May – June – 2011

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T.E. (Electrical) (Semester – II) Examination, 2011
POWER SYSTEM – II (New)
(2008 Pattern)

Time : 3 Hours   Max. Marks : 100

Instructions : *1) Answer **any three** questions from **each** Section.*
*2) Answer **three** questions from Section **I** and **three** questions from Section **II**.*
*3) Answers to the **two** Sections should be written in **separate** books.*
*4) **Neat** diagrams must be drawn **wherever** necessary.*
*5) Black figures to the **right** indicate **full** marks.*
*6) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*
*7) Assume suitable data, if **necessary**.*

SECTION – I

1. a) What do you mean by receiving end circle diagram ? **2**

b) Explain the procedure of drawing the receiving end circle diagram. **6**

c) A 275 kV, three phase line has the following line parameters :

$A = 0.93\angle 1.5^\circ$, $B = 115\angle 77^\circ$

If the receiving end voltage is 275 kV determine :

i) Sending end voltage required, if a load 250 MW at 0.85 p.f. (lagging) is being delivered at receiving end.

ii) The maximum power that can be delivered if the sending end voltage is held at 295 kV. **8**

OR

2. a) Explain 'Surge Impedance Loading' and methods to improve it. **8**

b) Explain the following concepts used in power system :

i) Compensation

ii) Complex power. **8**

3. a) What are the advantages and drawbacks of EHV transmission ? 8

b) The power of 12000 MW is required to be transmitted over a distance of 1000 km at voltage level of 750 kV, at 50 Hz. The angle between receiving and sending end is 30°. The average values of line parameter :

r Ω / phase / km = 0.0136

X Ω / phase / km = 0.272

Determine :

i) Possible number of circuits required with equal magnitude of sending and receiving end voltage, with 30° phase difference.

ii) The current transmitted per phase.

iii) Total line loss in percentage of power handling capacity. 8

OR

4. a) Explain the phenomena of 'corona' in E.H.V. A.C. transmission. 6

b) Explain in brief following terms : 4

i) Disruptive critical voltage

ii) Visual critical voltage.

c) In three phase overhead line the conductor have each diameter of 30 mm and arranged in the form of an equilateral triangle. Assuming fair weather conditions air density factor is 0.95 and irregularity factor 0.95. Find the minimum spacing between the conductors if the disruptive critical voltage is not to exceed 230 kV between the lines. Breakdown strength of air may be assumed to be 30 kV per cm (peak). 6

5. a) Explain the use of impedance and reactance diagram in power system analysis with an illustration. 8

b) A 12 MVA, 15 kV, three phase alternator has a reactance of 12% and is connected through a $\Delta - Y$ transformer to a high voltage transmission line having a total reactance of 100Ω and voltage 138 kV. A load of 13.8 kV, 15 MVA with an impedance of (0.85 + j0.526) is connected at the end of line through Y – Y transformer. Both transformer banks are composed of three single phase transformers connected for three phase operation. Each transformer is rated 6.5 MVA, 13.8/138 kV with a reactance of 10%. Choose a base MVA as 15 MVA and base kV as 13.8 kV from load ckt. Draw the reactance diagram and determine the terminal voltage of generator. Neglect resistance of load. 10

OR

6. a) Explain in detail the subtransient transient and steady, states at the 3 phase S.C. fault condition on an unloaded alternator, and explain how you will find subtransient, transient and steady state currents ? **10**

b) A three phase T.L. operating at 11 kV and having a resistance at 0.8Ω and reactance at 2.4Ω is connected to generating station bus bar through 6 KVA transformer having a resistance of 5%. The bus bar is supplied by a 10 MVA alternator having 15% reactance. Calculate S.C. KVA fed to symmetrical fault between phases.

If it occurs at

i) Load end of T.L.

ii) High voltage terminals of transformer.

Consider transformer of transformation ratio = 1, base MVA = 10 MVA, base kV = 11 kV. **8**

SECTION – II

7. a) State **true** or **false** in case of the following statement with reasons.

i) The zero sequence impedance of three phase transmission line is generally 2.5 times that of positive sequence impedance.

ii) The negative sequence reactance is the average of direct and quadrature axis subtransient reactances.

iii) The neutral grounding impedance Z_n appears as $3Z_n$ in the zero sequence equivalent circuit.

iv) For a fault at the terminals of an alternator with solidly grounded neutral, a single line to ground fault is generally more severe than a three phase fault.

v) It is possible to know the type of fault from the knowledge of the sequence components of fault current. **10**

b) The original set of voltage phasors $V_a = 4$, $V_b = 3\angle -90^\circ$ and $V_c = 8\angle 143.1^\circ$ volts. Find all the voltage components for positive, negative and zero sequence systems. **8**

OR

8. a) Derive the expression for fault current in case of L-L-G fault through a fault impedance Z_f in terms of sequence. Draw the sequence network for this type of fault. **10**

b) A power system when subjected to different types of fault at a location where actual values were 30 MVA and 120 kV. The fault currents observed are :

Fault Type	Fault current in Amps
Three phase fault	988 A
L – G fault	1203 A
L – L fault	856 A

Find the p.u. value of equivalent positive, negative and zero sequence reactance at the fault point. Consider actual and base values of MVA and kV same, at fault pt. 8

9. a) Explain with suitable example the method to express circuit equations in the form $[I]_{bus} = [Y]_{bus}\ [V]_{bus}$. Explain the significance and nature of elements of $[Y]_{bus}$ along with a simple method to form $[Y]_{bus}$ matrix for a power system. 8

b) Explain the Newton-Raphson method for load flow analysis along with flow chart. 8

OR

10. a) Write a general form of power flow equations for n-bus power system and explain
   i) Nature and characteristics of equations
   ii) Various constraints to be considered
   iii) Types of buses. 8

b) An incomplete nodal admittance matrix for a four bus system with negligible charging admittance is given below. Find out the missing elements

$$\begin{bmatrix} 1.372 - j\,5.491 & -0.392 + j\,1.569 & -0.588 + j\,2.353 & Y_{14} \\ Y_{21} & Y_{22} & -1.176 + j\,4.706 & 0 \\ Y_{31} & Y_{32} & Y_{33} & -1.176 + j\,4.706 \\ Y_{41} & Y_{42} & Y_{43} & Y_{44} \end{bmatrix}$$

All values are in p.u. 8

11. a) Explain with reasons in short :
   i) HVDC transmission is economical and preferable over HVAC transmission for long distance only.
   ii) Modern HVDC systems use 12 pulse converters.
   iii) HVDC transmission offers less corona loss.
   iv) Reliability of HVDC transmission is more. 8

b) What are the recent development in HVDC transmission system ? Discuss future scope of HVDC transmission systems in India. 8

OR

12. a) Explain constant current control method for HVDC transmission system. 8

b) Explain the different types of HVDC links. Name any two HVDC systems in India. 8