Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

V SEMESTER B. TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
END SEMESTER ON-LINE PROCTORED EXAMINATIONS
DECEMBER 2021

POWER SYSTEM ANALYSIS [ELE 3154]
REVISED CREDIT SYSTEM

Time: 75 Minutes + 10 Minutes **Date: 30 December 2021** **Max. Marks: 20**

Instructions to Candidates:

- Answer **ALL** questions.
- Time: 75 minutes for writing + 10 minutes for uploading.
- Write your **name, registration number, section** and **sign** on the **top right corner** of every answer sheet.
- Write **page numbers** and **total number of pages** on each page.
- Missing data may be suitably assumed.

1A. For the system shown in Fig. 1A, determine the generator terminal voltage. The transformer 'T' comprises of 3 single phase units each rated 16.667 MVA, 14/127 kV and 10% reactance. Choose 100MVA, 14kV in the generator circuit.

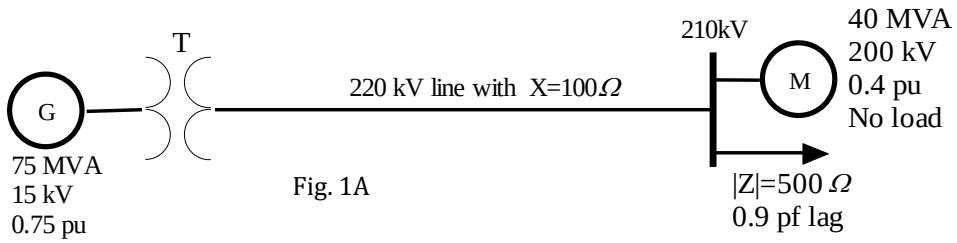


Fig. 1A

(03)

1B. Consider the 3 bus system shown in Fig. 1B. The generators are of 100 MVA with transient reactance of 10% each. Both transformers are 100 MVA with a leakage reactance of 5%. The reactance of each of the lines to a base of 100 MVA, 110 kV is 10%. Obtain the short circuit current in p.u for a 3 phase solid short circuit on bus 3. Assume pre-fault voltage to be 1.0 pu

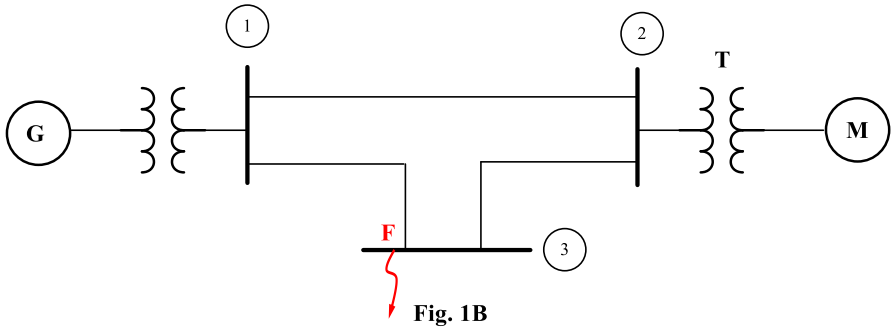
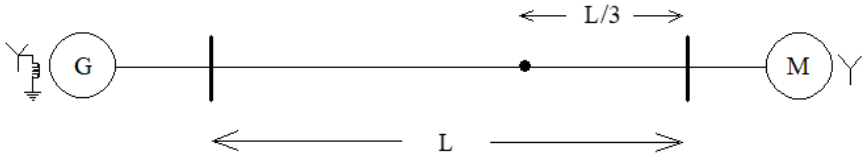


Fig. 1B

(02)

1C. A synchronous generator is connected to a synchronous motor through a transmission line Fig. 1C. A fault occurs at one-third distance away from the motor towards the generator. The symmetrical components of the current from the generator towards the fault are (in pu): I_{a1} = 0.8 – j 1.4; I_{a2} = j 0.5; I_{a0} = j 3.375 and from the motor toward the fault are I_{a1} = -0.8 – j 3.1; I_{a2} = j 0.625; I_{a0} = 0.

Assume $X_1 = X_2$ for generator, motor and transmission line. Describe the type of fault. What is the fault current? Also find the pre-fault current if any, in line 'a'.

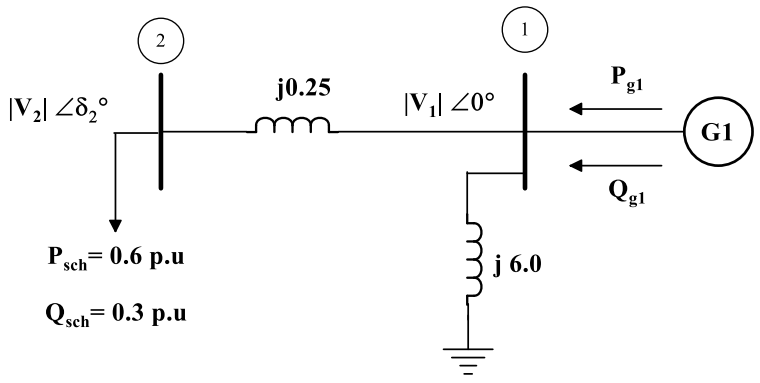


(05)

2A. A 20 MVA, three-phase, 50 Hz generator delivers rated power at unity power factor via a step up transformer, double circuit transmission line and step down transformer to an infinite bus bar. The generator unit has a kinetic energy of 2.5 MJ/MVA at rated speed. It's Xd' = 0.3 per unit. The transformers have negligible resistance and reactance of 0.3 per unit on a 20 MVA base. The voltage behind the transient reactance is 1.05 per unit and the voltage of the infinite bus is 1 per unit. A three phase short circuit occurs at the mid-point of one of the transmission lines. Determine the variation of power angle using point by point method for a period of 0.5 sec with Δt=0.05sec. ***(03)***

2B. For the power system described in question 2A, ascertain the stability of the system. Also determine the accelerating power and the power angle at the end of 0.6 sec. ***(02)***

2C. A two bus power system is as shown below. Using Newton Raphson method, determine the voltage magnitude $|V_2|$ and power angle δ_2 at bus no. 2 at the end of 1 iteration.



Assume the following initial conditions $\delta_2^{(0)} = 0$(zero) rad, $V_2^{(0)} = 1$ p. u, $|V_1|$=1 p.u. ***(05)***