

University Electrical Engineering

Name: _____ Score: _____

1. A coil gives 150 At of magnetomotive force round a core of reluctance 75 000 At/Wb. What is the flux, in mWb?

_____ mWb

2. A DC motor has $k\Phi = 2 \text{ V} \cdot \text{s}$ and draws 30 A of armature current. What torque does it make, in N · m?

_____ N · m

3. What is the synchronous speed of a 2-pole motor on 60 Hz, in rpm?

_____ rpm

4. A 2-pole generator feeds a 50 Hz grid. At what speed does it turn, in rpm?

_____ rpm

5. The study uses 100 MVA and 33 kV. What is the base impedance, in Ω ? Give 2 decimal places.

_____ Ω

6. The slack bus has a fixed real power, set before the power flow is solved.

☐ True ☐ False

7. A buck designed for CCM has $\Delta I_L = 0.29 \text{ A}$. The load falls to 0.1 A. What happens?

- ☐ Nothing; $V_{\text{out}} = D \cdot V_{\text{in}}$ always holds
- ☐ The ripple current doubles
- ☐ It enters discontinuous conduction and V_{out} rises above $D \cdot V_{\text{in}}$
- ☐ V_{out} falls to zero

8. The 0.5 mm gap adds four times the core's reluctance. What happens to the flux for the same coil current?

- ☐ It falls to one quarter
- ☐ It falls to one fifth
- ☐ It stays the same, because the gap is tiny
- ☐ It falls by 4%

9. A series motor can safely run with no load on its shaft.

☐ True ☐ False

10. Doubling the rotor resistance doubles the breakdown torque.

☐ True ☐ False

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1. **2 mWb**

$$\Phi = F/R_m = 150/75\,000 = 0.002 \text{ Wb} = 2 \text{ mWb.}$$

2. **60 N · m**

$$T = k\Phi I_a = 2 \times 30 = 60 \text{ N} \cdot \text{m.}$$

3. **3600 rpm**

$$n_s = 120 \times 60/2 = 3600 \text{ rpm.}$$

4. **3000 rpm**

$$n_s = 120 \times 50/2 = 3000 \text{ rpm, exactly, with no slip.}$$

5. **10.89 Ω**

$$Z_{base} = 33^2/100 = 10.89 \text{ } \Omega \text{ (kV squared over MVA gives ohms).}$$

6. **False**

The slack bus fixes the voltage and angle. Its power is whatever the loads plus the losses need, and it is known only after solving.

7. **It enters discontinuous conduction and V_{out} rises above $D \cdot V_{in}$**

The boundary is $\Delta I_L/2 = 0.145 \text{ A}$. Below it the inductor current reaches zero each cycle, and the simple formula no longer holds.

8. **It falls to one fifth**

The total reluctance becomes $1 + 4 = 5$ times the core alone, so the flux is one fifth: 1.005 mWb becomes 0.201 mWb.

9. **False**

Its flux comes from the armature current. With no load the current, and so the flux, is small, and the speed rises until something fails.

10. **False**

The peak height does not depend on R'_2 . More rotor resistance only moves the peak to a larger slip, which raises the starting torque.