Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech

Branch : EEE **Semester** : 5

Title of the Course : Power System Analysis **Course Code** : EEL 302

Time: 3 hrs **Maximum Marks: 50**

Section A

Attempt all question **(10×1 = 10)**

Q. [1] What is single line diagram?

Q. [2] For a given base voltage and base volt amperes, the per unit impedance value of an element is x. Calculate the per unit impedance value of this element when the voltage and volt amperes bases are both doubled.

Q. [3] How the base values are chose in per unit representation of a power system?

Q. [4] Why is one of the buses taken as slack bus in a power system?

Q. [5] What is the need for short circuit studies?

Q. [6] Distinguish between symmetrical and unsymmetrical faults with neat sketch.

Q. [7] Write the symmetrical components of a three phase system?

Q. [8] What is sequence operator?

Q. [9] Define swing curve. What is the use of this curve?

Q. [10] Define transient stability of a power system

Section B

Attempt any four **(4×5 = 20)**

Q. [1] What do you understand by percentage reactance? Why do we prefer to express the reactances of various elements in percentage values for short-circuit calculations?

Q. [2] Derive an expression for fault current for doube line-to-ground fault by symmetrical components method.

Q. [3] Explain the step by step procedure of load flow solution for the Newtom- Rapshon method.

Q. [4] Three zones of a single phase circuit are identified in the following Fig. A. The zones are connected by transformer T_1 and T_2, whose rating are also shown. Given $V_s = 220\angle 0^0, X_{line} = 2\Omega$ and $Z_{load} = (0.9 + j0.2)$. Using base values of 30 kVA and 240 volts in zone 1, draw the per-unit impedance circuit and the per unit source voltage. Also calculate the load current both in per-unit and in amperes. Transformer winding resistances and shunt admittance branches are neglected.

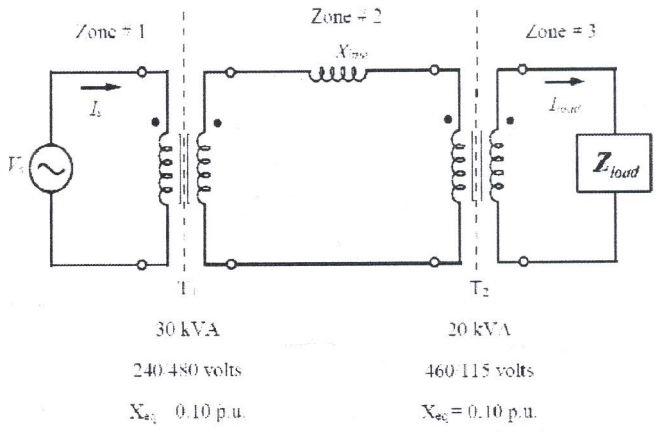

Fig. A

Q. [5] Consider the impedance diagram of Fig. B in which the system parameters are given in per unit by $Z_{11} = Z_{22} = j0.25$, $Z_{12} = j0.2$, $Z_{13} = j0.25$, $Z_{23} = Z_{34} = j0.4$ and $Z_{24} = j0.5$. Evaluate the Y-bus matrix form give line specification.

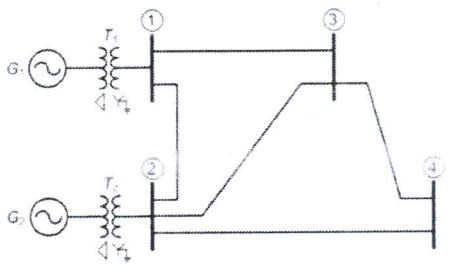

Fig. B

Section C

Attempt any two **(2×10 = 20)**

Q. [1] A 3-phase transmission line operating at 10 kV and having a resistance of 1ohm and reactance of 4 ohm is connected to the generating bus-bars through 5 MVA step-up transformer having a reactance of 5%. The bus-bars are supplied by a 10 MVA alternator having 10% reactance. Calculate the short-circuit current, if it occurs, (*i*) at the load end of transmission line, (*ii*) at the high voltage terminals of the transformer in fig. C.

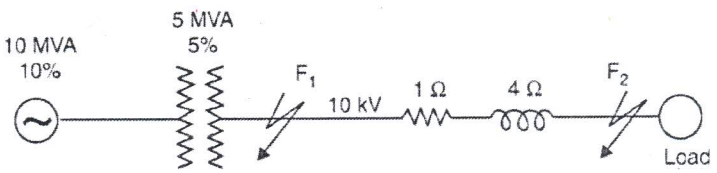

Fig. C

Q. [2] Derive and explain the equal area criterion for stability of a power system.

Q. [3] Derive swing equation and discuss the importance of stability studies in power system planning and operation.

Q. [4] Derive the expression for the three phase power in terms of symmetrical components.