

## **ENEE 381 Problem Set #4**

**10/14/04 due 10/26/04**

**Questions like (1) -(6) and (9) -(14) could easily be on the first examination**

- (1) A length of loss-less transmission line is first short-circuited at one end and then open-circuited. The impedance measured at the other end in the first case is  $Z_1$  and  $Z_2$  in the second. Prove that  $Z_1 Z_2 = Z_0^2$ . This is a convenient way for measuring the characteristic impedance of an unknown line.
- (2) A 50 ohm transmission line is terminated with an impedance of  $20-j30$ . What is the magnitude and phase of the reflection coefficient?
- (3) Repeat question (2) using the Smith chart
- (4) A 75 ohm transmission line is terminated with a load of  $150 + j50$  ohm. Compute  $\rho$  in terms of both amplitude  $|\rho|$  and  $\phi$ . What fraction of incident power is absorbed in the load?
- (5) Use Smith chart. A line with  $Z_0 = 100\Omega$  is terminated with an unknown load. The SWR is found to be 3. A current maximum is observed  $0.1\lambda$  from the load. What are:
  - (a) the load?
  - (b) the reflection coefficient  $\rho$ , magnitude and angle?
  - (c) how would you match the line without changing the load at the end of the line?
- (6) Use Smith chart. A transmission line of characteristic impedance 75 ohm is terminated with an impedance  $50+j125$  ohm.  $0.1\lambda$  from the load a 150ohm shorted stub  $0.2\lambda$  long is connected in shunt to the main line. What are:
  - (a) The reflection coefficient in magnitude and phase at this point?
  - (b) The standing wave ratio?
  - (c) Where is the nearest current minimum that is greater than  $0.1\lambda$  from the load?
  - (d) Where is the nearest point greater than  $0.1\lambda$  from the load where the line can be matched with an open 75 ohm stub?
- (7) RWvD 5.2b
- (8) RWvD 5.5b
- (9) RWvD 5.7f Do with and without the Smith Chart
- (10) RWvD 5.8a Use Smith Chart
- (11) RWvD 5.8c Use Smith Chart
- (12) RWvD 5.10a Use Smith Chart
- (13) RWvD 5.10b Use Smith Chart
- (14) RWvD 5.10g Use Smith Chart