Portland State University

Electrical & Computer Engineering

EE 347 Power Systems I

-Homework #5-

Text Questions: 3-9, 10-6, 11-1, 11-6

Text Problems: 3-22(a,d), 10-7, 10-8

Problem 1:

Consider the 19-20 transmission line in Trudnowski et al.[1,2,3] Develop short, medium and long transmission line ABCD models for this line. Compare the VR and efficiency calculations that derive from these models, and comment on the differences.

Problem 2:

Consider the PowerWorld model from HW#4 P1 (the uncompensated model).

- Resize the transmission line and transformers such that a 200 kVA, 0.95 load may be added in future without any components exceeding 90% of rated apparent power.
- Determine the efficiency of each transformer and the transmission line with the new load in place.
- Prepare a one-line diagram of this power system. Label apparent power, bus voltage magnitude and phase, per-unit resistance and reactance values for each system component and other parameters you deem appropriate to note. Assume the transformers are all delta/grounded wye (low side/high side), and label them as such.

Problem 3:

Evaluate the Ozzie Outback Electric Power Company system, shown in Figure 11-6, given the transmission line and load specifications from Tables 11-5 and 11-6 respectively.

Produce a report noting the line flow information for all five transmission lines. Produce a table noting real, reactive and apparent power for each line. Note if a line is overloaded.

Re-design the power system by adding static VAr compensation to alleviate overloaded transmission lines and busses that have voltages out of tolerance. Use a minimum amount of compensation. Re-run the analysis and produce a table showing the new power flows and bus voltages.

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[1] D. Trudnowski, M. Donnelly, E. Lightner, "Power-System Frequency and Stability Control using Decentralized Intelligent Loads," Reprinted for limited distribution from conference proceedings paper submission for 2005 IEEE Power Engineering Society T & D Conference and Expo

[2] Posted on the ECE 347 D2L site

[3] Referring to the Trudnowski table on page 7, "Cap. (pu)" is the shunt capacitive *admittance*, $Y_{C,pu}$.

The MatLab m-file for this power flow study may be found on D2L ("Chapman m Files"), along with an input data file. Execute the m-file by entering 'power_flow filename' at the command prompt.

Reports must be original compilations that are succinct and easy to read; please do not cut and paste the report tables from Chapman's code.

Fundamentals of Engineering Exam Problem 1:

Which of the following most likely presents a leading power factor?

(A) An electric resistance water heater
(B) A toaster
(C) An over-excited synchronous generator
(D) A squirrel-cage motor

Fundamentals of Engineering Exam Problem 2:

Psuedo-code from a computer program contains the following segment:

```
i = -1
while i < 5
        i = i + 2
else break
```

What is the value of i at the conclusion of this routine?

(A) 0
(B) 1
(C) 3
(D) 5