Mark scored :

KATHMANDU UNIVERSITY
End Semester Examination
July, 2018

Level : B. Sc.
Year : IV

Course : PHYS 431
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date JUL 2 2 2018

SECTION "A"
[10 Q. × 1 = 10 marks]

Choose and tick the most appropriate answer.

1. The atmospheric selective scattering of solar radiation is
   [a] directly proportional to the wavelength of radiation and caused by water vapour
   [b] directly proportional to the wavelength of radiation and caused by air molecules
   [c] inversely proportional to the wavelength of radiation and caused by water vapour
   [d] inversely proportional to the wavelength of radiation and caused by air molecules

2. The mean day or the average day (date) of the month corresponding to February, June, October and November are respectively
   [a] 17, 11, 15, 14 [b] 16, 15, 15, 14 [c] 16, 11, 15, 14 [d] 16, 11, 14, 10

3. In a typical horizontal axis wind turbine (HAWT), one of the principal subsystems 'drive train' consists of the
   [a] rotating parts of the turbine
   [b] hub and blades of the turbine
   [c] tower structure and supporting foundation of the turbine
   [d] turbine housing, machine bed-plate and yaw orientation system

4. A tidal power plant with a basin area of 10^6 m^2 starts operating in a tide of range 12 m. Assume that the average sea water density is about 1025 kg/m^3 and the acceleration due to gravity is about 9.81 m/s^2. If the power plant stops operating when the head on it falls below 3 m, the average power generated in one emptying process is about
   [a] 12.3 MW [b] 20.3 MW [c] 30.3 MW [d] 41.8 MW

5. For temperature difference $\Delta T = 20°C$ and warm ocean surface water temperature $T_h = 27°C$ with $\rho = 1\times10^3$ kg/m^3 and $C = 4.2\times10^3$ J/kg/K, the flow rate required to yield 1 MW from an ideal heat engine is about
   [a] 0.114 m^3/s [b] 0.147 m^3/s [c] 0.178 m^3/s [d] 0.221 m^3/s

6. Heating of coal in oxygen deficient environment is called
   [a] pyrolysis [b] combustion [c] gasification [d] liquefaction

7. The rotor blades are adjusted in order to ensure shockless entry of water as a governing part of
   [a] Gas turbine [b] Pelton turbine [c] Kaplan turbine [d] Francis turbine

8. In a nuclear fission reactor the neutron multiplication factor K is less than 1. The reactor is said to be in
   [a] critical sate
   [b] sub-critical state
   [c] super critical state
   [d] uncontrolled state

9. In which of the following decay does the element not change?
[a] α-decay [b] β^--decay [c] β^+-decay [d] γ-decay

10. Which one of the following statements is true?
[a] In thermionic emission, number of electrons emitted depends upon the temperature
[b] For obtaining higher efficiency, thermionic emitter is made up of low melting point
[c] In thermionic emission, number of electrons emitted is independent of the temperature
[d] For obtaining higher efficiency, thermionic emitter is made up of a material of higher work function

SECTION "B"

[10 Q. × 1 = 10 marks]

Fill in the blanks.

11. If G_{sc} = 1353 W/m^2, then at latitude 43° N on April 15, the day's solar radiation on a horizontal surface in the absence of the atmosphere is about ..... (MJ/m^2).

12. One of the most popular kite anemometer was the TALA kite, and TALA stands for .....

13. The rock occurring at moderate depths but to which water does not have access, either because of the absence of ground water or the low permeability of the rock, is called the .....

14. If ρ is the water density, g is the acceleration due to gravity, 'a' is the amplitude, λ is the wavelength, L is the width of the wave perpendicular to the direction of propagation of the wave and f is the frequency, then the power per unit length of the wave is .....

15. The wide range of energy-rich fuels (char residue) can be produced by roasting dry woody matters in a reactor vessel in the absence of air, and this process is called the .....

16. The hydroelectricity plants having generation capacity less than 10 MW and more than 100 kW are called .....

17. Energy released by the fission of 1 kg of U-235 is about .....

18. In thermonuclear fusion reaction, the Lawson criteria for D-T reaction is expressed as .....

19. The temperature at which the thermoelectric EMF is maximum is called .....

20. The reaction that takes place at the anode of H_2-O_2 fuel cell is written as .....

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F.M. : 55

SECTION "C"
[5 Q. × 4 = 20 marks]

1. Classify geothermal resources. Discuss the geothermal fields with a labeled diagram.

OR

What is the basic principle used in energy from tides (tidal energy). Define spring tide, neap tide and tidal range.

2. Derive an expression for the power per unit area of the surface from the ocean wave.

OR

Explain the basic principle of ocean thermal energy conversion (OTEC). Draw a schematic diagram of an OTEC system.

3. Explain the process of formation of different types of coal and also mention their ages and variation of quality with age.

4. Describe the conductivity (dilution gauging) method for the measurement of flow rate of water in a river.

5. What is a fuel cell? Describe a H_2-O_2 fuel cell with a well labeled diagram. Mention the important applications of fuel cells.

OR

Write a short note on thermoelectric power generation. Describe the advantages and limitation of such a power generator.

SECTION "D"
[5 Q. × 7 = 35 marks]

6. Explain the calibration of solar radiation measuring instruments (radiometers). Discuss briefly Angstrom compensation pyrheliometer. Calculate the sunrise hour angle, sunrise time (in terms of solar time) and day length at Kathmandu (latitude 27° 42' N) both at the summer and winter solstice.

OR

Define the area concentration ratio. Discuss different types of concentrating or focusing type solar energy collectors. Derive an expression for the area concentration ratio of a circular dish concentrator.

7. Discuss the local winds and planetary winds. Derive an expression for the thrust on turbines.

OR

Discuss the different types of wind speed measuring instruments. Also, discuss the environmental impacts of wind energy systems.

8. What do you mean by biomass? Explain why biomass is considered as a renewable energy source and also considered as an indirect form of solar energy. Discuss the different types of biomass conversion technologies.

9. What is meant by critical mass required for a nuclear fission reaction? Explain the terms: critical, sub-critical and super critical states of nuclear chain reaction. A city requires 200 MW of electrical power on an average. It is to be supplied by a nuclear power plant of efficiency 50% using U-235 as fuel. Calculate the amount of fuel required for one day's operation. (Assume that the energy released per fission of U-235 is 200 MeV)

OR

Outline the distinguishing features of an impulse turbine and a reaction turbine. In a hydroelectric power plant, water flows from a reservoir through a pipe to a turbine 100 m below the dam. If the overall station efficiency is 70% and water flow rate is 1000 m^3/hr, what is the power output from the station?

10. Draw a schematic diagram of an MHD power generating system and explain its working principle. Deduce the expression for the maximum power generated per unit volume of the system. What are the main advantages of a MHD power generator?