Ref No:

Ex/EE/T/323/2018

B.E. ELECTRICAL ENGINEERING THIRD YEAR SECOND SEMESTER - 2018

SUBJECT: - POWER SYSTEM PERFORMANCE

Full Marks: 100

Time: Three hours **(50 marks for this part)**

Use a separate Answer-Script for each part

No. of Questions		PART -I Answer any Three (Two marks reserved for well-organized answers)	Marks
1)	a) i)	Illustrate and justify the following statements: "Active power flow is strongly coupled with power angle and Reactive power flow is strongly coupled with voltage."	(3×4)
	ii)	"System frequency has to be kept within narrow bounds".	
	iii)	"Transients in excitation control do not affect the dynamics of load frequency control."	
	b)	Illustrate the factor on which the limit of under-excitation of synchronous generators depends.	(4)
2)	a)	A power system having a generation capacity of 2000 MW and connected load of 1000 MW operates at a frequency of 50Hz. The load is suddenly increased by 20 MW. Assuming free governor operation, calculate the change in frequency and generator output. Illustrate how the gap between the increase in load and increase in generation is supplied by the system. Also explain, how power balance is met (i) just after the increase in load and (ii) in the intermediate time between the load increase and the establishment of the new steady state. Assume governor regulation to be 4%. The load changes by 1% for 1% change in frequency.	(8)
	b)	Illustrate with proper block diagram the supplementary control in connection with Load frequency control.	(8)
3)	a)	A power system consists of four identical 500 MVA generating units feeding a total load of 1020 MW. The inertia constant of each unit is 5 on 500 MVA base. The load varies by 1.5% for 1% change in frequency. When there is a sudden drop in load by 20 MW, then find (i) the system block diagram with the constants H & B expressed on 2000 MVA base, (ii) the system frequency deviation assuming that there is no speed governing action.	(10)
	b)	Derive the swing equation for a synchronous generator.	(6)
4)	a)	The K.E stored in the rotor of a 20 MVA, 4 pole 50 HZ alternator is 60 MJ. The input to the machine is 15 MW at a developed power of 13.5 MW. Calculate the accelerating power assuming that acceleration remains constant for 10 cycles. Determine the value of power angle at the end of 10 cycles.	(8)

(please turn over)

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	b)	Illustrate the following methods of improving transient stability: (i) Use of auto-reclosure circuit breakers. (ii)Use of braking resistors.	(2×4)
5)	a)	Illustrate with proper diagram the static excitation system. Also explain the term "field flashing".	(8)
	b)	Illustrate with proper diagram the function of Load Compensator in excitation system.	(4)
	c)	Illustrate the term "ceiling voltage" in excitation systems.	(2)
	d)	Illustrate "synchronous condenser".	(2)