KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.E.
Year : III

Course : MEEG 328
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 28 JUL 2024

SECTION "A"
[10 Q. × 1 = 10 marks]

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

1. A thermosyphon system of solar collector requires _____ to run
   a. an electric pump
   b. an electric motor
   c. compressor
   d. no electrical device

2. An optimum pH of feeding material for anaerobic digestion is _____
   a. 4 b. 5 c. 7 d. 8

3. The range of wind speed suitable for wind power generation is
   a. 0-5 m/s b. 5-25 m/s c. 25-50 m/s d. 50-75m/s

4. Flow Duration Curve (FDC) is useful for the design and sizing of
   a. Solar dryer
   c. Downdraft gasifier
   c. Solar PV
   d. Microhydro power plant

5. An instrument used for measuring global irradiance is called
   a. anemometer b. pyranometer c. pyrheliometer d. hygrometer

6. Which of the following is a commonly used material in solar cells
   a. Copper b. bronze c. silicon d. germanium

7. The sun radiated solar energy on the earth surface on a normal sunny day is approximately
   a. 1350 W/m^2 b. 200 W/m^2 c. 1500 W/m^2 d. 900 W/m^2

8. Which of the following source of energy caused by uneven heating of earth's surface
   a. solar b. wind c. biomass d. geothermal

9. Fixed dome household biogas digester provides _____ gas pressure to the biogas stoves.
   a. Constant b. variable c. above 5 bars d. above 10 bar

10. The wind speed at site A for a wind farm is 10% higher than at site B. What would be the expected increase in wind power extraction at site A compared to site B?
    a. 22% b. 33% c. 44% d. 55%

SECTION "B"

[10 Q. × 1 = 10 marks]

Fill in the Blank

11. The amount of energy available in the wind at any instant is proportional to ___ of the wind speed

12. A 100Wp solar PV system installed in the area where average solar insolation is 1825 $kWh/m^{-2}y^{-1}$ and considering no effect of temperature variation and soiling effect can generate _____ kWh electricity per annum?

13. _____ gasifier produces typically less than 1% of tar-oils and so are used widely for internal combustion engine operation.

14. To manage 50 kg of cattle manure considering 50 days of hydraulic retention time and 30 L biogas production per kg cattle manure, the required size of biogas plant required is _____?

15. A typical spacing between turbines in a wind farm in terms of their rotor diameters D is approximately _____

16. The fraction of power in the wind that a modern wind turbine can extract is approximately _____

17. A rapid heating process that converts biomass into bio-oil within seconds is _____

18. The typical capacity factor of solar PV is _____%.

19. Composting is the decomposition of organic matter in the _____ of air.

20. Biomass _____ is the process of in which pelletized or crushed biomass is partially oxidized under restricted air supply for the generation of producer gas.

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SECTION "C"

Attempt *ALL* questions. Assume suitable data if any is missing.

1. Discuss briefly how electricity is generated from solar photovoltaic (PV). Describe an ideal IV characteristics of solar cell and show the effect of high temperature on it. Calculate hydraulic energy, solar PV power and pump size for a water supply system in a village with an average insolation of 4.6 kWh/m^2/day for the following requirements: Population 2500, average water consumption 60 liters/day/person and total dynamic head 220.5 m. Assume pump efficiency is 60%, load mismatching factor 0.8, and derating factor 0.9. [2+3+6]

2. Briefly discuss about the concept of power extraction from wind. Do you think wind resource assessment (WRA) is pivotal for the installation of wind turbine, why? The supplied cold-water temperature in a solar collector is 10 °C and the hot water temperature at the storage is 55 °C. The average solar radiation of the site is 4 kWh/m2/day. Estimate the collector area requirement for the hot water demand of 1200 L per day for a typical commercial building demand when system efficiency of the collector is 80% and the collector efficiency is 60%. [3+3+5]

3. Discuss the current energy consumption scenario of Nepal? In Nepal, more than 90% of electricity is generated from Run of River (RoR) hydropower, what do you think, heavily relying on RoR for electricity generation is the right way of energy planning and energy security? Do you think we need diverse energy mix in our energy supplies, why? [5+6]

4. What is anaerobic digestion process? Briefly describe biochemical process of anaerobic digestion? A livestock farm wants to manage cattle dung of 500 kg daily (dung contains 20% TS and 80% VS) in his farm located in Janakpur, Nepal. You are supposed to provide the required plant size, daily water requirement, daily biogas production and equivalent amount of LPG substitution from the available waste. [1+4+6]

5. Write short notes on [4+3+4]
   a. Fluidized bed gasifier
   b. Hydrograph and Flow Duration Curve
   c. Improved Cookstove