KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024

Level : B.E.
Year : III
Time : 2 hrs. 30 mins.

12 FEB 2024

Course : CHEG 321
Semester : I
F.M. : 40

SECTION "B"
[5Q × 8 = 40 marks]

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

1. a. Based on its use classify and explain the different types of Hydropower dams. [2]

   b. Explain the need of guide vane and needle spear for hydro turbines. [2]

   c. The runoff data of a river at a particular site is as given below: [4]

Month	Discharge (m3/month)
January	40
February	25
March	20
April	10
May	0
June	50
July	75
August	100
September	110
October	60
November	50
December	40

   (i) Draw a hydrograph and find the mean flow,
   (ii) Draw the flow duration curve,
   (iii) Find the power in MW available at mean flow if the head available is 80 m and overall efficiency of generation is 85%.

   Consider each month of 30days for your calculations.

2. a. Describe the function of different components of a Nuclear Power Reactors. [3]

   b. Explain the different underground mining techniques used for coal extraction. [3]

   c. Describe the different types of underground facilities for storage of Natural Gas. [2]

3. a. What do you mean by Gasoline Reforming? Describe any one of the gasoline reforming processes. [2]

   b. Describe any two solar thermal technologies being used in Nepal. [3]

   c. A solar photovoltaic pumping system is to be designed for a rural community in Nepal. The details of the water source and consumption of the community are: [3]

Water source:	dug well
Static head:	30m
Draw down level:	5m
Pipe friction loss:	1m
Monthly average solar insolation:	4.5kWh/m2/day
Population:	250
Average water consumption(human):	25litres/day/person
Number of cattle:	50
Average water consumption(cattle):	40litres/day/cattle

   Calculate the size of the solar photovoltaic module required for the system.

12 FEB 2024

4. a. Draw and describe the power versus wind speed curve for a wind turbine. [3]
   b. What is biomass gasification? Explain any one type of biomass gasifier in use. [3]
   c. Explain how a geothermal heat pumps works with a suitable diagram. [2]

5. a. With a diagram, explain the working principle of a Hydrogen Fuel cell. [3]
   b. What is an Energy Audit? Describe how preliminary energy audit is carried out in an industry. [3]
   c. List out ten energy conservation opportunities that can be adopted in our homes. [2]

6. a. Point out they key objectives of the UN Sustainable Development Goal 7: Affordable and Clean Energy and describe how these can be achieved in context of Nepal. [2]
   b. How is energy stored in a supercapacitor? Describe the characteristics of a supercapacitor in comparison to a battery. [3]
   c. Suppose a farmer has 20 pigs each producing 3kg/day of dung and 2 cows each producing 10kg/day of dung. He is to cook for a household of 7 and he has 3 lights each for 4 hours per day. He has plenty of water. Does the farmer have enough input to meet the energy demands and what plant size should he choose? [3]

Biogas plant design considerations

Loading rate for various plant size		
Plant Size (m^3)	Daily load rating(kg)	
	Hills	Terai
4	24	30
6	36	45
8	48	60
10	60	75
15	90	110
20	120	150

Design Parameters of a Biogas Plant		
S.N.	Parameters	Value
1	C/N ratio	20-30
2	pH	6-7
3	Digestion temperature	20-35
4	Retention time (HRT)	40-100 days
5	Biogas energy content	6kWh/m^3
6	One cow yield	10 kg dung/day
7	Gas production per kg of cow dung	0.023 -0.04 m^3
8	Gas production per kg of pig dung	0.04-0.059 m^3
9	Gas production per kg of chicken dung	0.065-0.116 m^3
10	Gas production per kg of human excreta	0.02-0.028 m^3
11	Gas requirement for cooking	0.25 m^3/person
12	Gas requirement for lighting one lamp	0.125 m^3/hour

KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024

Marks Scored:

Level : B.E.
Year : III

12 FEB 2024

Course : CHEG 321
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date :

SECTION "A"

[20Q. × 0.5 = 10 marks]

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

1. 1 tonne of oil equivalent defined by statistics division of United Nations Secretariat and International Energy Agency is equivalent to ....
   a. 45.432GJ b. 36.874GJ c. 32.432GJ d. 41.868GJ

2. … dam is an example of a non-rigid dam.
   a. Arc b. Rock fill c. Timber d. Steel

3. A hydropower site has an effective head of 100 m, a flowrate of 6,000 cubic meters per second and plant efficiency 83%, the annual energy generated will be …
   a. 18.39TWh b. 4.57GWh c. 43.6TWh d. 1.82GWh

4. Control rods are used in a Nuclear Power Reactor to control the ..... in the reactor.
   a. r ate of reaction b. neutrons released c. heat produced d. fuel supplied

5. The carbon content in a Bituminous coal is between … percentage.
   a. 60 - 70 b. 71 - 77 c. 77 - 87 d. 87 - 97

6. In an abiogenic process of natural gas formation methane is formed by .....
   a. chemical reaction of hydrogen rich gases and carbon molecules
   b. transformation of organic matter by microorganisms
   c. compression of organic matter at a very high pressure and for long time
   d. deposition of plant in the bottom of sea and compression

7. For motor fuel the octane number of the petroleum oil should be above ...
   a. 77 b. 80 c. 87 d. 90

8. The optimum tilt angle for a solar panel with solar altitude angle 55° is …
   a. 35° b. 45° c. 55° d. 125°

9. The peak sun of a site is 5, the energy required by the load is 5000Wh, the derating factor is 0.9 and columbic efficiency is 0.9. The system voltage is assumed to be 24V. The size of solar module required for the load is .....A.
   a. 1286.00 b. 24.3 c. 41.66 d. 51.44

10. The capacity of battery for a load of 50A for 4 hours, depth of discharge 0.8, efficiency 0.8 and day of autonomy 2 is .....Ah.
    a. 39.06 b. 400 c. 625 d. 156.25

11. Rated speed of a wind turbine is greater than … speed.
    a. cut out b. cut in c. furling d. maximum

12. The highest C/N ratio for the materials among, cow dung, pig dung, elephant dung, and straw is that of …
a. straw b. pig dung c. cow dung d. elephant dung

13. Pink hydrogen is the hydrogen produced from …
a. solar energy b. natural gas c. nuclear energy d. coal

14. …….. incorporates an electricity generating system based on pendulum connected to generator.
a. Salter duck b. Geothermal plant
c. Oscillating water column d. TAPCHAN

15. The national energy efficiency strategy 2075 of Nepal aims to increase the energy efficiency growth to …. % by 2030.
a. 0.84 b. 1.68 c. 2.5 d. 15

16. Energy saving in a domestic ceiling fan can be done by replacing resistive regulator by … regulator.
a. inductive b. capacitive c. electronic d. thermal

17. Abney level is an instrument used to measure the ….
a. wind speed b. solar radiation c. sulphur content d. head

18. The air mass ratio for the standard test condition for a solar photovoltaic module is ...
a. 0.5 b. 1 c. 1.5 d. 2

19. …helps bind the cellulose/ hemicelluloses matrix while adding flexibility to the mix.
a. Lignin b. Starch c. Sugar d. Fibre

20. Supercapacitors are preferred over battery because of high ….
a. discharge time b. efficiency c. energy density. d. power density