KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.Sc.
Year : III

Course : ESEE 309
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 08 AUG 2024

SECTION "A"

[20 Q. × 1 = 20 marks]

Choose and encircle in the most appropriate option from each set of choices

1. _____ these are not strictly renewable energy resources but are very abundant in availability and are very low in pollution.
   a. Hydroelectric energy
   b. Biomass
   c. Geothermal energy
   d. Hydrogen and fuel cells

2. _____ can travel deep into the lungs where it can aggravate asthma, chronic bronchitis, emphysema, and other lung conditions.
   a. NOx
   b. VOCs
   c. Particulate Matter
   d. Hydrocarbon

3. Which of the following is an example of physio-chemical conversion technique to convert biomass into usable forms of energy?
   a. Pyrolysis
   b. Gasification
   b. Anaerobic Digestion
   d. Extraction with esterification

4. The standard emf is _____ for hydrogen-oxygen fuel cells.
   a. 1.23 V
   b. 1 V
   c. 1.5 V
   d. 1.62 V

5. Winds having following speed are suitable to operate wind turbines.
   a. 10-25 m/s
   b. 15-30 m/s
   c. 5-25 m/s
   d. 10-20 m/s

6. What is the wind turbine power if blade length is 52 m, wind speed is 12m/sec and power coefficient is 0.4?
   a. 2 MW
   b. 2.6 MW
   c. 3 MW
   d. 3.6 MW

7. A family with 5 members plans to install a solar water heater which is mainly used for bath. The hot water temperature required for bath is 50^0 C. While the annual average temperature of cold water is 23^o C. Assuming that each person needs 60 liters of hot water for taking bath a day, how much heat should be provided by the solar water heater to satisfy the family's demand for bath?
   a. 5100 Kcal/day
   b. 6100 Kcal/day
   c. 7100 Kcal/day
   d. 8100 Kcal/day

8. Average solar radiation in Nepal is _____
   a. 3.5 kWh/m2 /day
   b. 4.5 kWh/m2/day
   c. 3.5 Wh/m2/day
   d. 4.5 W/m2/day

9. The hydraulic energy of impulse turbine are completely converted into _____ before trans formation in the turbine runner.
   a. heat energy
   b. kinetic energy
   c. potential energy
   d. mechanical energy

10. _____ is biological material derived from living, or recently living organisms.
a. Biomass b. Biogas c. Biofuel d. Biostate

11. The most prevalent GHGs is _____
a. Methane b. Nitrous Oxide c. Carbonmonoxide d. Carbondioxide

12. United Nations Framework Convention on Climate Change made commitments as; _____
a. Parties have differentiated goals and responsibilities.
b. Parties have common but differentiated responsibilities.
c. Parties have same goals and responsibilities.
d. Parties have their own goals and responsibilities.

13. Earth receives _____ Of energy from sun.
a. 175 PetaWatts b. 180 PetaWatts c. 190 PetaWatts d. 200 PetaWatts

14. The extractable power from the wind is given by: $P = 1/2\rho AV^3C_p$. In the equation C_p is known as
a. Betz constant law b. Betz formula
c. Betz limit d. Betz wind modeling limit

15. _____ are the sources of energy which have been in use for a long time, e.g., coal, petroleum, natural gas and water power.
a. Renewable Energy Sources b. Non-renewable Energy Sources
c. Conventional Energy Sources d. Non-Conventional Energy Sources

16. The combustion of fossil fuels leads to the release of pollution into the atmosphere and these fossil fuels are mainly based on _____
a. inorganic compounds b. inorganic carbon compounds
c. organic compounds d. organic carbon compounds

17. Only _____ Of the total solar energy reaches outside the atmosphere reaches the surface of the earth.
a. 47% b. 57% c. 67% d. 77%

18. Wind energy is harnessed as _____ energy with the help of windmill or turbine.
a. Mechanical b. Thermal c. Solar d. Electrical

19. Which of the following is the most popular application of hydrogen fuel cell?
a. Fuel cell vehicles b. Fuel cell spacecraft
c. Fuel cell energy power plants d. Fuel cells stand-alone power supplies

20. _____ emits from lightning, soil bacteria, high temperature fuel combustion and results acid rain and primary pollutants that produces photochemical smog.
a. Sulphur dioxide b. Particulate Matter
c. Nitrous oxide d. Ozone

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SECTION "B"
[55 marks]

Attempt *ALL* questions. Students should attend the questions in serial order. Assume necessary data with logical explanation.

1.
a. Define carbon and emission trading.
b. What are the sources for GHGs emission?
c. List out the different environmental impacts of the climate change. [3+2+2]

2. A rural municipality office in Mustang needs the following electric system: [3+4]
a. 5 watt 12 V d.c lamp, 12 in numbers to be used for 8 Hrs for block A
b. 5 watt 12 V d.c lamp, 8 in numbers to be used for 6 Hrs for block B
VHF telecommunication equipments of system voltage of – 48 V d.c, power consumptions in talk and receive mode (2 hrs/day) is 50 watt, power consumption in standby mode is 10 watt.
Show all the load calculations in tabular form. Calculate the solar array and battery bank.

3. List out the different types of HP according to power production. Describe run-off river and reservoir types of HP.
Government of Nepal, Ministry of water resource, irrigation and energy decided to add 50 MW of wind generation to its system. If the individual unit area rated 3 MW in a 14 m/sec wind speed at standard condition and have power coefficient 0.36 and electrical mechanical efficiency of 90% each. What is the required area of each rotor? What is the rotor dia. if the rotor is two bladed horizontal axis propellers? If the turbine is required to deliver rated power at 20rpm and generator rated speed is 1800 rpm, what is the average torque at the low speed and high speed shaft? [3+4]

4. Explain the working principle of hydropower with diagram. At a hydropower station, the design is 1.25 times more than the head during monsoon season whereas the design flow discharge and design load are 500 m^3/sec and 56 m respectively. Determine the flood discharge in downstream? [4+3]

5. Define utilization, plant and load factors of a HP. The diameter of penstock in hydropower plant is 2 m having frictional coefficient of 0.054. HP developers wishes to install a penstock pipe having frictional coefficient of 0.032. What will be the diameter of penstock pipe for frictional coefficient 0.032. Assume the discharge and the length for both cases.
Take: head loss (H_L) = $4FLV^2/2gd$ [3+4]

6. Define E Number and CDM. The organic matter present in MSW or wastewater is represented by the equation: $C_{18} H_{19} O_9 N$. Calculate the heat value in KJ/Kg. using the modified Dulong's formula. [3+4]

P.T.O.

7. Below is the case study of a village in Dhading district of Nepal. Design the solar pumping system with neat and clear figure for the water supply scheme. [7]

a. Population of people = 200 with annual increment of 4%
b. Water consumption = average 25 lpcd
c. Population of cattle = 50
d. Water consumption = 40 lit/day/cattle
e. Static head = 20m
f. Draw down level = 3m
g. Pipe friction = 0.5m

8. Write short notes on (***ANY TWO***): [3+3]

a. Hybrid Vehicles
b. Super capacitors
c. Green hydrogen