KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2019

Marks Scored:

Level : B.E.
Year : IV

Course : EPEG 410
Semester: I

Exam Roll No:

Time: 30 mins

F.M : 10

Registration No.:

Date 05 MAR 2019

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Encircle the most appropriate answer for the following questions.

1. Which of the following is not a Renewable Energy source?
   A. Hydrogen fuel B. Biomass C. Fossil fuel D. Tidal energy

2. A solar photovoltaic system has a battery of 100Ah, 12V @C5. The ideal size of the solar photovoltaic module to charge the battery, with a peak sun of 5 will be.....
   A. 100Wp B. 240Wp C. 20 Wp D. 500Wp

3. A micro hydro project with discharge of 0.01 m^3 per second and having a gross head of 60 meters produces electricity in the range of .....
   A. 4-6 kW B. 6-8 kW C. 8-12 kW D. 12-16 kW

4. A blocking diode in solar panel protects the back flow of current from
   A. load to battery B. battery to panel C. panel to load D. load to panel

5. Which of the following hydro turbine is best suitable for 120 meters head?
   A. Francis B. Kaplan C. Pelton D. Cross flow

6. The major contents of Biogas are
   A. Methane and Carbon dioxide
   B. Hydrogen and methane
   C. Hydrogen and Carbon dioxide
   D. Carbon monoxide and Nitrogen

7. The total hydraulic energy required for water pumping is directly proportional to
   A. temperature at the water source
   B. amount of water at the source
   C. distance from the water source
   D. humidity at the water source

8. Total installed capacity of Hydro-power in nepal is in the range of
   A. 600 to 900 MW
   B. 900 to 1,200 MW
   C. 1,200 to 1,500 MW
   D. 83000 MW

9. Which of the following statement is correct?
   A. Increase in temperature increases the efficiency of solar PV cell
   B. Increase in temperate decreases the efficiency of solar PV cell
   C. Decrease in temperature increases the efficiency of the solar PV cell
   D. There is no relation between temperature and solar PV cell efficiency

10. The most common type of wind turbine used globally is.....
A. one bladed B. two bladed C. three bladed D. multi-bladed

11. Increase in Depth of Discharge (DoD) of a lead acid battery
A. Increase in Battery's life cycle B. Decrease in Battery's life cycle
C. Leads to instant damage of the battery D. Has no relation with battery lifecycle

12. ESIA stands for
A. Environmental Standard for Impact Assessment
B. Energy Standard for Impact Assessment
C. Energy and Social Impact Assessment
D. Environmental and Social Impact Assessment

13. In hydraulic power-generation systems, desilting basin are provided to prevent
A. high pressure B. high velocity C. high discharge D. high silt

14. The tilt angle preferred for a solar photovoltaic module in Nepal is .....degrees.
A. 60 B. 90 C. 30 D. 0

15. Renewable energy does not contribute to
A. Global warming B. Deforestation
C. Nuclear Waste D. Environmental problems

16. Of the following choices, which best describes or defines biomass .....
A. Massive living things
B. Inorganic matter that can be converted to fuel
C. Organic matter that can be converted to fuel
D. Petroleum

17. Wind is beneficial resource of energy as it doesn't cause
A. Pollution B. Echo C. Noise D. Sound

18. A solar photovoltaic system has a maximum load of 5A, a battery of 40Ah, 12V @ C5, solar photovoltaic module with rated current 8.8A and short circuit current of 9.8A. The rating of a charge controller will be approximated about.....
A. 8A B. 5A C. 8.8A D. 9.8A

19. The hydraulic energy required to pump 1000litres of water per day from a depth of 35m, with a pump efficiency of 100% is .....
A. 343Wh B. 35Wh C. 95Wh D. 29Wh

20. Which of the following energy source has the highest share in Nepal's energy mix?
A. Hydro-power B. Solar PV C. Biomass D. Fossil fuel

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F.M. : 40

SECTION "B"
[5Q × 8 = 40 marks]

Attempt *ANY FIVE* questions. Assume necessary data if required.

1. Explain the following terms with concern to solar photovoltaic systems. [2+2+4]
   a. Principles of Photovoltaic Effect
   b. By-pass diode and blocking diodes in solar photovoltaic module
   c. Maximum Power Point Tracker

2. a. Sketch label and describe the layout for a hydro power project of 60-80 MW range with net head of about 100 Mtrs. [5]
   b. Describe the different types of dams preferred for a hydropower power plant. [3]

3. A hilly village in west Rukum is without access to grid electricity. Of 50 households in total, the top most house of the village is at the altitude of 1850 meters. A reliable source of water with regular yield of 20 liters per second is available below to the village at an altitude of 1745 meters. Design a solar powered water pumping system with the following assumptions. [8]
   a. Average population per house hold is 4.2
   b. Average daily water consumption per person is 25 liters
   c. Average cattle per house is 1.3
   d. Average daily water consumption per cattle is 40 liters
   e. The ground surface length between the water source and the top most household is 285 meters
   f. The village has a school demanding 200 liters of water per day
   g. The system is to be designed with 2 days of autonomy

4. a. Biogas technology is a reasonable alternative for rural energy supply in Nepal. Describe the statement explaining potential uses of biogas technologies. [4]
   b. With a layout diagram describe the different components of a house hold biogas plant. [4]

5. Design a micro-hydro scheme for a village based on the following information.
The details of the Stream/river are as follows:
Depth 1 (D1) = 0.12 meters;
Depth 2 (D2) = 0.10 meters;
Depth 3 (D3) = 0.16 meters;
Depth 4 (D4) = 0.11 meters;
Width 1 (W1) = 1.5 meters
A floating cork takes 65 seconds travelling 35 meters of river length.
Other information

- Can use only 40 % of the available water for hydro-electricity
- Elevation of water surface at river= 1380 meters
- Elevation of proposed powerhouse location = 1270 meters

If the micro-hydro is connected to the grid and if a Power Purchase Agreement (PPA) is signed with NEA @ NPR 6.60 per kWh, what would be annual revenue of the project if the village consumes only 40 % of the generated energy? [8]

6. An industry in Banepa is using electricity supply from NEA and is paying the energy tariff @ NPR 8.55 per kWh in the day time; from 9 a.m. till 5 p.m. The industry operates for 350 days in a year and the minimum power demand during the afternoon is 100 kW. The industry has a south faced roof top sufficient installing 60 kW solar panel. Design most techno economically feasible solar photovoltaic system for the industry and calculate an amount per kWh that you would require as a subsidy so as to make your payback period as only 5 years.

Other required information for the design are:

- The industry has a PPA with NEA for supply of surplus power to local grid by netting the export @ NPR 7:30 per kWh.
- Installation cost of solar PV including all accessories is NPR 65,000 per kW.
- Operational cost of the system is 5 % of its total potential revenue @ NPR 7:30

[8]