

**TECHNOLOGY OF RENEWABLE POWER GENERATION
(REEN 5202)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Which of the following types of solar thermal collector is used to heat swimming pools?
(a) Low temperature collector (b) Medium temperature collector
(c) High temperature collector (d) All of the above.
- (ii) Which of the following fluid is used in parabolic trough power plant?
(a) Molten salt (b) Synthetic oil
(c) Pressurized steam (d) All of the above.
- (iii) Most widely used solar material is
(a) Arsenic (b) Cadmium (c) Silicon (d) Steel.
- (iv) Calculate Fill factor using the data: $P_{max} = 15 \text{ W}$, $V_{oc} = 18 \text{ V}$, $I_{sc} = 4 \text{ A}$.
(a) 0.65 (b) 0.59 (c) 0.20 (d) 0.98.
- (v) Series and parallel combination of the solar cell is known as
(a) Solar array (b) Solar light (c) Solar sight (d) Solar eye.
- (vi) Tip Speed ratio is defined as the ratio of
(a) speed of hub tip and downstream air speed
(b) speed of hub tip and upstream air speed
(c) speed of rotor blade tip and upstream air speed
(d) speed of rotor blade tip and downstream air speed.
- (vii) The maximum energy may be extracted from the incoming wind by an ideal wind turbine is
(a) 49.3% (b) 59.3% (c) 69.3% (d) 79.3%.
- (viii) Linear velocity of a particle at the crest of a wave is
(a) $a\omega$ (b) a/ω (c) ω/a (d) $a+\omega$.

- (ix) Cut-in speed for a wind turbine is
(a) the minimum wind speed at which the turbine is designed to come into operation
(b) the maximum wind speed at which the turbine is designed for operation
(c) the wind speed at which the turbine stops functioning
(d) the rotor speed.
- (x) The turbine used in a tidal range plant is
(a) Pelton turbine (b) Francis turbine
(c) Kaplan turbine (d) Cross flow turbine.

Group- B

2. (a) Outline the different method of sun tracking system applicable solar PV System. [(CO1)(Analyze/IOCQ)]
(b) Critically elucidate the different zone wise the salinity of solar pond with necessary schematic diagram. [(CO1)(Evaluate/HOCQ)]
6 + 6 = 12
3. (a) Explain with necessary schematic diagram, solar air conditioning and refrigeration system. [(CO1)(Remember/LOCQ)]
(b) Illustrate the designing concept of Solar Parabolic trough. [(CO1)(Understand/LOCQ)]
6 + 6 = 12

Group - C

4. (a) Critically explicate that how a solar inverter can improve the power quality? [(CO3)(Evaluate/HOCQ)]
(b) A certain 120 V, 60 Hz AC motor is to be powered by solar cell array during the day and at night, by a 120 V public utility. A DC to AC converter is available that changes the array DC output into a 120 V, 60 Hz AC with 90% efficiency independent of load phase angle, while running motor has a DC resistance of 300 ohm and an inductance of 0.3 H. How much power output must the array provide? [(CO3)(Evaluate/HOCQ)]
6 + 6 = 12
5. (a) In respect of designing of a Grid tied PV plant, discuss the function of smart meter. [(CO3)(Understand/LOCQ)]
(b) Discuss about the function of By-pass diode and blocking diode. [(CO2)(Understand/LOCQ)]
6 + 6 = 12

Group - D

6. (a) Explain the significance of wind turbine blade loading with a suitable sketch. [(CO4)(Understand/LOCQ)]

- (b) Briefly discuss the assumptions and implications of linearized Hinge-Spring Blade Rotor Model. [(C04)(Understand/LOCQ)]
6 + 6 = 12
7. (a) Find out the achievable maximum efficiency for an ideal horizontal axis wind turbine. [(C04)(Analyse/IOCQ)]
(b) What do you understand by 'pre-processing' for computational analysis? [(C04)(Understand/LOCQ)]
8 + 4 = 12

Group - E

8. (a) Briefly explain the single basin single effect tidal scheme. [(C05)(Understand/LOCQ)]
(b) What are the main advantages and disadvantages of tidal energy? [(C05)(Evaluate/HOCQ)]
6 + 6 = 12
9. (a) Briefly describe the vapour dominated Geothermal systems with a suitable schematic diagram. [(C05)(Remember/LOCQ)]
(b) What are the main advantages and disadvantages of ocean wave energy? [(C05)(Evaluate/HOCQ)]
6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	50	12.5	37.5

Course Outcome (CO):

After the completion of the course students will be able to:

1. Understand of design and evaluation solar thermal power plants.
2. Develop a comprehensive technological understanding in solar PV system components.
3. Get in-depth understanding of design parameters to help design and simulate the performance of a solar PV power plant.
4. Update themselves with the latest trends in wind turbine technology.
5. Understand geothermal and ocean thermal technologies.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

