

M.E. DEGREE EXAMINATIONS: JANUARY 2009

First Semester

ENERGY ENGINEERING

P07EN103 Renewable Energy Systems

Time: Three hours**Maximum Marks: 100****Answer ALL Questions:-****PART A (20 x 1 = 20 Marks)**

1. The energy released by 1 kg of U^{235} is equal to
a) 4500 tons of coal b) 2200 tons of coal c) 4500 kg. of coal d) 3200 kg of coal
2. Fast breeder reactor uses one of the following fuels
a) fast neutrons b) slow neutrons c) positron d) thermal neutrons
3. Which of the following is non renewable energy source ?
a) solar energy b) wind energy c) geothermal energy d) fossil fuels
4. The total solar radiation absorbed by the earth & its atmosphere
a) 3.8×10^{24} J/Yr b) 7.5×10^{20} J/Yr c) 1.3×10^{21} J/Yr d) 1.5×10^{22} J/Yr
5. The solar constant is
a) 1.5 kW/m² b) 110 kW/m² c) 1.353 kW/m² d) 429 kW/m²
- 6) Pyrheliometer is used to measure
a) Global radiation b) sunshine c) day length d) beam radiation
- 7) The conversion efficiency of a photovoltaic cell is approximately
a) 10 - 12 % b) 25 - 30 % c) 35 - 40 % d) 70 - 80 %
- 8) A simple type of solar pond is about
a) 5 to 10 cm deep b) 1 to 2m deep c) 5 m deep d) 10 m deep
- 9) The kinetic energy of wind is expressed as
a) ρAV b) $\frac{1}{2} \rho AV^3$ c) $\frac{\pi d^2}{4} V^3$ d) $\frac{1}{8} \rho AV$
- 10) The maximum theoretical wind coefficient is equal to
a) 27/16 b) 72/61 c) 61/27 d) 16/27
- 11) At the tip of the blades of modern wind turbine the velocity is
a) about 6 times the wind velocity b) 3 times c) 2 times d) 4 times
- 12) Yaw control is to
a) increase the area of the wind stream swept by blades
b) decrease the area of the wind stream swept by blades
c) increase the velocity of the turbine
d) decrease the velocity of the turbine

- 13) Which of the following is a wet process of biomass conversion technique
 a) pyrolysis b) liquefaction c) gasification d) fermentation
- 14) The period for cow dung to get well fermentation is
 a) 20 days b) 10 days c) 30 days d) 50 days
- 15) The calorific value of biogas is
 a) 19700 kJ/m³ b) 25000 kJ/m³ c) 40000 kJ/m³ d) 45000 kJ/m³
- 16) Thermo-Chemical conversion efficiency range of gasification is
 a) 70 – 90 % b) 30 – 40 % c) 10 to 20 % d) 45 – 50 %
- 17) The difference between fuel cell and other electric cell is
 a) Fuel & O₂ is supplied from outside b) no electrolyte in fuel cell
 c) no electrodes in fuel cell d) no chemical reaction in fuel cell
- 18) The temperature range of Liquid dominated geo thermal system is
 a) 650⁰C – 750⁰C b) 175⁰C – 315⁰C c) 1200⁰C – 1500⁰C d) 50⁰C – 150⁰C
- 19) Solar energy absorption by water takes place according to
 a) Einsteine's Law b) Newton's Law c) Ohm's Law d) Lambert's Law
- 20) Which type of turbine is used for small Hydel plant?
 a) Gas Turbine b) Francis Turbine c) Impulse Turbine d) Straflo Turbine

PART B (5 x 16 = 80 Marks)

21. a) Discuss in detail the renewable energy scenario in India

(OR)

- b) Comment on nuclear energy option as future energy and its impact on environment

22. a) (i) Explain the principle of photovoltaic cell for power generation (10)
 (ii) What are the advantages & disadvantages of solar energy conversion (6)

(OR)

- b) With neat sketches describe a solar heating system using water heating solar collectors.

23. a) Explain the design consideration of Horizontal axis wind machine.

(OR)

- b) Prove that in case of horizontal axis wind turbine maximum power can be obtained when Exit velocity = 1/3 wind velocity and $P_{max} = \frac{8}{27} \rho A V^3$.

24 a) Design a community bio gas plant for a village. Assume suitable data.

(OR)

b) Explain how bio diesel is produced? What are the advantages of bio diesel?

25 a) Classify fuel cells. Explain Ion- Exchange membrane cell

(OR)

b) (i) The basin area of a tidal power plant is $30 \times 10^6 \text{m}^2$. The tidal range is 12 m.
Calculate the energy generated in kWh (10)

(ii) What is small hydel power plant? Explain any one type. (6).
