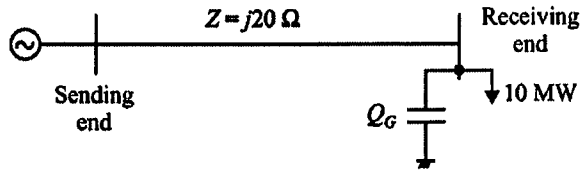
Ref. No: Ex/PE/PC/B/T/311/2024

B. E. Power Engineering 3rd Year 1st Semester Examination - 2024

Subject: Power Transfer System **Time: 3 hours** **Full Marks: 100**

No. of Questions		Marks
	CO1 (Answer any *One*)	
1.	a) What is String efficiency? What are the various methods deployed for improving string efficiency?	2+3
	b) A string of 4 insulators has self-capacitance equal to 4 times the pin-to-earth capacitance. Calculate (i) the voltage distribution across various units as a percentage of total voltage across the string and (ii) string efficiency.	15
	c) Define i) Skin Effect ii) Proximity effect iii) Dielectric loss in cable iv) Intersheath Grading	2.5x4
2.	a) Define and explain briefly the followings: i) Utilization factor ii) Maximum Diversified demand iii) Coincident factor iv) Diversity factor	2.5x4
	b) State the disadvantages of low power factor.	5
	c) A d.c. 3-wire system is to be converted into a 3-phase, 4-wire system by adding a fourth wire equal in X-section to each outer of the d.c. system. If the percentage power loss and voltage at the consumer's terminals are to be the same in the two cases, find the extra power at unity power factor that can be supplied by the a.c. system. Assume loads to be balanced.	15
	CO2 (Answer any *One*)	
3.	a) Define and explain Surge Impedance Loading.	5
	b) Derive the expression for Inductance of single-phase lines.	10
	c) An overhead transmission line at a river crossing is supported from two towers of height 40 m and 80 m above water level with a span of 250 m. Weight of the conductor is 1.16 kg/m and the working tension is 1800 kg. Determine the clearance between the conductor and the water level midway between the towers.	15
4.	a) Define and explain Ferranti Effect.	5
	b) Derive expressions for the *ABCD* constants for a lossless long transmission line. Assume distributed parameters for the line.	10
	c) Figure below shows a three-phase, 33-kV line feeding a per-phase load of 10 MW. If the impedance of the line is $Z = j20\ \Omega$, determine the load angle and the reactive power to be supplied by the capacitive source connected at the load end to maintain a line voltage of 33 kV at the load.	15
		
	CO3 (Answer any *One*)	
5.	a) Explain the static and dynamic response of an AVR loop. How can its dynamic response be improved?	3+3+4
	b) Two generators, each rated at 200 MW and 300 MW, are supplying power to a network. Both the generators	

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	are loaded at 50% of their individual full rated capacity and the system frequency is 50 Hz. The load on the system decreases by 150 MW and the frequency rises by 0.5 Hz. Compute (i) the droop of each generator and (ii) the droop in per unit. Assume that the load is decreased on each generator in proportion to their individual rating.	10
6.	a) Derive an expression for the change of tie-line power and frequency when the two control areas have equal parameters.	10
	b) Two equal control areas have the following parameters: $R=3.5Hz/pu\ MW$, $H=4.5s$, normal operating frequency $f_0=50\ Hz$. If the synchronizing coefficient T_0 is equal to 0.2, determine the damping coefficient α and angular frequency ω.	10
	CO4 (Answer any One)	
7.	a) Distinguish between transient and steady-state stability and discuss the need for performing stability analyses of power systems.	4+6
	b) How the equal area criterion is applied when there is a sudden (a) increase in power input, and (b) decrease in power output due to a three-phase fault?	5+5
8.	a) What is dynamic braking and state its function in improving the transient stability.	
	b) A three-phase, 50-Hz, synchronous generator is delivering 0.9 pu real power to an infinite bus via the transmission circuit shown in Fig. below. All values shown in the circuit diagram are in per unit on a common system base. A temporary three phase fault occurs in the middle of line 2. Determine the rotor angle position before the fault occurs. Also compute the critical clearing angle if the fault is cleared by opening the faulted line. Assume $H = 4.5$ MJ/MVA.	3+7 10