1. A completely transposed three-phase double-circuit line abc and a'b'c' is composed of conductors with radius r=16.67 mm, arranged as shown in Fig.1. aa', bb' and cc' are in parallel respectively.

   (a) Find the capacitance to neutral per kilometer per line. Neglect the effect of earth. (permittivity $\varepsilon=8.854\times10^{-9}$ F/km) (9%)

   (b) If one circuit line a'b'c' is out of use and a'b' are short circuited on one end, find the voltage per kilometer on a'b'circuit induced by the currents flowing in another abc circuit. The effective value of the currents is 1000 A and symmetrical in three phase. (5%)

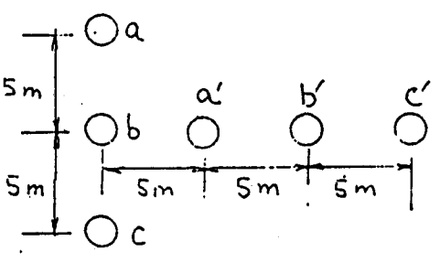

Fig.1

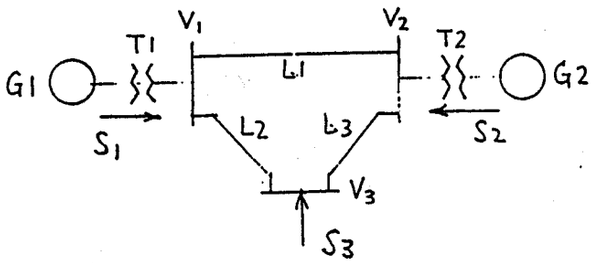

Fig.2

2. The one-line diagram of a electrical power system is shown in Fig.2. Available data in p.u. are given as fallows. All resistances are neglected.
   G1,G2: $x_d=0.9$, $x_d''=0.1$
   T1,T2: x=0.1
   L1,L2,L3: x=0.25

   (a) Find the complex power into each bus as the bus voltages are:
   $V_1=1\angle10^\circ$, $V_2=1\angle10^\circ$, $V_3=1\angle0^\circ$ (8%)

   (b) Find the subtransient current for a symmetrical three-phase short circuit fault on bus 3. (12%)

3. In a system of 132KV, the line to ground capacitance is 0.01 μF and the inductance is 5 henries. Determine the voltage appearing across the pole of a C. B. if a magnetizing current of 5 amps(instantaneous value) is interrupted. Determine also the value of resistance to be used across the contacts to elimate the restriking voltage. (16%)

4. The capacitance of a 3-core lead sheathed cable measured between any two of the conductors with sheath earthed is 0.19 μF per Km.
Determine the equivalent star connected capacitance and the KVA reguired to keep 16Km of the cable charged when connected to 20KV, 50Hz supply. (16%)

5. (a) Why do induction motors run at low power factors when lightly loaded? (4%)
(b) Lists the factors involved in voltage buildup of a shunt D.C. generator. (10%)

6. In the system shown in Fig.2, the inductances in henrys are given as L11=(2+cos2θ)*10e-3; L12=0.2 cosθ; L22=20+5cos2θ. If i_1=5amp and i_2=.05amp, a. Find the coenergy of the system. b. Find the torque T(θ). (10%)

7. A 200-v three-phase four-pole 50Hz squirrel-cage induction motor develops a maximum internal torque of 250 percent at a slip of 20 percent when operating at rated voltage and frequency. If the effect of stator resistance is neglected, determine the maximum internal torque that this motor would develop if it were operated at 220-v and 60Hz. Under these conditions at what speed in revolutions per minute would maximum torque be developed? (10%)

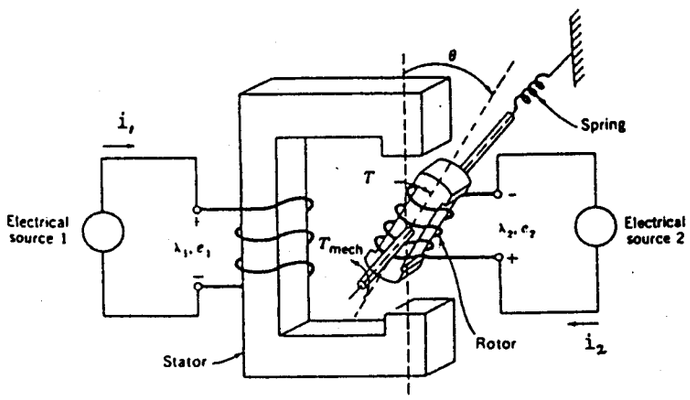

Fig.2