BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF ENGINEERING AND SCIENCE

DEPARTMENT OF ENGINEERING AND PHYSICS

BACHELOR OF SCIENCE HONOURS DEGREE IN ENVIRONMENTAL PHYSICS AND ENERGY SOURCES (HBScEPES)

HPH213/HPH420 (2): CONVENTIONAL AND RENEWABLE ENERGY RESOURCES

DURATION: 3 HOURS TOTAL MARKS: 100

JAN 2025

INSTRUCTIONS TO CANDIDATES
Answer **ALL** parts of Section A and any **THREE** questions from Section B.
Section A carries 40 marks and Section B carries 60 marks.

SECTION A

1. (a) (i) Discuss any two key challenges in achieving energy sustainability at a global level. (4 marks)

(ii) Propose potential solutions to overcome these challenges. (4 marks)

(b) Explain the concept of the "atmospheric window" and its relevance in the context of solar radiation and climate change mitigation. (6 marks)

(c) Compare and contrast the lifecycle environmental impacts of nuclear energy with those of coal, highlighting both advantages and disadvantages of nuclear energy as a conventional energy source. (8 marks)

(d) Discuss the technical and environmental challenges associated with ocean thermal energy conversion (OTEC). (6 marks)

(e) (i) What is air mass, and how does it affect the performance of photovoltaic panels? (4 marks)

(ii) How does the variation in air mass affect solar energy harnessing in different geographical locations? (4 marks)

(f) Suggest two energy-efficient measures that can be employed in:
(i) Industrial sectors. (2 marks)
(ii) Residential sectors. (2 marks)

SECTION B

2. Analyze how the costs and environmental impacts of energy production influence energy policy decisions in both developed and developing countries. Provide specific examples to support your analysis. (20 marks)

3. Evaluate the advantages and disadvantages of conventional energy sources (oil, coal, gas, nuclear) in terms of energy efficiency, environmental impact, and long-term sustainability. (20 marks)

4. (a) Explain the principles of solar energy utilization, focusing on the role of solar radiation, the attenuation of solar radiation in the atmosphere, and the significance of the atmospheric window. (10 marks)

(b) Describe the process of geothermal energy generation and discuss the advantages and disadvantages of using geothermal energy as a renewable energy resource. (10 marks)

5. Describe the various renewable energy resources available, such as wind, hydro, biofuels, wave, and tidal energy. For each resource, outline the key principles of its operation and its potential to contribute to global energy supply. (20 marks)

6. Discuss the factors that must be considered when sizing renewable energy systems, including demand, resource availability, and technological limitations. Provide examples of how improper sizing can affect system performance and sustainability. (20 marks)

END OF PAPER