GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2022
WIND AND SOLAR ENERGY SYSTEMS
EE801A

TIME ALLOTTED: 3 HOURS   **FULL MARKS: 70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)
Answer any *ten* from the following, choosing the correct alternative of each question: **10×1=10**

			Marks	CO No

1. (i) In which collector the efficiency is maximum _____   1   CO1
    a) Flat Plate
    b) Line Focusing
    c) Evacuated Tube
    d) Paraboloid Dish

   (ii) The solar cell efficiency is about _____   1   CO1
    a) 25%
    b) 15%
    c) 48%
    d) 63%

   (iii) The Pyranometer measures _____   1   CO1
    a) Direct Radiation
    b) Diffusion Radiation
    c) Both a and b
    d) None of the above

   (iv) The single solar cell voltage is about _____   1   CO1
    a) 0.2 V
    b) 0.5 V
    c) 1.0 V
    d) 2.0

   (v) The solar heater function is to convert the solar energy in to _____   1   CO2
    a) Radiation
    b) Electrical Energy
    c) Thermal Energy
    d) None of the above

   (vi) In solar cells _____ material is used   1   CO2
    a) Copper
    b) Silver
    c) Silicon
    d) None of the above

(vii)	In which region winds are stronger and constant? a) Deserts b) Offshore c) Low altitudes sites d) All of above		1	CO1
(viii)	Concentrated solar power (CSP) systems use _____ to focus a large area of sunlight into a small beam. a) Lenses b) Mirrors c) Trackers d) option a & b		1	CO1
(ix)	Wind energy is converted into electrical energy with the use of a) Turbine b) Generators c) Motors d) Blades		1	CO2
(x)	A rotor installed in a fixed orientation with the swept area perpendicular to the predominate wind direction is called a) Nacelle b) Yaw fixed machines c) Blades d) Turbine		1	CO2
(xi)	Total power P_t for wind power plant is a) $\rho\pi d^2 v^3/8$ b) $\rho\pi d^2 v^3/4$ c) $\rho\pi d^2 v^3/2$ d) $\rho\pi d^2 v^3$		1	CO2
(xii)	Which of the following is an input to power electronic type frequency converter used in vertical type wind turbines? a) Variable AC type frequency from wind turbines b) Zero ripple waves from wind c) Constant Ac type frequency from wind turbines d) Variable DC type frequency from wind turbines		1	CO3

GROUP – B
(Short Answer Type Questions)
Answer any *three* from the following: 3×5=15

			Marks	CO No
2.	(a)	Describe, classification of solar cell technologies.	5	CO1
3.	(a)	Describe V-I characteristics of solar cell. Explain working principle of solar photovoltaic technology.	5	CO1

4.	(a)	What is beam and diffused radiation?	2	CO1

	(b)	Define and explain the following with neat diagrams:
		   i) Solar azimuth angle
		   ii) declination angle
			3	CO1

5.	(a)	A single solar cell (10 cm × 10 cm) produces a voltage of 0.5 V and a current up to 2.5 A. If the solar insolation is 800 W/m^2, Calculate the efficiency of the solar cell.	5	CO1
6.	(a)	Calculate the maximum power output of a 15m diameter wind turbine at one atmospheric pressure and wind speed of 12m/s.	5	CO2

GROUP – C
(Long Answer Type Questions)
Answer any *three* from the following: 3×15=45

			Marks	CO No
7.	(a)	Explain the operation of wind power plant with wind power equation.	8	CO2
	(b)	An offshore wind turbine with three 10meter blades rotates at a leisurely 10 RPM. The wind is whipping along at 15 meters per second. Calculate the tip speed ratio for this turbine.	7	CO1
8.	(a)	With proper Schematic Diagram describe a Grid connected Solar Photovoltaic system.	7	CO3
	(b)	A PV system feeds a DC motor to produce 1 HP power at the shaft. The motor efficiency is 85%. Each module has 36 multicrystalline silicon solar cell arranged in 9X4 matrix. The cell size is 125mmX125mm and efficiency 12%. Calculate number of modules required in PV array. Assume global radiation incident normally to the panel as 1 KW/m^2.	8	CO1
9.	(a)	With proper Block Diagram, explain Wind Energy Conversion system.	5	CO2
	(b)	Wind at 1 standard atmospheric pressure and 15^0 C has velocity of 15 m/s, calculate (i) The total power density in the wind stream (ii) The maximum obtainable power density (iii) A reasonably obtainable power density (iv) Total Power (v) Total Torque Given: turbine diameter = 120 m, and turbine operating speed = 40 rpm at maximum efficiency. Propeller type wind turbine is considered.	10	CO1
10.	(a)	Illustrate the difference between stand-alone and grid connected systems.	7	CO3
	(b)	Explain the solar wind interconnected system with battery storage using block diagram.	8	CO3
11.		Write short notes on any three of the followings:	3x5=15	
	(a)	MPPT	5	CO1
	(b)	Power Electronics Converter for Solar Systems.	5	CO3
	(c)	Solar Thermal Technology	5	CO2
	(d)	Betz Limit	5	CO1
	(e)	Power quality Issues during Grid Integration of Solar and Wind Energy	5	CO3