



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



I SEMESTER M.TECH (EMAL / PESC) MAKE UP EXAMINATIONS,

DEC 2015 / JAN 2016

SUBJECT: POWER SYSTEM OPERATION AND CONTROL [ELE 505]

REVISED CREDIT SYSTEM

Time: 3 Hours

07 January 2016

MAX. MARKS: 50

Instructions to Candidates:

✤ Answer ANY FIVE FULL questions.

- ✤ Missing data may be suitable assumed.
- 1A. Derive the expression for the voltage profile of a 600km symmetrical line on no load. (08)
- 1B. Write a brief note on Reactive power requirements of symmetrical lines. (02)
- 2A. Draw the block diagram of a generator connected to infinite bus with AVR & PSS and explain. (06)
- 2B. A two area system has the following data:
 - Area A : Rated capacity 500Mw, R= 2.5Hz/ per unit Mw, D= 0.02per unit
 - Area B : Rated capacity 2000Mw, R= 2.0Hz/ per unit Mw, D= 0.02per unit

There is a sudden increase in load of 20Mw in area A, find

a) Steady state frequency deviation b) Tie-line power flow c) Area control error in each area. (04)

- 3. What is the significance of parks's transformation? Using the Park's voltage equations derive the expression for no load voltage of an alternator. (10)
- 4A. A 50 Hz synchronous generator having H = 5 MJ/MVA and Xd¹ = 0.3 pu is connected to an infinite bus as shown in Fig.4A The generator is delivering 1 p.u of real power to the infinite bus. A 3 phase fault occurs at the middle of one of the lines, the fault is cleared by opening the faulted line. Determine the critical clearing angle. E= 1 p.u.



4B. Solve the following two equations in X_1 and X_2 using Newton-Raphson method. Show calculations for one iteration. (04)

 $f_1(x_1,x_2) = x_1^2 + 3 x_1x_2 - 4 = 0$ $f_2(x_1,x_2) = x_1x_2 - 2x_2^2 + 5 = 0$ $x_1^0 = 1 \& x_2^0 = 2$

- 5. Derive the block diagram representation of a two area system. Derive expressions for drop in frequency and tie line transmitted power. (10)
- 6A. The network details for a power system is as given.

Bus data:

Bus Number	Type of Bus	P_L in MW	Q_L in MVAR
1	Slack		
2	Load	400	320
3	Load	300	270

Line Data:

From Bus	To Bus	Line Admittance in PU
1	2	-j33.33
2	3	-j20
3	1	-j80

Determine the voltages at the buses 2 and 3 at the end of two iterations using Gauss-Siedal method.

6B. Derive the expression for the transient direct axis inductance of a synchronous generator. (03)

(07)