## III B. Tech II Semester Supplementary Examinations, November- 2019 POWER SYSTEM ANALYSIS

(Electrical and Electronics Engineering)

Note: 1. Question Paper consists of two parts (Part-A and Part-B)

Max. Marks: 70

Time: 3 hours

2. Answering the question in **Part-A** is compulsory 3. 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] Write the list of ways of adding impedance to existing system for the modification of Z<sub>bus</sub> c) [4M] d) Discuss why the three phase fault is a symmetrical fault? [4M] What is the requirement of the symmetrical components in the power system analysis? [4M] e) Write the list of electrical factors which will affect the stability problem in the power [4M] system. PART -B **(48 Marks)** A 50 kW three phase star connected load is fed by a 210 kVA transformer with the 2 [8M] 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. b) An infinite bus supplies a purely resistive 5 MW, 2.3 kV and a 7.5 MVA, 13.2 kV [8M] 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. 3 a) Draw and explain the equivalent circuit of 3 bus system and derive the static load flow [8M] equations. b) Derive the expression for the limits of reactive power and discuss how it is considered for [8M] PV bus to PQ bus conversion? 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 Draw the equivalent circuit and derive the expression for the sub transient reactance of a) [8M] alternator during the short circuit. b) Explain in detail about the steps to be followed for the symmetrical fault calculations. [8M] An unbalanced 3 phase delta load, constituting resistances of 4.1  $\Omega$ , 6  $\Omega$  and 10  $\Omega$ 6 [8M] a) 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. The line to line voltages of a three phase system measure 110 V, 150 V and 200 V. Find [8M] the magnitudes of the positive and negative sequence components of delta voltages and star voltages.

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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 9x10<sup>3</sup> kg-m<sup>2</sup>. Find the kinetic energy in MJ at rated speed, the inertia constant M and H, the acceleration in degrees per sec<sup>2</sup> and in rpm/sec. If the input power is 20 MW and the output power is 14 MW.

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