Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent Institution of MAHE, Manipal)

I SEMESTER M. TECH (ESM) MAKE-UP EXAMINATIONS DEC 2017 SUBJECT: POWER SYSTEM OPERATION AND CONTROL [ELE 5102]

REVISED CREDIT SYSTEM		
Time	: 3 Hours Date: 26 DECEMBER 2017 Max. Mark	s: 50
Instructions to Candidates:		
	 Answer ALL the questions. 	
	 Missing data may be suitably assumed. 	
1A.	Draw and explain the block diagram representation of excitation system of a generator with exciter load saturation curve.	(04)
1B.	The one-line	
	diagram of a power system is shown in Fig. 1B.	
	$G \qquad T1 \qquad j100\Omega \qquad 2 \qquad J2 \qquad 3 \qquad M$ $G \qquad J1 \qquad J100\Omega \qquad 2 \qquad J2 \qquad J2 \qquad J2 \qquad J2 \qquad J2 \qquad J2 \qquad J2$	
	The ratings are given as G : 30MVA, 11 kV, X" = 20% T1 : 30 MVA, 220 kV /6.6 kV, X =10% T2 : 30 MVA, 6.6 kV /220 kV, X = 10% The terminal voltage of bus 3 is maintained at 6 kV. Choose a base of 30 MVA, 220 kV on the transmission line. Determine the terminal voltage of the generator if the Motor is drawing 10 MW at 0.9 n f lagging	(06)
		(00)
2A.	Derive the expression for mechanical equation of an alternator using Park's variables.	(05)
2B.	Find an expression for the fault current when a line to line fault occurs at the terminals of an	(02)
20	The regulation parameter \mathbf{P} of 100MW E0Hz generator is 5%. By how much will the turbine	(03)
26.	power increase if the frequency drops by 0.2Hz with the speed changer setting unchanged.	(02)
3A.	Explain the role of PSS to improve dynamic stability.	(02)
3B.	What are the benefits with the application of FACTs controllers?	(03)
3C.	Derive the block diagram representation of a single-area system including power system	
	response.	(05)
4A.	By using the circuit convention of 3-phase synchronous generator, derive the expressions for self and mutual inductances for stator coils.	(04)
4B.	An unbalanced voltages are given by $V_a = 200 \angle 0V$, $V_b = 200 \angle 245V$ and $V_c = 200 \angle 105V$.	
	Determine (i) symmetrical components of line voltages and (ii) The positive sequence component of line voltage $V_{\rm b}.$	(04)
4C.	Explain different voltage control methods used in the power system.	(02)

- **5A.** A synchronous generator is feeding 1.0 p.u power to a large 50 Hz power network over a double circuit transmission line. The maximum steady state power that can be transmitted over the line with both circuits in operation is 2.0 p.u and is 1.4 p.u with only one of the circuits. A solid three phase fault occurring at the network end of one of the lines causes it to trip. Determine the critical clearing angle in which the circuit breakers must trip so that synchronism is not lost. Derive the formulae used. What further information is needed to estimate the critical clearing time?
- **5B.** Derive the expression for voltage for midpoint shunt compensated transmission line.

(06)

(04)