Code No: R1632022 **R16** SET - 1

III B. Tech II Semester Supplementary Examinations, February-2022

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. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A (14 Marks)

1. a) Define the node incidence matrix. [2M]
   b) Define the voltage controlled bus. [2M]
   c) What are the merits of Z_{bus} building algorithm? [3M]
   d) What do you understand by short circuit kVA? [2M]
   e) Derive the expression for power in symmetrical components. [3M]
   f) What are the applications of equal area criterion? [2M]

PART –B (56 Marks)

2. Draw an impedance diagram for the electric power system shown in Fig.1, showing all impedances in per unit on a 100 MVA base. Choose 20 kV as the voltage base for generator. The 3-phase power and line-line ratings are given below: [14M]

   G_1 : 90 MVA, 20 kV, X= 9% ; T_1 : 80 MVA, 20/200 kV, X= 16%
   T_2 : 90 MVA, 200/20 kV, X= 20% ; G_2 : 90 MVA, 18kV, X= 9%
   Line : 200 kV, X =120 ohms
   Load : 200 kV, S = (48+j64) MVA

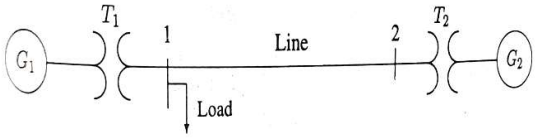

Fig.1

3. a) What is load flow solution? Explain its significance in analysis of power system. [7M]
   b) Develop load flow equations suitable for solution by Gauss Seidel method using bus admittance matrix. [7M]

4. Using the method of building algorithm, find the bus impedance matrix for the network shown in Fig.2. [14M]

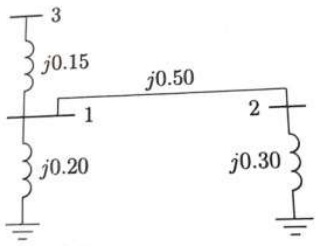

Fig.2

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5. a) How are reactors classified? Explain the merits and demerits of different types of system protection using reactors. [7M]

   b) The system shown in Fig.3 is initially on no load with generators operating at their rated voltage with their emf's in phase. The rating of the generators and transformers and their respective percent reactance's are marked on the diagram. All resistances are neglected. The line impedance is j 160 ohms. A 3-phase balanced fault occurs at the receiving end of the transmission line. Determine the short circuit current and short circuit MVA. [7M]

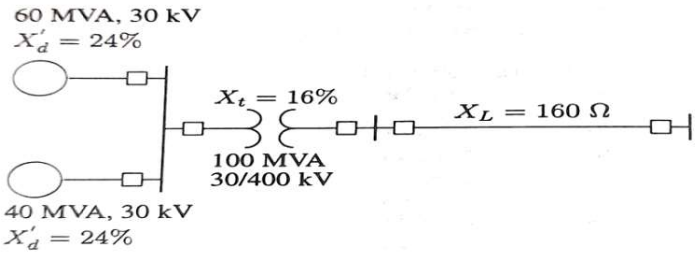

Fig.3

6. a) What are sequence impedances? Obtain expression for sequence impedances in a balanced static 3-phase circuit. [7M]

   b) A 20 MVA, 6.6 kV star connected generator has positive, negative and zero sequence reactance's of 30 %, 25 % and 7% respectively. A reactor with 5% reactance based on the rating of the generator is placed in the neutral to ground connection. A line to line fault occurs at the terminals of the generator when it is operating at rated voltage. Find the initial symmetrical line to ground r.m.s fault current. Also find the line to line voltage. [7M]

7. a) Derive swing equation and discuss its application in the study of power system stability. [7M]

   b) A 4-pole, 50 Hz, 11 kV turbo generator is rated 75 MW and 0.86 p.f lagging. The machine rotor has a moment of inertia of 9000 kg-m^2. Find the inertia constant in MJ/ MVA and M constant or momentum in MJ/ elec. Degree. [7M]

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