ELL203: Major

Time: 120 min

Max. Marks: 50

Note: Mention the constants and other data used in the computations.

1. A 440 V, 4-pole delta-connected 50 Hz, three-phase induction motor has a full-load slip of 5 percent, an efficiency of 90%, and a power factor of 0.87 lagging. At starting, the motor develops 1.5 times the full-load torque but draws 7.0 times the rated current at the rated voltage. This induction motor is to be started with an autotransformer reduced voltage starter. Assume rated power output of the motor is 100 kW. (A) What should the output voltage of the starter circuit be to reduce the starting torque until it equals the rated torque of the motor? (B) What will the motor starting current and the current drawn from the supply be at this voltage? (10)

2. The following test data are obtained for a 3-phase 200 MVA, 11 kV, 50 Hz star-connected synchronous machine.

I_f (A)	100	150	300	450	600	750	900	1050
V-line (kV)	2.5	3.5	7.0	8.0	10.0	11.0	11.8	12.5
Short-ckt-current (A)	733	1100	2199	3298	4398	5500	-	-

(A) Determine the per-unit saturated synchronous reactance, and (B) the field current required if the synchronous machine is to deliver 100 MVA at rated voltage at 0.8 leading pf. (10)

3. A 75 kVA transformer (Tr-A) is to be connected in parallel with a 200 kVA transformer (Tr-B). Both transformers have a turns ratio equivalent to their 2400/240 V, and are operated in step-down mode. The percentage impedances of transformers (based on individual transformer ratings) are: Tr-A: $3.56\lfloor 62.57^0$; Tr-B: $4.177\lfloor 74.73^0$. Determine the kVA rating of the bank without overloading any one of the transformer. (10)