Mansoura University
Faculty of Engineering
Electrical Engineering Dept.

Power System 4
Fourth year students
Time allowed: 90 minutes

Final Exam., January 2011

Second Part

➢ Please Attempt ALL Questions

Fourth Question

(a) A synchronous generator operating at 50 Hz delivers 1p.u power to an infinite busbar through a network in which resistance may be neglected. A fault occurs which reduces the maximum power transferable from 1.6 p.u before fault to 0.4 p.u. After the fault clearance, the maximum transferable power is 1.3 p.u.

(i) If the fault is cleared at an angle of 78^{o}, **check** the system stability.
(ii) Determine the critical clearing angle.

(b) A load is supplied from an infinite busbar of voltage 1 p.u. through a link of series reactance X p.u. and of negligible resistance and shunt admittance. The load consists of a constant power component of 1p.u. at 1 p.u. voltage and a per unit reactive power component (Q) which varies with the received voltage (V) according to the law: $(V-0.82)^2 = 0.22(Q-0.83)$, All per unit values are to common voltage and MVA bases. **Determine** the limit values of X for which the system is stable.

Fifth Question

(a) A single phase sinusoidal supply is feeding a nonlinear load through a R-L series impedance. The supply voltage and the load current are given as time functions:
v=100 sin 314t Volts, and i= 10 sin 314t+ 2.7 sin(3*314t+30)+1.6 sin(5*314t-45) Amperes, respectively. Take R=0.4 Ohms and L= 3 mH. **Compute:**
(i)The K-factor of the load voltage.
(ii)The distortion power and the load power factor.

(b)Write a short note about main power quality problems giving the definition, cause, and effect of each.

Sixth Question

(a) Discuss the methods of controlling harmonic distortion in power systems.

(b) Four utilities are scheduled to transact energy by a central dispatching scheme. Their buy/sell offers are shown in the table. Assume 14% of the total savings are set aside to compensate for transmission cost among the pool parties. **Calculate** the costs and savings of each utility.

Utilities selling energy	Incremental cost R/MWH	MWH for sale
A	26	140
B	30	90
Utilities buying energy	Decremental cost R/MWH	MWH for purchase
C	35	60
D	44	170

good luck