

**NON CONVENTIONAL ENERGY SOURCES
(AEIE 3132)**

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) For a solar PV cell dark current is because of
(a) minority particles (b) majority particles
(c) gamma particles (d) alpha particles.
- (ii) 1 bbl = ? litre
(a) 259 (b) 159 (c) 59 (d) 359.
- (iii) The outermost layer of the earth is
(a) Magma (b) Mantle
(c) Crust (d) Solid iron core.
- (iv) Fossil fuel will soon be exhausted because
(a) it has limited storage (b) it is renewable
(c) it is commercially used (d) thermal power plants use it.
- (v) Which type of fluid is used in OTEC?
(a) Water (b) Liquid ammonia
(c) Liquid nitrogen (d) Liquid ethanol.
- (vi) The tip-speed is the ratio of
(a) the wind speed to the rotational speed of the blade
(b) the rotational speed of the rotor to blade speed
(c) the rotational speed of the blade to the wind speed
(d) none of these.
- (vii) If the velocity of the wind is increased by two time, then power will be increased by what factor?
(a) 8 (b) 16 (c) 4 (d) 2.
- (viii) A high tidal cycle is duration of
(a) 6 hours (b) 12 hours
(c) 12 hours 25 minutes (d) 24 hours.

- (ix) A pyrhelimeter is an instrument that measures
 (a) diffuse solar radiation (b) scattered solar radiation
 (c) beam solar radiation (d) total solar radiation.
- (x) If concentration ratio is 7.66, what will be the value of angle of acceptance?
 (a) 15° (b) 30° (c) 45° (d) 7.5°.

Group- B

2. (a) Explain 'topping cycle' and 'bottoming cycle' are used in the cogeneration of the electricity from coal. [(CO1)(Analyze/IOCQ)]
 (b) Design a hybrid system consist of solar cell based energy and wind energy. [(CO1)(Design/HOCQ)]
 (c) Design a diagram where electricity is generated from both from the gas turbine and the steam turbine in thermal power plant. [(CO1)(Design/HOCQ)]
4 + 4 + 4 = 12
3. (a) "Electricity generation from fossil fuels are still dominating" justify your answer. [(CO1)(Analyze/IOCQ)]
 (b) Analyze the effects of carbon monoxide on human with respect to concentration and duration of contact. [(CO4)(Analyze/IOCQ)]
 (c) Analyze different steps of detailed energy audit with respect to plan of action and its purpose. [(CO6)(Analyze/IOCQ)]
3 + 4 + 5 = 12

Group - C

4. (a) What are the different losses to be consider in semiconductor based solar cell? [(CO2)(Remember/LOCQ)]
 (b) What is a solar PV module? Define fill factor. [(CO2)(Remember/LOCQ)]
 (c) Is there any relation between the current with the thickness of the solar cell? How this current can be maximized? [(CO2)(Evaluate/IOCQ)]
4 + (2 + 2) + 4 = 12
5. (a) How to design a solar cell model with one diode and two resistances. Hence draw the equivalent circuit diagram solar cell and write down the corresponding current expression. [(CO3)(Design/HOCQ)]
 (b) In a glazed flat plate collector, only a fraction α of radiation is absorbed and the rest is reflected. In a multiple reflection cover system with ρ_d , as the reflectance for the diffused light. Prove that.

$$(\alpha\tau)_{net} = \frac{\alpha\tau}{1-(1-\alpha)\rho_d}$$
 [(CO3)(Analyze/IOCQ)]
 (c) Derive an expression of the transmittance considering only absorption. [(CO3)(Remember/LOCQ)]
(2 + 2) + 4 + 4 = 12

Group - D

6. (a) What is understood by pitch angle control and Ekman layer?
[[CO5](Remember/LOCQ)]
- (b) Analyze the site selection criterion to installed Wind Energy Extraction System on the offshore.
[[CO5](Analyze/IOCQ)]
- (c) If a wind mill is designed with wind speed u_0 is 8 m/s for a particular location, air density ρ is 1.2 kg/m³ and rotor diameter is 60 m. What will be expected maximum extracted energy from the given data in this model?
[[CO5](Design/HOCQ)]
(2 + 2) + 4 + 4 = 12
7. (a) Comparative analyses the vertical axis and Horizontal Axis Wind Turbine (HAWT).
[[CO3](Analyze/IOCQ)]
- (b) Derive the relation between extracted wind power and unperturbed wind speed by Betz Model.
[[CO5](Understand/LOCQ)]
- (c) Comparative analysis between updraft and downdraft type gassifier.
[[CO3](Analyze/IOCQ)]
(3 + 3) + 2 + 4 = 12

Group - E

8. (a) A tidal plant has reservoir area 50*10⁴ m². The tidal has a range of 12 m. The turbine can be operational with a head of 3 m or more. The turbine generator has efficiency of 80%. Estimate the total power in one filling and employing cycle.
[[CO3](Evaluate/IOCQ)]
- (b) What is the source of tidal energy? What is the minimum tidal range required for the working of a tidal plant? How much is the potential in tides?
[[CO3](Remember/LOCQ)]
- (c) To design a Dolphin type wave energy generator is installed along a width of 500 m. The mean amplitude of the wave is 2 m with a period of 10 s. What will be the installed capacity of the plant?
[[CO4](Design/HOCQ)]
3 + (1 + 1 + 4) + 3 = 12
9. (a) Comparative analysis between single flash steam in liquid dominated high temperature plant and hard dry rock binary fluid system in case of geothermal based energy extracted system (block diagram must).
[[CO3](Analyse/IOCQ)]
- (b) What are the environmental problems caused by geothermal energy?
[[CO4](Understand/LOCQ)]
- (c) If OTEC system is designed with data under consideration the upper layer and at depth 1500 m layer of the ocean temperature of ocean are 28°C and 8°C, respectively. What will be the expected efficiency from this OTEC system designed?
[[CO3](Design/HOCQ)]
(4 + 4) + 2 + 2 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	27.08	51.04	21.88

Course Outcome (CO):

After the completion of the course students will be able to

1. Understand the issue of fuel availability; analyze the supply and demand of fuel in the world.
2. Identify the different sources of renewable energy and innovative technologies in harnessing energy from renewable sources.
3. Explain production of electricity from clean resources.
4. Study the environmental impacts of a power plant with various resources.
5. Apply the wind energy for human usage.
6. Learn the conception of the economical use of renewable energy resources over conventional energy sources.

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