW)	Horas de Utilización diaria	Energía (kW H)
Focos	10	20		4	
Refrigera dora	1	500		4	
Plancha	1	1000		0.5	
Televisor	2	250		8	
		Pot. Total		Energia Total	

$E_{AC} = E`_{AC} / n_{inv}$; $n_{inv} = 0.9$

$E_D = (E_{AC}+E_{DC})*1.25$

$Pmax = FS*E_D*1kW/m2 /(E_{Disponible})$; FS = 0.5

$N_{paneles} = 1.1* Pmax /C$; C = 200 W

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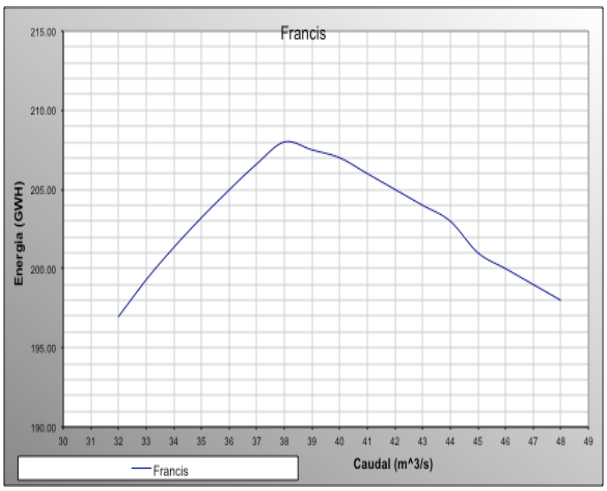
DAILY INCLINAND SOLAR RADIATION [kWH/m2]	
β [Grados]	5
En	5
Feb	5.5
Mar	5.6
Abr	5.7
May	5.8
Jun	5.7
Jul	5.6
Ago	5.5
Sept	5.4
Oct	5.3
Nov	5
Dic	4



14. What is the total power_____

15. What is the Total energy_____

16. How Many Panels _____

17. There is a hydroelectric project with a design flow of 10 m3/s, for the entire year, and it is known that the power delivered to the system is 15 MW. Using the following data, calculate the gross head:
    - Turbine performance 85%
    - Generator performance 95%
    - Losses due to self-consumption 1%
    - Losses due to penstock 2% of the gross head

$$P_{(KW)} = \frac{9.8*\rho*H_N*Q_D*\eta_{TURB}*\eta_{gen}*(1\text{-autocons}\%)}{1000}$$

18. If the annual equivalent hours that the plant operates from the previous year is 4,500 hours, how much energy would the plant deliver per year.

19. Electrical energy is considered:
    a) Primary Energy
    b) Secondary Energy
    c) Energy Vector
    d) None of the above

20. What are the main components of a hydroelectric plant?
    a) Solar panels and batteries
    b) Wind turbines and transformers
    c) Weir, intake work, channel, forebay, pipe and building
    d) Nuclear reactor and cooling tower

	ANSWERS			
	a	b	c	d
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ACADEMIC INTEGRITY DECLARATION:
I have not given, nor have I received unauthorized assistance to complete this exam.