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GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

Ph.D. (Second Semester) Examinations, May – 2025

WPPEEE2011/23SPPEEE2011– Non-conventional Energy Sources

(EEE)

Time: 3 hrs Maximum: 70 Marks

The figures in the right hand margin indicate marks.

	Answer *ANY FIVE* Questions. **(14 x 5 = 70 Marks)**	**Marks**
1.a.	Describe briefly the Extra-terrestrial solar radiation and Terrestrial radiation.	8
b.	What are the main components of solar distillation and explain its operation with neat diagram?	6
2.a	Describe with a neat sketch the working of a wind energy system with main components.	6
b	Design the rotor radius of a multi-blade wind turbine that operates in a wind speed of 36 kmph to pump water at a rate of $6m^3$/hr. with a lift of 6m. Also, calculate the angular velocity of the rotor. Given water density=1000 kg/m^3; g = 9.8m/sec^2; water pump efficiency = 50%; efficiency of rotor to pump = 80%; CP = 0.3, λ = 1.0 and air density = 1.2 kg/m^3.	8
3.a.	Explain how wind generator can aid solar power generation in case of hybrid systems.	7
b.	A tidal power plant of the simple single basin type, has a basin area of 30x106 m^2. The tide has a range of 12 m. The turbine, however stops operating when the head on it falls below 3m. Calculate the energy generated in one filling (or emptying) process, in kilowatt hours if the turbine generator efficiency is 0.73.	7
4.a	Explain the significance of Dry rock and hot aquifer analysis in Geothermal energy conversion.	6
b	Calculate the volume of the Digester and the power developed by a Bio-digester with dry mass input per day is 15 kg, retention time of 30 days, operating temperature of 30^0C, biogas yield of 0.2 m^3/Kg of dry mass, burner efficiency of 65% and methane proportion of 0.85. Assume that heat combustion of methane is 28 MJ/m^3.	8
5.a.	Give a brief note on prospectus of Geothermal energy in context to India.	7
b.	Describe the ‘closed cycle’ OTEC system, with its advantages over ‘open cycle’ system.	7
6.a.	Discuss why surge tanks are necessary for short to medium length pipe lines in a hydroelectric development.	7
b.	A mini-hydel plant for developing 500 kW to supply a small town operates under a head of 80 m (about 250 feet). The efficiency is 90%. Assume k=0.5. Calculate the diameter and thickness of pipe required, and the quantity of water flow per second at full load.	7
7.a	What is the difference between biomass and biogas? Explain the process of biomass conversion?	6
b	Write short notes on (i) Pumped hydro (ii) Spillway	8
8.a.	Explain about biofuels and explain the process of extracting commercial biofuels.	7
b.	A hydro power plant with 1050 MW output has an efficiency of 93%. The plant load factor is 65%. It operates at a constant head of 60m. Calculate i) The maximum flow rate required ii) The quantity of water to be stored behind a dam to cater for a year’s load requirement.	7

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