Answer key

	P.E.S. COLLEGE OF ENGINEERING **(AN AUTONOMOUS INSTITUTE)** **CHH. SAMBHAJINAGAR-431002** **Regular Winter Examination – 2025** **Course: F.Y.M. Tech. Branch : Electrical Power System Semester : I** **Subject Code & Name: MTPESEPS104T Renewable Energy Grid Interface & Control Technique** **Max Marks: 60 Date: Duration: 3 Hr.**		
	Instructions to the Students: *1. All the questions are compulsory.* *2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.* *3. Use of non-programmable scientific calculators is allowed.* *4. Assume suitable data wherever necessary and mention it clearly.*		
		(Level/CO)	Marks
Q. 1	**Solve Any one of the following.**		
A)	Explain the integration issues associated with synchronous, induction, and converter-based sources in grid-connected systems. • Synchronous generator integration issues (inertia, excitation, fault current) – **4 marks** • Induction generator issues (reactive power demand, voltage dip, stability) – **4 marks** • Converter-based source issues (low inertia, harmonics, control dependency) – **4 marks**	**L2/CO2**	**12**
B)	Explain how voltage management is carried out in grid-connected renewable energy systems using reactive power control techniques. • Voltage control concept in grid-connected RES – **3 marks** • Reactive power control methods (STATCOM, inverter Q-control, tap changers) – **5 marks** • Benefits and practical relevance – **4 marks**	**L2/CO3**	**12**
Q.2	**Solve Any one of the following.**		
A)	Explain the fault-level issues and protection considerations associated with integrating distributed generation sources into the grid. • Fault level variation due to DG – **4 marks** • Protection challenges (relay coordination, bidirectional flow) – **4 marks** • Protection solutions (adaptive relays, fault current limiters) – **4 marks**	**L4/CO2**	**12**
B)	Analyze the impact of synchronous, induction, and converter-based generation on power quality and transient performance of the power system. • Impact on power quality (harmonics, flicker, voltage dip) – **6 marks** • Impact on transient performance (fault response, recovery) – **6 marks**	**L2/CO4**	**12**
Q. 3	**Solve Any one of the following.**		
A)	Describe the role of Automatic Voltage Regulators (AVRs) and turbine governors in damping oscillations and maintaining transient stability in wind farms.	**L3/CO4**	**12**

	• Role of AVR in voltage & transient stability – **6 marks** • Role of turbine governor in damping oscillations – **6 marks**		
B)	Demonstrate the impact of wind generation variability on transient response of the power system. • Wind variability characteristics – **4 marks** • Effect on transient response (frequency, voltage, power oscillations) – **4 marks** • Mitigation methods (controls, storage, grid support) – **4 marks**	**L2/CO4**	**12**
Q.4	**Solve Any one of the following.**		
A)	Explain the causes of low-frequency oscillations in power systems and the role of PSS in damping them. • Causes of low-frequency oscillations – **4 marks** • Need and principle of PSS – **4 marks** • Role of PSS in damping oscillations – **4 marks**	**L3/CO4**	**12**
B)	Demonstrate how PSS can be implemented in Full Rated Converter (FRC) based wind farms. • FRC wind farm concept – **4 marks** • PSS control structure & signal selection – **4 marks** • Implementation strategy & benefits – **4 marks**	**L4/CO5**	**12**
Q. 5	**Solve Any one of the following.**		
A)	Describe the role of energy storage and charge controllers in stand-alone PV systems. • Role of energy storage (battery types, functions) – **6 marks** • Role of charge controllers (PWM, MPPT, protection) – **6 marks**	**L2/CO2**	**12**
B)	Analyze the protection requirements of PV systems against over-current, over-voltage, and islanding conditions. • Over-current protection – **4 marks** • Over-voltage protection – **4 marks** • Islanding detection & protection – **4 marks**	**L2/CO3**	**12**
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