

KATHMANDU UNIVERSITY
End Semester Examination
July, 2019

Mark scored:

Level: B.Sc.
Year : IV

Course : PHYS 431
Semester : II

Exam. Roll No.:

Time: 30 mins.

F.M. : 20

Registration No.:

Date :

SECTION "A"
[10 Q. × 1 = 10 marks]

Choose and tick the most appropriate answer.

- Solar altitude angle α_s is defined as
 - the angle between the vertical and the line to the sun
 - the angle between the horizontal and the line to the sun
 - the angle made by the plane surface with the horizontal
 - the angle between the beam radiation on a plane surface and normal to that surface
- The day angle B on December 17 is about
 - 334
 - 345
 - 350
 - 354
- At the hill and mountain sides,
 - the air above the slopes heats up during the day and cools down at night more rapidly than the air above the low lands which causes the air to rise along the slopes during the day and flow down at night.
 - the air above the slopes heats up during the day and cools down at night more rapidly than the air above the low lands which causes the air to flow down during the day and rise along the slopes at night.
 - the air above the low lands heats up during the day and cools down at night more rapidly than the air above the slopes which causes the air to rise along the slopes during the day and flow down at night.
 - the air above the low lands heats up during the day and cools down at night more rapidly than the air above the slopes which causes the air to flow down during the day and rise along the slopes at night.
- Semi-thermal regions have a temperature gradient of
 - $< 40^\circ\text{C}/\text{km}$
 - $\sim 80^\circ\text{C}/\text{km}$
 - $\geq 80^\circ\text{C}/\text{km}$
 - $\sim 40^\circ\text{C}/\text{km}$ to $80^\circ\text{C}/\text{km}$
- In ocean thermal energy conversion (OTEC), the flow rate required to yield P watts from an ideal heat engine operating between the temperatures T_h and T_c is given by
 - $\frac{PT_h}{\rho C(T_h - T_c)}$
 - $\frac{PT_c}{\rho C(T_h - T_c)}$
 - $\frac{PT_h}{\rho C(T_h - T_c)^2}$
 - $\frac{PT_c}{\rho C(T_h - T_c)^2}$
- The calorific value of Bituminous coal is about
 - 8600 – 8700 cal/kg
 - 8600 – 8700 Kcal/kg
 - 6500 – 7000 cal/kg
 - 7000 – 8500 Kcal/kg
- Greenhouse effect refers to an increase in
 - greenery
 - carbon dioxide
 - global temperature
 - atmospheric pressure

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Level: B.Sc.
Year : IV
Time : 2 hrs. 30 mins.

Course : PHYS 431
Semester: II
F.M. : 55

SECTION "C"

[5 Q. × 4 = 20 marks]

1. What do you mean by geothermal energy? Discuss the geothermal resources.

OR

Define the terms spring tide and neap tide. Write down the advantages and disadvantages of tidal energy.

2. With a labeled diagram, discuss the dolphin-type wave-power machine (wave-energy conversion device). Write down the advantages and disadvantages of ocean wave energy?

OR

Explain why biomass is considered as a renewable energy source and also considered as an indirect form of solar energy. Discuss the biochemical conversion technologies.

3. What is a fuel cell? Describe a H₂-O₂ fuel cell with a well labeled diagram. Mention the important applications of fuel cells.
4. Describe area-velocity method for the measurement of flow rate of water in a river.
5. What is Seebeck effect? Describe briefly a thermoelectric power generator.

OR

Write a short note on fossil fuel and its environmental impact.

SECTION "D"

[5 Q. × 7 = 35 marks]

6. How do you convert the local standard clock time into solar time by applying two corrections? At Madison (longitude 89.4°), what is the solar time corresponding to 10:30 AM central time on February 3? (Standard time corresponding to longitude 90°)

OR

Differentiate between a solar pond and an ordinary homogeneous pond. Discuss the estimation of average solar radiation. Write down the environmental impacts of solar energy systems.

7. In case of horizontal axis wind turbines, derive an expression for the maximum power extraction by the Betz limit (criterion).

OR

Discuss the classification of wind energy collectors. With a labeled diagram, explain the principal subsystems of a typical horizontal axis wind turbine (HAWT).

8. What is the basic principle of ocean thermal energy conversion (OTEC)? Draw a schematic diagram of an OTEC system and determine the maximum output of mechanical power one can obtain from the system.
9. Deduce the expression for power in kW from a hydropower plant with head H and discharge Q . In a hydroelectric power plant, water flows from a reservoir through a pipe to a turbine 90 m below the dam. If the overall station efficiency is 80% and water flow rate is $2000 \text{ m}^3/\text{hr}$, calculate the power output from the station.

OR

Describe the main components of nuclear fission reactor. What is meant by critical mass in nuclear fission? A city requires 100 MW of electrical power on an average. It is to be supplied by a nuclear power plant of efficiency 45% using U-235 as fuel. Calculate the amount of fuel required for one year's operation. (Assume that the energy released per fission of U-235 is 200 MeV)

10. What is meant by nuclear fusion? Explain with an example. For the nuclear force to overcome the repulsive Coulomb force, the separation distance between two deuterons must be approximately $1.0 \times 10^{-14} \text{ m}$.
 - a. Calculate the height of the potential barrier due to the repulsive force.
 - b. Estimate the temperature required for a deuteron to overcome the potential barrier assuming an energy of $3/2 k_B T$ per deuteron (where k_B is Boltzmann's constant).