Ref No: Ex/EE/5/T/323/2019

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) THIRD YEAR

SECOND SEMESTER - 2019

SUBJECT: - POWER SYSTEM PERFORMANCE

Time: Three hours **Full Marks: 100**

(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)	With proper phasor diagrams derive the expression for active power and reactive power in a salient pole rotor synchronous generator.	(6)
	b)	Explain "Infinite Bus" and its characteristics.	(4)
	c)	With proper explanation state the factor on which the limit of under-excitation of Synchronous generator depends. Also Explain the term "Synchronous Condensor "	(6)
2)	a)	Derive the following expression $\Delta f(s) = -\Delta P_D(s)/\left(B+\left(1/R\right)\right)$ where the symbols have their usual meanings. Assume an isolated complete automatic load frequency control system block diagram.	(8)
	b)	Explain Supplementary Control in connection with a Load Frequency Control System and explain how it helps to nullify the change in frequency error.	(8)
3)	a)	Two generators are supplying power to a system. Their ratings are 50 and 500 MW respectively. The frequency is 50 Hz and each generator is half loaded. The system load increases by 110 MW and as a result the frequency drops to 49.5 Hz. What must the individual regulations be if the two generators should increase their turbine powers in proportion to their ratings?	(8)
	b)	Explain why the transients in excitation voltage control vanish much faster and do not affect the dynamics of Power frequency control. Also state how the increase in load demand under steady conditions is met in the load frequency control system with free governor action.	(8)
4)	a)	Derive and explain the swing equation for synchronous generators. State the assumptions you make.	(8)
	b)	With a neat diagram explain the operation of static excitation system.	(8)
5)		Write short notes on (**any two**): (i) Use of Auto-reclose CBs and Braking Resistors for improvement of transient stability. (ii) Brushless Excitation System. (iii) Equal Area Criterion for Transient Stability. (iv) The function of over excitation and under excitation limiters and power system stabilizers in connection with an excitation system.	(8+8= 16)

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PART-II

Answer **any three** questions
Two marks reserved for neatness

1. a) Derive necessary equations to show that 8

   i) The real power transferred over a line depends on the power angle and not on the difference between sending and receiving end voltage.

   ii) The reactive power transferred over a line does not depend on power angle but on the difference between the sending end and receiving end voltage.

   b) What do you understand by series compensation in transmission lines? 4

   c) Explain loadability of transmission line. 4

2. a) Mention the advantages of HVDC transmission. 6

   b) Describe the different types of dc links used for HVDC transmission. 6

   c) Mention the functions of major components of HVDC transmission system 4

3. a) Why load flow study is necessary? Explain step by step G-S method for load flow study. 3+6

   b) Determine the bus admittance matrix of a 4 bus system, the parameters of which are given below: 7

Bus code	Line impedance (pu)	Charge admittance (pu) $y_{pq}/2$
1-2	*0.02 + j00.8*	*j0.04*
2-3	*0.06 + j024*	*j0.03*
2-4	*0.04 + j0.16*	*j0.025*
3-4	*0.04 + j0.16*	*j0.025*
1-3	*0.01 + j00.4*	*j0.015*

4. a) Describe the different types of current limiting reactors. 6

b) Explain the advantages of using per unit system in power system. 4

c) Four 10 MVA generators each having a reactance of 0.2 pu are operating in parallel. They feed a transmission line through a 40 MVA transformer having per unit reactance of 0.05. Determine the fault MVA for a fault at the sending end of the line. Draw relevant circuit diagrams. 6

5. Write short notes on any four: 4x4

i) Static Var Compensator ii) On load tap changing transformer iii) Receiving end power circle diagram iv) Break even distance in HVDC transmission v) Bus types in load flow study.