MANIPAL INSTITUTE OF TECHNOLOGY
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V SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
PROCTORED ONLINE MAKEUP EXAMINATIONS, FEBRAUARY 2022

POWER SYSTEM ANALYSIS [ELE 3154]
REVISED CREDIT SYSTEM

Time: 75 Minutes + 10 Minutes **Date: 26 February 2022** **Max. Marks: 20**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Time: 75 minutes for writing + 10 minutes for uploading.

1A. Two generators operate in parallel to supply power to a synchronous motor through a transmission line having transformers at both the ends. There are lagging loads at the generator and motor terminal buses.

i) Draw a single line diagram of the sample power system described above.

ii) Draw impedance/reactance diagrams of the system for a) load flow study b) Fault analysis ***(03)***

1B. A generator-transformer unit is connected to a transmission line through a circuit breaker. The unit ratings are generator 10 MVA, 6.6 kV, Xd''=0.1pu, Xd'=0.2pu, Xd=0.8pu. Transformer 10 MVA, 6.9/33 KV, reactance=0.08 pu. The system is operating on no load at a line voltage of 30 kV, when a 3 phase fault occurs on the line just after the circuit breaker. Find

i) Initial symmetrical r.m.s. current in the circuit breaker.

ii) Current to be interrupted by the breaker and interrupting KVA. ***(02)***

1C. A generator on no load has a terminal voltage of Ea =1.0 pu per phase. The magnitudes of fault currents for a L-G, LL, LL-G faults at the terminals of the generator are 5.0 pu, 3.464 pu and 5.454 pu respectively. If a LLL-G fault occurs at the terminals of the generator, determine the fault current. ***(05)***

2A. A 50 Hz, 4 Pole turbo generator rated 20 MVA, 11 kV has an inertia constant of H = 9 kW.second/kVA. Find the kinetic energy stored in the rotor at synchronous speed. Find the acceleration, if the input less the rotational losses is 26800 HP and the electrical power developed is 16 MW. ***(02)***

2B. A 2220 MVA, 24 kV and 60 Hz synchronous machine is connected to an infinite bus through transformer and double circuit transmission line, as shown in the following figure. The infinite bus voltage V =1.0 pu. The direct axis transient reactance of the machine is 0.3 pu, transformer reactance is 0.2 pu, and the reactance of each transmission line is 0.3 p.u., all to a base of the rating of the synchronous machine. Initially, the machine is delivering 0.8 pu real power and reactive power is 0.074 pu with a terminal voltage of 1.0 pu. The inertia constant H = 5 MJ/MVA. All resistances are neglected.

(i) A temporary three-phase fault occurs at the sending end of one of the lines. When the fault is cleared, both lines are intact. Determine the critical clearing angle and the critical fault clearing times.

(ii) A three-phase fault occurs at the middle of one of the lines, fault is cleared, and the faulted line is isolated. Determine the critical clearing angle. ***(03)***

2C. The bus voltages of the network shown in Fig.2C are $V_1 = 1.02\angle 0°, V_2 = 1.0329\angle 3.917°$ and $V_3 = 0.9744\angle 1.7285°$. Obtain the active and reactive power losses in all the three lines and power supplied by generator G1.

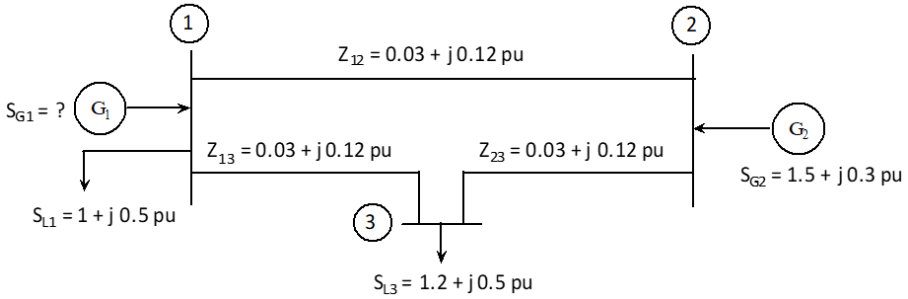

Fig 2.C ***(05)***