

國立臺灣科技大學

九十一學年度博士班招生考試試題

系所組別：電機工程系甲組

科目：電力工程

(共六題，總分 100 分)

1. A 20-kVA, 20000/480-V, 60-Hz distribution transformer is tested with the following results:

Open-circuit test (Measured from low voltage side)	Short-circuit test (Measured from high voltage side)
Voltage $V_{oc} = 480$ V	Voltage $V_{sc} = 1130$ V
Current $I_{oc} = 1.51$ A	Current $I_{sc} = 1.00$ A
Power $P_{oc} = 271$ W	Power $P_{sc} = 260$ W

- (a) Find the per-unit equivalent circuit for this transformer at 60 Hz. (10%)
- (b) What would the rating of this transformer be if it was operated on a 50-Hz power system? (5%)
2. A 25-kW 125-V separately excited dc machine is operated at a constant speed 3000 r/min with a constant field current such that the open-circuit armature voltage is 125 V. The armature resistance is  $0.02\Omega$ . Compute the armature current, terminal power, and electromagnetic torque when the terminal voltage is 128 V. (15%)
3. A three-phase Y-connected 480-V (line-to-line), 20-kW, 60-Hz four-pole induction motor has the following equivalent-circuit constants in ohms per phase referred to the stator:
- $$R_1 = 0.21 \quad R_2 = 0.20 \quad X_1 = 1.2 \quad X_2 = 1.1 \quad X_M = 39$$
- The total friction and core losses may be assumed constant at 1340 W. The motor is connected directly to a 480-V, 60-Hz ac source. Compute the shaft speed in r/min, shaft output torque in N-m, efficiency, and input power factor for slip of 2 percent. (20%)



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4. A three-phase transmission line is 300 miles long and serves a load of 400 MVA, 0.8 lagging-power factor at 345 kV. The  $ABCD$  constants of the line are

$$A = D = 0.8180 \angle 1.3^\circ$$

$$B = 172.2 \angle 84.2^\circ \text{ ohm} \quad C = 0.001933 \angle 90.4^\circ \text{ mho}$$

- (a) Determine the sending-end line-to-neutral voltage, the sending-end current and the percent voltage drop at full load.
- (b) Determine the receiving-end line-to-neutral voltage at no load, the sending-end current at no load, and the voltage regulation. (20 %)
5. A salient-pole synchronous generator has  $X_d = 1.0$  and  $X_q = 0.6$ . It operates at rated condition with a  $pf = 0.8$  lagging. All values are in per unit on generator bases.
- (a) Find  $E_f$  and  $\delta$ .
- (b) Calculate  $P$  and  $Q$  by power equation.
- (c) Calculate  $P_{max}$ . (15 %)
6. Discuss briefly how do the factors listed of the over-current relays affect high voltage circuit breaker operation during relay coordination setting process in relay scheme: (a)time dial, (b)current tap, (c)CT ratio. (15 %)

