1. Given the two-machine system of Fig. 1, we select, quite arbitrarily, a base voltage of 161 KV for the transmission line and a base voltampere of 20MVA.

(a) Find the pu impedance of all components referred to these bases. The apparatus has ratings as follows:

Generator: 15MVA, 13.8 kv, $x = 0.15$ pu
Motor: 10MVA, 13.2 KV, $x = 0.15$ pu
T1: 25MVA, 13.2-161KV, $x = 0.10$ pu
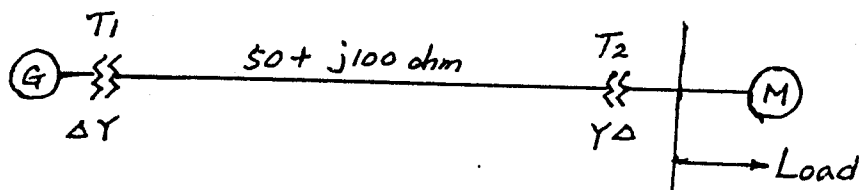T2: 15 MVA, 13.8-161KV, $x = 0.10$ pu
Load: 4MVA at 0.8 pf lag

Fig. 1. A two-machine system

(b) Suppose that the motor is a synchronous machine drawing 10MVA at 0.9 pf lead and the terminal voltage is 1.1 p.u. What is the voltage at the generator terminals? (20%)

2. A cable has a surge impedance, Z, of 30 ohms. The propagation velocity, V, is 500 feet per microsecond. Calculate the per foot series inductance, L, and shunt capacitance, C, of the cable. (10%)

3. (a) What is meant by switching surge? What is the importance of the suppression of switching surge in the EHV & UHV systems?

(b) Describe the suppression of switching surge by way of preinsertion resistor, and state how the optimum insertion resistance can be obtained. (10%)

4. Explain how a revolving magnetic field may be produced by current in stationary windings. Derive a formula for speed of the revolving field in the terms of number of poles and frequency.

(10%)

5. An eight-pole 60Hz squirrel cage induction motor is deliberately loaded to a point where pull-out or stalling will occur. The rotor resistance per phase is 0.3 ohm, and the motor stalls at 650 rpm. Calculate:

(20%)

(a) The synchronous speed, N_s
(b) The breakdown slip, S_b
(c) The locked-rotor reactance (the standstill reactance).
(d) The rotor frequency at the maximum torque point.

6. To indentify the equivalent circuit parameter of a 100 kVA 4KV/1KV transformer, a short-circuit test is performed with the power input of 2.5 KW at

$$V_1 = 224V \quad \text{and} \quad I_1 = 25A$$

Determine the parameters R_{eq} and X_{eq} of the transformer referred to the primary.

(10%)

7. Explain each of the following terms:

(i) Paschen's law

(ii) IKL (Isokeraunic level)

(iii) BIL (Basic lightning impulse insulation level)

(iv) differential relay

(v) $1\frac{1}{2}$ · circuit breaker scheme.

(20%)