

POST-GRADUATE DEGREE PROGRAMME
Term End Examination — December, 2024
ENVIRONMENTAL SCIENCE (PGES)
Paper – ENVS CC104 : ENERGY AND ENVIRONMENT
(Under CBCS from January 2024 Enrolment Session)

Time : 2 hours

Full Marks : 50

Weightage of Marks : 80%

Special credit will be given for accuracy and relevance in the answer. Marks will be deducted for incorrect spelling, untidy work and illegible handwriting. The weightage for each question has been indicated in the margin.

1. Answer any *five* of the following : 2 × 5 = 10
- a) What are the types of coal with energy content ?
 - b) State the major composition of petroleum.
 - c) What is OTEC ?
 - d) Mention two advantages and disadvantages of wind turbine.
 - e) Compare monocrystalline and polycrystalline solar cell.
 - f) What is solar pond ?
 - g) State the reasons why ${}_{92}\text{U}^{235}$ is used in generating nuclear energy and not ${}_{92}\text{U}^{238}$. What happens when thermal neutrons collide with ${}_{92}\text{U}^{238}$?
 - h) State two uses of moderator in nuclear reactor. Write down the name of one moderator.
2. Answer any *four* of the following : 5 × 4 = 20
- a) i) What are the four basic properties of natural gas ?
ii) Write down the composition natural gas. $2\frac{1}{2} + 2\frac{1}{2}$
 - b) Deduce the energy produced by
 - i) Wind turbine having radius 'r' wind velocity 'u' and air density 'd'.
 - ii) State five major disadvantages of hydropower generation. 3 + 2

- c) What is bio-energy ? What are the role of micro-organism in bio-energy production ? 1 + 4
- d) What are the different types of bio-fuels ? Describe the mechanism to produce ethanol as biofuel. 2 + 3
- e) Draw the circuit diagram of solar photovoltaic cell to generate electricity. Explain its operation. 2 + 3
- f) Name three different types of solar collector and discuss any one of such collector.
- g) What do you mean by fast-breeder reactor ? Explain its mechanism. 2 + 3
- h) What are the sources of energy of sun or other star ? Write down one such reaction to produce the energy.

3. Answer any *two* of the following : $10 \times 2 = 20$

- a) Explain the operation of heavy water reactor with diagram. What are the pros and cons of this reactor ? 6 + 4
- b) Describe a typical biogas plant and explain how does it converts organic waste into energy ? 7 + 3
- c) i) How petroleum is produced from crude oil by fractional distillation ?
- ii) Mention five major components other than carbon in coal, with percentage. 6 + 4
- d) i) What is geothermal energy ? State three environmental disadvantages of geothermal energy.
- ii) Find the fusion energy when four protons, each having mass 1.6726×10^{-27} kg, fuse to form $2H_e^4$ having mass 6.645×10^{-27} kg, and velocity of light $c = 2.997 \times 10^8$ m/s. (use the relation $E = mc^2$). (2 + 3) + 5