

KATHMANDU UNIVERSITY
End Semester Examination
June/July, 2023

Marks Scored:

Level : B.E.

Year : I

Exam Roll No. :

Time: 30 mins.

Course : MEEG 141

Semester : I

F. M. : 20

Registration No.:

Date **14 JUL 2023**

SECTION "A"
[20Q. × 1 = 20 marks]

Encircle the most appropriate alternative from each set of choices.

- Embodied carbon refers to the greenhouse gas emissions arising from which of the following?
a. Manufacturing b. Operation c. Both (a) and (b) d. None of the mentioned
- Which of the following statements best describes energy?
a. The measure of an object's mass and velocity
b. The capacity to do work or produce heat
c. The amount of force applied to an object
d. The measure of an object's temperature
- Which of the following processes does not involve a transfer of heat?
a. Boiling water on a stove
b. Melting ice into water
c. A car engine running and producing exhaust gases
d. None of the above
- Convection is primarily driven by _____.
a. Temperature difference between two objects
b. Direct contact between two objects
c. Electromagnetic waves
d. Movement of fluid or gas
- In a heat engine, the working substance _____.
a. Absorbs heat and does work b. Absorbs work and does heat
c. Absorbs both heat and work d. Absorbs neither heat nor work
- The working principle of a refrigerator is based on _____.
a. Conduction b. Convection c. Radiation d. The reverse Carnot cycles
- The primary difference between a heat pump and a refrigerator is _____.
a. The direction of heat transfer b. The working principal
c. The type of refrigerant used d. The size and capacity
- Solar thermal collectors are used to _____.
a. Convert sunlight into electricity
b. Concentrate solar energy for heating water or space
c. Store solar energy in batteries
d. Reflect sunlight for cooling purposes

9. The flash point of diesel lies in which range _____.
a. 0 °C-10 °C b. 12 °C-24 °C c. 52 °C-96 °C d. None of the mentioned
10. Which of the following has the shortest wavelength?
a. Microwaves b. Infrared rays c. Ultraviolet rays d. Gamma rays
11. Which of the following factors can affect the efficiency of wind turbines?
a. Wind speed and direction b. Blade height and size
c. Blade design and materials d. All of the mentioned
12. Run-of-river hydropower systems generate electricity by _____.
a. Storing water in reservoirs and releasing it through turbines
b. Constructing large dams and regulating water flow
c. Harnessing the natural flow of a river or stream
d. Using tidal forces to generate power
13. Which of the following is the Photo-chemical conversion process _____.
a. Photosynthesis b. Ozone formation c. Solar collector d. Both (a) and (b)
14. Which of the following is an electro-chemical component commonly used in fuel cells?
a. Inductor b. Diode c. Electrolyte d. Relay
15. A complete combustion gives which colored flame?
a. green b. red c. Black d. Blue
16. Which of the following is not the component of Fire Triangle?
a. Oxygen b. Heat c. Fuel d. Foam
17. A polar plot displaying the frequency of occurrence of wind by direction is called a _____.
a. Wind Tunneling b. Wind Rose c. Wind Scattering d. None of the mentioned
18. The primary greenhouse gas emitted from burning fossil fuels for energy is _____.
a. Carbon dioxide (CO₂) b. Methane (CH₄)
c. Nitrous oxide (N₂O) d. Sulfur dioxide (SO₂)
19. The energy transition refers to the global shift towards _____.
a. Increasing reliance on fossil fuels b. nuclear power generation
c. Renewable energy sources d. Expanding coal-fired power plants
20. Which of the following power plant is considered as peak load power plant?
a. Solar Photo voltaic b. Nuclear Power Plant
c. Wind Turbine d. Hydro power plant

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

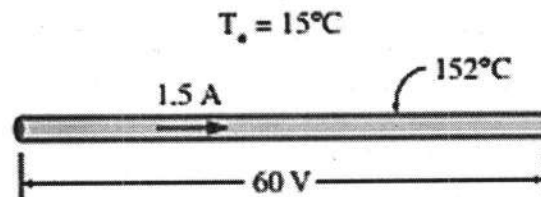
Course : MEEG 141
Semester : I
F. M. : 55

SECTION "B"

Attempt *ALL* questions. Assume any missing information/conditions if necessary.

1. a. What do you understand by sustainability? What are 'Sustainable Development Goals' put forth by the United Nations? [1.5+1.5]
b. As an engineer, which of the 17 sustainable development goals would you like to act upon to make your society sustainable and why? [3]
2. a. What is the basic thermodynamic cycle that models a spark ignition engine or a petrol engine? Explain the cycle in p - v diagram. [1+3]
b. How does the compression ratio affect the efficiency of a spark ignition engine and what limits the compression ratio of such type of engines? [2]
3. a. Explain combustion with appropriate chemical reaction. How would you determine whether or not a combustion process is complete? [2+1]
b. What are the reasons for the incomplete combustion? What can be done to make a complete combustion? [2+2]
c. Why a complete combustion gives blue flame whereas an incomplete combustion gives yellow or orange flame? [2]
4. a. Explain with chemical reaction and diagram the process of charging and discharging of lead acid battery. Why does sulfation take place in secondary cell electrode? [2+1]
b. Why is water topped up at certain interval of time in secondary battery? What factor determines the amount of water to be added in the battery? [1+1]
c. What is the requirement of boost charge in secondary battery? [1]
5. Consider a mountain stream with an effective head of 100 meters and a flow rate of 6 million liters per minute. How much power could a hydro plant generate? Assume the plant efficiency of 86%. How much energy will the hydro plant generate each year? How many people will this energy support considering that annual energy consumption is 300 kWh per person. [4]
6. Describe the working of pump storage plant. What are base load and peak load power plant? Explain how the hydropower plant is considered peak load power plant? [2+1+1]
7. Derive the equation for the power generated from the wind. What are the different components of wind Turbines? Even though the power generated by the wind turbine is proportional to the velocity of wind, what are the factors that limits the operating velocity of wind turbine? [2+1+1]

8. A 2 m long, 0.3 cm diameter electrical wire extends across a room at 15 °C. Heat is generated in the wire as a result of resistance heating and the surface temperature of the wire is measured to be 152 °C in steady operation. Also, the voltage drops and electric current through the wire are measured to be 60 V and 1.5 A, respectively. Disregarding any heat transfer by radiation, determine the convection heat transfer coefficient for heat transfer between the outer surface of wire and the air in the room. [4]



9. The roof of an electrically air-conditioned home is 6 m long, 8 m wide and 0.25 m thick and is made of a flat layer of concrete whose thermal conductivity is $k = 0.8\text{ W/m }^\circ\text{C}$. The temperature of the inner and outer surfaces of the roof at one of the nights were measured to be 15 °C and 4 °C respectively for a period of 10 hours. Determine the following: [2+2]
- Rate of heat loss through the roof considering heat transfer is only through conduction
 - Cost of air conditioning, if the electricity tariff per unit is Rs. 10.25.
10. Write short notes on (ANY TWO): [4+4]
- Agrivoltaics
 - Energy Efficient Buildings
 - Electric power generation