**Scheme – G**

# Sample Question Paper

**Course Name : Diploma in Electrical Power System**

**Course Code : EP**

**Semester : Fifth**

**17510**

**Subject Title : Power System Analysis**

**Marks : 100** **Time: 3 hrs**

**Instructions:**

1. All questions are compulsory
2. Illustrate your answers with neat sketches wherever necessary
3. Figures to the right indicate full marks
4. Assume suitable data if necessary
5. Preferably, write the answers in sequential order

**Q1A) Attempt any THREE of the following** **12 Marks**

a) Draw a single line diagram showing the essential components in a modern power system
b) State the need of reactive power compensation in power system
c) " AC resistance is more than DC resistance", Justify
d) Derive generalized circuit constants of two network connected in series

**B) Attempt any ONE of the following** **06 Marks**

a) Two generalized circuit constants are connected in parallel having generalized circuit constants $A_1$, $B_2$, $C_3$, $D_4$ & $A_2$, $B_2$, $C_2$, $D_2$. Determine the overall ABCD constants of the network.
b) State the effect of capacitance on performance of the transmission line.

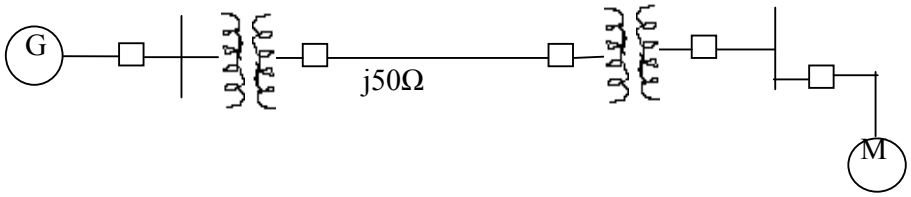
**Q2. Attempt any TWO of the following** **16 Marks**

a) i) Define the generalized circuit & generalized circuit constants.
ii) Prove that the complex power in power system is defined as S=VI* instead of S=V*I.
b) A 220 kV, 50Hz , 200Km long, 3-phase line has its conductors on the corners of a triangle with sides 6m, 6m, & 12m. The Conductor radius is 1.81cm. Find the capacitance per phase per km, capacitive reactance per phase, Charging current and total charging Mvars.
c) A 275 kV 3- phase line has the following line parameters. $A= 0.92\angle 1.8^0$ ; $B= 110\angle 77^0$ If the receiving end voltage is 275 kV, determine
   i) Sending end voltage if a load of 200 MW at 0.8 lagging p.f is being delivered at the receiving end.
   ii) Maximum power that can be delivered if sending end voltage is 295 kV & receiving end voltage is 275 kV.

**Q3. Attempt any FOUR of the following** **16 Marks**

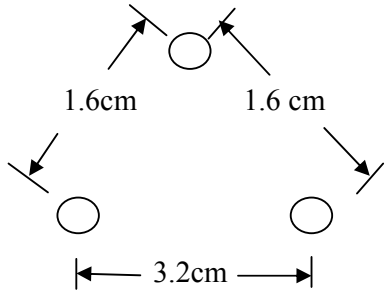
a) Draw the per unit reactance diagram for the power system shown in following figure. Neglect resistance and use a base of 100MVA, 220KV in 50 ohm line. The ratings of the generator, motor and transformer are given below:

Generator (Y): 40MVA; 25kV; X"=20%
Synchronous motor (Y): 50 MVA; 11 kV; X"=30%
Y-Y Transformer: 40 MVA; 33/220 kV, X=15%
Y-Δ Transformer: 30 MVA; 11/220 kV (Δ-Y), X=15%.




b) Describe the stepwise procedure for drawing receiving end circle diagram.

c) Determine the inductance of a 3 phase line operating at 50Hz and conductors arranged as follows. The conductor diameter is 0.8cm.




d) A 275 kV transmission line has following GCC A=0.85∠ $75^0$, B= 300∠$75^0$. Determine the power at unity p.f. that can be received if the voltage at each end is maintained at 275kV.

e) Describe the concept of self GMR and self GMD in the calculation of transmission line inductance.

**Q4. A) Attempt any THREE of the following** **12 Marks**

a) State the factors that influence skin effect & Proximity effect

b) A 3 phase 132 kV transmission line delivers 40MVA at 0.8p.f. lag. Draw circle diagram and determine the sending end voltage. Given that A= 0.98∠$3^0$, B=110∠$72^0$

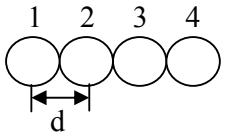
c) Write the equation for converting the p.u. impedance expressed in one base to another. List the advantages of per unit computation

d) State the expression for complex power at receiving end of transmission line. Derive the condition for maximum power at receiving end.

**B) Attempt any ONE of the following** **06 Marks**

a) Prove that AD-BC=1 for medium transmission line network.

b) Find the self GMD for following arrangement of conductors with radius of each conductor 'r'




**Q5. Attempt any TWO of the following** **16 Marks**

a) A 132kV, 50 Hz, 3 phase transmission line delivers a load of 50 MW at 0.8 p.f. lagging at the receiving end. The generalized constants of the transmission line are, $A= 0.95\angle 1.4^0$, $B= 96\angle 78^0$, $C= 0.0015\angle 90^0$. Find Calculate sending end voltage, sending end current & % Voltage Regulation. Use nominal 'T' method.

b) State the field of application of following reactive power consumption equipments:
   i) Shunt capacitor bank
   ii) Inductance reactor bank
   iii) Synchronous condenser
   iv) Auto transformer

c) A 50 Hz, 3 phase 275kV, 400 Km transmission line has the following parameters:
   Resistance = 0.035 ohm/km per phase
   Inductance = 1.1mH / km per phase
   Capacitance 0.012 μf /Km per phase
   If the line is supplied at 275KV, determine the MVA rating of a shunt reactor having negligible losses that would be required to maintain 275KV at the receiving end when the line is delivering no load. Use nominal π method.

**Q6. Attempt any FOUR the following** **16 Marks**

a) Calculate the inductance per phase of a 3 phase system where conductors are placed at the corners of an equilateral triangle of sides 1.5 m each. The diameter of each conductor is 1.2cm. Also calculate the inductance per phase if conductors are arranged in the horizontal line with 1.5 m distance between adjacent conductors.

b) A generator rated at 30MVA, 11KV has a reactance of 20% connected to a 3-phase, 50 MVA, 11/132 kV, Δ-Y transformer with X=15%. Calculate its p.u. reactance of generator and transformer for a base of 50MVA and 10KV.

c) Derive the expression for flux linkages of an isolated current carrying conductor due to internal flux only.

d) State the importance of reactive power in power system with an example.

e) A medium transmission line has series impedance is (20+j52) ohms and shunt admittance is $315x10^{-6}$ siemens/phase. Calculate A, B, C, D constants of the line assuming nominal 'T' circuit.