Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE-UP EXAMINATIONS, DECEMBER 2018

SUBJECT: POWER SYSTEM ANALYSIS [ELE 3105]

Date: 30 December 2018 **Time : 3 Hours** **Max. Marks: 15**

Instructions to Candidates:

- Answer **ALL** the questions.

1A Draw the impedance diagram for the power system is as shown in Fig 1A. Bus 2 is loaded with 50 MVA, at 11 KV with load power factor of 0.8 lag. A three phase fault occurs at Bus 2. Find a) fault current and b) generator bus voltage. Consider 50 MVA and 11KV as the base values in the load circuit.

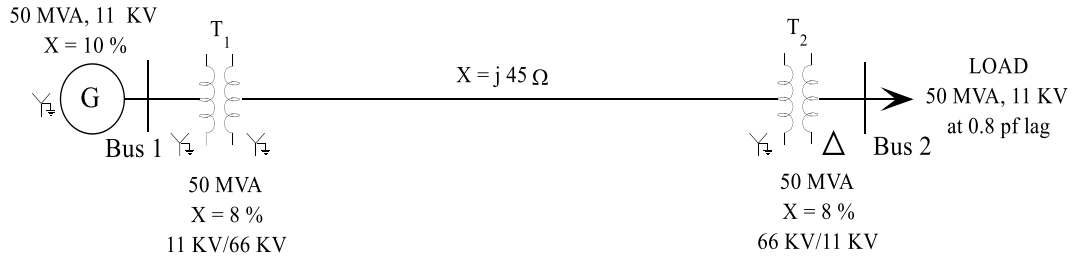

Fig 1 A

(06)

1B Draw and explain the per unit representation of three winding transformer. ***(04)***

2A Distinguish between the momentary current and interrupting current of a circuit breaker. ***(02)***

2B A generator is connected through a transformer to a synchronous motor. On a common base the per unit sub-transient reactance of the generator and motor are 0.15 and 0.35 respectively. The leakage reactance of the transformer is 0.1 per unit. A 3 phase fault occurs at the terminals of the motor, when the terminal voltage of the generator is 0.9 p.u. and the output current is 1.0 p.u. at 0.8 p.f. leading. Find the fault currents in the generator and motor. Use terminal voltage of the generator as the reference phasor and obtain the solution by

i). Method of internal voltages
ii). Using Thevenin's theorem. ***(08)***

3A Derive expressions for the sequence components of the fault current for a double line to ground fault on an unloaded generator. Draw the sequence networks connection. ***(04)***

3B A 20 MVA, 13.8 kV generator has X"=25%, X_2=35% and X_0=10%. Determine the sub-transient current in the generator and the line to line voltages for sub-transient conditions when a single line to ground fault occurs at the generator terminals with the generator operating unladed at rated voltage. Neglect resistance. Draw the relevant sequence network connection. ***(06)***

4A For the power system shown in fig 4A, a three phase fault is applied at the point P as shown. Find the critical clearing angle for clearing the fault with simultaneous opening of the breakers 1 and 2. The reactance values of various components are indicated on the diagram. The generator is delivering 1.0 pu power at the instant preceding the fault.

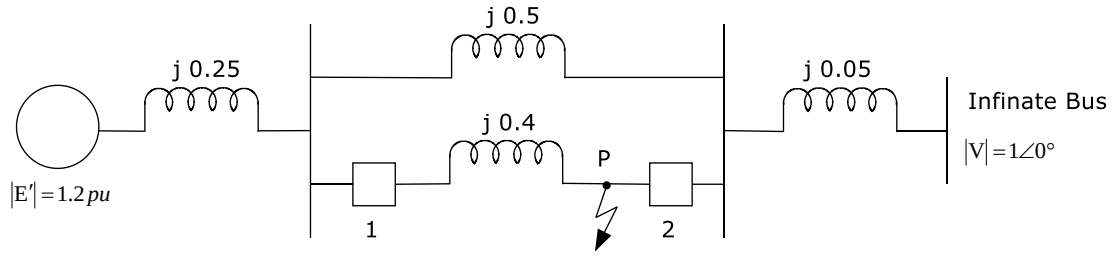

Fig 4A ***(05)***

4B In the power system shown in Fig.4B, the line impedances are marked in per unit on a 100MVA base. Using the Gauss-Seidel method, determine the voltage at the buses 2 and 3 and use two iterations.

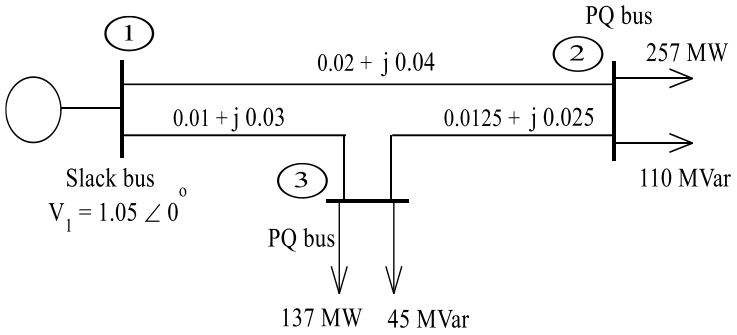

Fig. Q.4B

(05)

5A Using matrix algebra, eliminate node-3 in the network shown in Fig. 5A and draw the reduced network. The values on figure represent reactances in p.u on a common base.

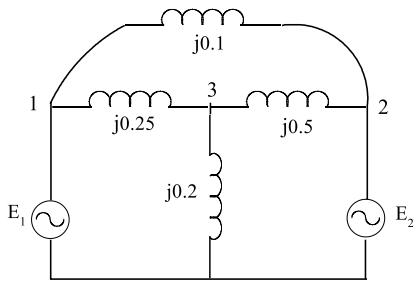

Fig 5A ***(04)***

5B Obtain the voltage of bus-2 for two bus power system network after one iteration using Newton-Raphson method. Assume bus-1 is slack bus with voltage of $1.0\angle 0^0$pu and initial voltage of bus-2 as $0.85\angle -15^0$pu. The scheduled loads at bus-2 are (0.45+j0.15)pu and line impedance connecting buses is (0.1+j0.5)pu. ***(06)***