

1. A surge of 100 kV travelling in a line of natural impedance 600 ohms arrives at a junction with two lines of surge impedances 800 ohms and 200 ohms respectively. Find the surge voltages and currents transmitted into each branch line. (20%)
2. A 132 kV, 50 Hz, 3-phase, 100 km long transmission line has a capacitance of  $0.012 \mu\text{F}$  per km per phase. Determine the inductive reactance and KVA rating of the arc suppression coil suitable for the line to eliminate arcing ground phenomenon. (20%)
3. The synchronous reactance of a cylindrical rotor machine is 1.2 p.u. The machine is connected to an infinite bus whose voltage is 1 p.u. through an equivalent reactance of 0.3 p.u. For a power output of 0.7 p.u., the power angle is found to be  $30^\circ$ .
  - (a) Find the excitation voltage  $E_f$  and the pull-out power.
  - (b) For the same power output the power angle is to be reduced to  $25^\circ$ . Find the value of the reduced equivalent reactance connecting the machine to the bus to achieve this. What would be the new pull-out power? (20%)
4. A  $\frac{1}{3}$ -hp 120-V 60-Hz capacitor-start motor has the following constants for the main and auxiliary windings (at starting):  
Main winding,  $Z_m = 4.5 + j3.7 \Omega$   
Auxiliary winding,  $Z_a = 9.5 + j3.5 \Omega$   
Find the value of starting capacitance that will place the main and auxiliary winding currents in quadrature at starting. (20%)

5. Explain each of the following terms:

(i) Proximity effect

(ii) Diverter resistance

(iii) Earthing transformer

(iv) Fringing effect

(v) Differential relay

(vi) Disconnecting switch

(vii) Critical flashover voltage

(viii)  $1\frac{1}{2}$  circuit breaker scheme

(ix) IKL (Isokeraunic level)

(x) BIL (Basic lightning impulse insulation level)

(20%)