Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

V SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS NOV/DEC 2016

SUBJECT: POWER SYSTEM ANALYSIS [ELE 3105]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 03 December 2016** **MAX. MARKS: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- Graph sheets shall be supplied, if required.

1A. The single line diagram of a two machine system is as shown in Fig.Q1A. Draw the impedance diagram of the system choosing a base of 11.5 kV, 60 MVA in the motor circuit. The transformer T_2 comprises of 3 single phase units each rated 15 MVA, 11/127 kV and 10% reactance. ***(07)***

1B. Define the following as applied to the rating of a Circuit Breaker:
(i) Momentary current and (ii) Interrupting current.
Mention suitable multiplication factors to determine the above currents in terms of respective symmetrical currents. ***(03)***

2A. A synchronous generator and synchronous motor both rated 25 MVA, 11 kV have transformers rated 25 MVA, 11/66 kV connected at their terminals. The two transformers are linked by a transmission line operating at 66 kV. Subtransient reactance of generator and motor are 15% each, transformers have leakage reactance of 10% each and line reactance is 12%. The motor is drawing 15 MW, 0.8 pf lagging with a terminal voltage of 10.6 kV. When a symmetrical three phase fault occurs at motor terminals, determine the voltage behind transient for generator and motor. Hence obtain subtransient currents in generator, motor and fault. ***(05)***

2B. A generator has E_a =1.0 pu and the magnitudes of the fault currents for L-G, LL, LL-G faults are 5.0, 3.464 and 5.454 respectively. Determine the fault current for LLL-G fault. ***(05)***

3A. The motor shown in Fig.Q3A is receiving 12 MW at 0.8 pf lagging at a terminal voltage of 6 kV. A single line to ground fault occurs at the middle of one of the lines. Determine the fault current in per unit using generator rating as common base. ***(07)***

3B. Derive expressions for the sequence components of the fault current for a LL fault on an unloaded generator. ***(03)***

4A. A 20MVA, 50Hz generator delivers 20MW over a double circuit line to an infinite bus. The generator has kinetic energy of 2.52MJ/MVA at rated speed. The generator transient reactance is 0.4 pu. Each line has a reactance of 0.3 pu on a 20MVA base. Magnitudes of E=1.1 pu and V= 1.0 pu. A three phase fault occurs at the midpoint of one of the transmission lines. Plot swing curve up to 0.3 sec.. Step size = 0.05 sec. Assume fault is sustained. ***(08)***

4B. Derive Swing equation of a generator from fundamentals, swinging with respect to an infinite bus. ***(02)***

5A. Using matrix algebra, eliminate node-3 in the network shown in Fig.Q5A and draw the reduced network. Values on figure represent voltages, currents and reactances in p.u on a common base. ***(03)***

5B. Solve the equation $x^3 - 64 = 0$ using Newton Raphson method and x(0)=3. Show the calculations for two iterations. ***(02)***

5C. The one line diagram of a power system is shown in Fig.Q5C. The transmission line reactances are marked on 100 MVA base. Using Gauss-Seidal method, determine the slack bus real and reactive power generation at the end of first iteration. ***(05)***

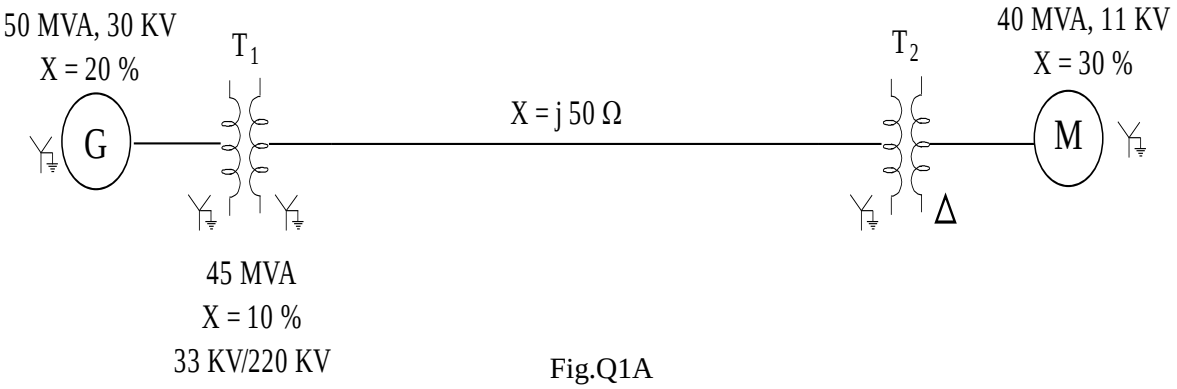

Fig.Q1A

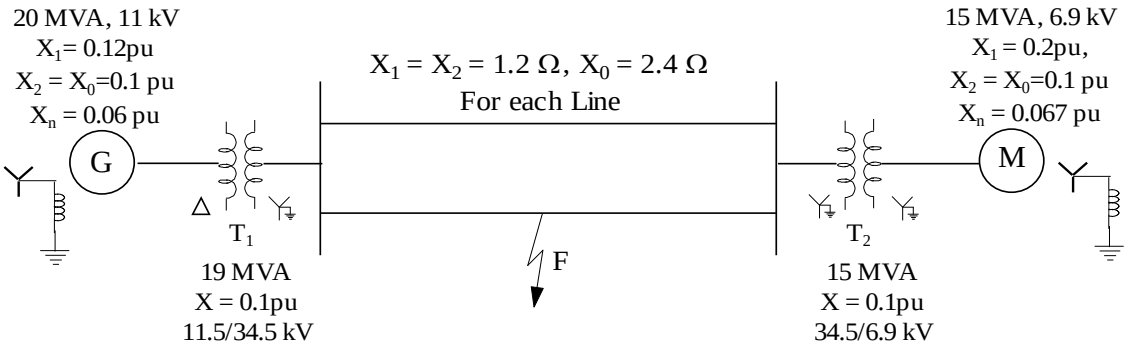

Fig. Q3A

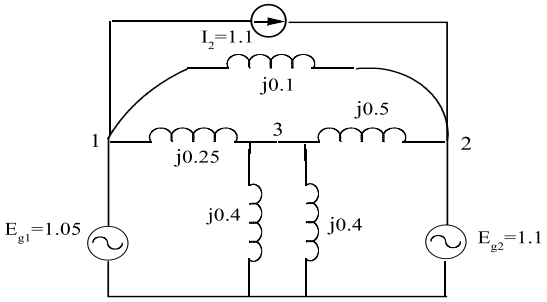

Fig Q5A

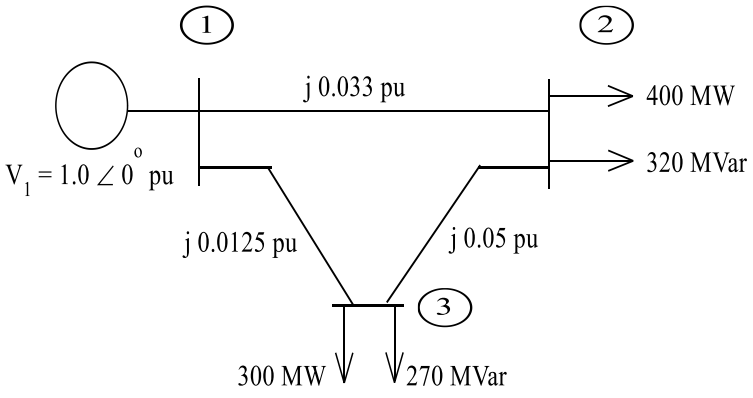

Fig Q5C