

III B. Tech II Semester Supplementary Examinations, November- 2019

POWER SYSTEM ANALYSIS

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)2. Answering the question in **Part-A** is compulsory3. Answer any **THREE** Questions from **Part-B**

PART -A**(22 Marks)**

- 1 a) Write the criterion to be followed in the selection of base values in the power system. [3M]
- b) Write the advantages of algorithmic approach for the power flow studies. [3M]
- c) Write the list of ways of adding impedance to existing system for the modification of Z_{bus} matrix. [4M]
- d) Discuss why the three phase fault is a symmetrical fault? [4M]
- e) What is the requirement of the symmetrical components in the power system analysis? [4M]
- f) Write the list of electrical factors which will affect the stability problem in the power system. [4M]

PART -B**(48 Marks)**

- 2 a) A 50 kW three phase star connected load is fed by a 210 kVA transformer with the voltage rating of 11 kV/400V through a feeder. The length of the feeder is 0.74 km and the impedance of the feeder is $(0.15 + j3)$ ohms/km. If the load power factor is 0.75, find the impedance of the feeder and load. [8M]
- b) An infinite bus supplies a purely resistive 5 MW, 2.3 kV and a 7.5 MVA, 13.2 kV synchronous motor having a sub transient reactance of 22%. Find the per unit impedances for a base of 66 kV, 15 MVA in the primary. [8M]
- 3 a) Draw and explain the equivalent circuit of 3 bus system and derive the static load flow equations. [8M]
- b) Derive the expression for the limits of reactive power and discuss how it is considered for PV bus to PQ bus conversion? [8M]
- 4 The impedances connected between various buses are : [16M]
 $X_{10} = 1.24\Omega$, $X_{30} = 1.25\Omega$, $X_{12} = 0.25\Omega$, $X_{23} = 0.4\Omega$, $X_{24} = 0.125\Omega$ and $X_{43} = 0.2\Omega$. In which '0' is the reference node. All the impedances are in p.u. Derive the bus impedance matrix for the network connecting the above impedances.
- 5 a) Draw the equivalent circuit and derive the expression for the sub transient reactance of alternator during the short circuit. [8M]
- b) Explain in detail about the steps to be followed for the symmetrical fault calculations. [8M]
- 6 a) An unbalanced 3 phase delta load, constituting resistances of 4.1Ω , 6Ω and 10Ω connected in delta formation and connected to a balanced three phase system of 200 V line to line. Find the positive, negative and zero sequence currents in the load circuits and in the supply lines. [8M]
- b) The line to line voltages of a three phase system measure 110 V, 150 V and 200 V. Find the magnitudes of the positive and negative sequence components of delta voltages and star voltages. [8M]

- 7 a) Derive the expression for the maximum power transfer from the steady state power. [8M]
b) A 4 pole, 50 Hz, 60 MVA turbo generator has a moment of inertia of $9 \times 10^3 \text{ kg-m}^2$. Find the kinetic energy in MJ at rated speed, the inertia constant M and H, the acceleration in degrees per sec² and in rpm/sec. If the input power is 20 MW and the output power is 14 MW. [8M]

