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 $k\Phi = 2$ V · 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 $\Delta I_L = 0.29$ A. The load falls to 0.1 A. What happens?

   ☐ Nothing; V_out = D · V_in always holds

   ☐ The ripple current doubles

   ☐ It enters discontinuous conduction and V_out rises above D · V_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

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☐ True ☐ False

1. **2 mWb**

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

2. **60 N · m**

   $T = k\Phi I_a = 2 \times 30 = 60$ N · m.

3. **3600 rpm**

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

4. **3000 rpm**

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

5. **10.89 Ω**

   $Z_{base} = 33^2/100 = 10.89\ \Omega$ (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 · V_in**

   The boundary is $\Delta I_L/2 = 0.145$ 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.

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