Reg. No. : | | | | | | | | | | | | |

Question Paper Code: U5510

M.E. DEGREE EXAMINATION, NOV 2025

Professional Elective

POWER ELECTRONICS AND DRIVES

21PPE510– WIND ENERGY CONVERSION SYSTEMS

(Regulation 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1.	(a)	Differentiate between the theoretical predictions of simple momentum theory and practical performance measurements of WECS, highlighting the role of turbulence and losses.	CO3 - Ana	(20)
		Or		
	(b)	Investigate the limitations of simple momentum theory when applied to large-scale wind farms, focusing on wake effects and rotor interaction.	CO3 - Ana	(20)
2.	(a)	Calculate the optimal tip speed ratio and rotor diameter for a site with average wind speed data, and solve for the annual energy output.	CO2-App	(20)
		Or		
	(b)	Solve for the structural stresses on turbine blades by applying thrust equations, and compute the impact of rotor speed variations on blade fatigue life.	CO2-App	(20)
3.	(a)	Solve for the output characteristics of a constant-speed constant-frequency system using synchronous and squirrel cage induction generators.	CO2-App	(20)
		Or		
	(b)	Implement a modeling approach for fixed-speed WECS that combines rotor dynamics, drive train inertia, and generator parameters, and compute its predictive accuracy.	CO2-App	(20)

4.	(a)	Calculate the power output of variable-speed wind energy systems using wind speed–power characteristics, and solve for the optimum operating point.	CO2-App	(20)
		Or		
	(b)	Implement a variable speed–variable frequency scheme for an isolated grid application, and compute its performance advantages.	CO2 - App	(20)
5.	(a)	Implement a ramp rate limitation strategy for a grid-connected wind farm, and compute compliance with frequency stability requirements.	CO2-App	(20)
		Or		
	(b)	Compute the ancillary services (frequency and voltage support) provided by a wind power plant, and implement methods to optimize their economic operation	CO2-App	(20)