1. General Aptitude

Question:
The digit in the unit's place of the product 3999 × 71000 is?

Solution:
The unit digit of 3999 is 9, and the unit digit of 71000 is 0.
Therefore, the unit digit of the product is 9 × 0 = **0**.

---

2. Network Theory

Question:
In a series R-L circuit, the impedance is given by Z = R + jωL. If R = 10 Ω and L = 0.5 H, what is the impedance at ω = 100 rad/s?

Solution:
Z = R + jωL = 10 + j(100)(0.5) = 10 + j50.
Magnitude of Z = √(10² + 50²) = √(100 + 2500) = √2600 ≈ **51.0 Ω**.

---

3. Control Systems

Question:
For a unity feedback system with open-loop transfer function G(s) = 10/(s+2), what is the system's steady-state error for a unit step input?

Solution:
Type of system = 0 (no integrator).
Steady-state error for step input e_ss = 1 / (1 + K_p), where K_p is the position error constant.
K_p = lim(s→0) [G(s)] = 10/2 = 5.
e_ss = 1 / (1 + 5) = 1/6 ≈ **0.167**.

---

4. Power Systems

Question:
In a 3-phase system, if the line-to-line voltage is 400 V, what is the line-to-neutral voltage?

Solution:
Line-to-neutral voltage = Line-to-line voltage / √3 = 400 / √3 ≈ **230.9 V**.

---

5. Electrical Machines

Question:
A 4-pole, 50 Hz induction motor operates at a slip of 0.02. What is the rotor speed?

Solution:
Synchronous speed, N_s = 120f / P = (120 × 50) / 4 = 1500 rpm.
Rotor speed, N_r = N_s × (1 - s) = 1500 × (1 - 0.02) = 1500 × 0.98 = **1470 rpm**.

---

6. Signals and Systems

Question:
The Laplace transform of f(t) = e^(-2t)u(t) is?

Solution:
L{f(t)} = 1 / (s + 2), where u(t) is the unit step function.

---

7. Power Electronics

Question:
In a half-wave controlled rectifier with a resistive load, the average output voltage is?

Solution:
$V_{avg} = (V_m / \pi) \times (1 + \cos(\alpha))$, where V_m is the maximum voltage and α is the firing angle.
For $\alpha = 0°$, $V_{avg} = V_m / \pi$.

---

8. Electromagnetic Fields

Question:
The electric field intensity at a point 2 m away from a 10 μC point charge is?

Solution:
$E = kQ / r^2 = (9 \times 10^9) \times (10 \times 10^{-6}) / (2)^2 = 2250$ N/C.

---

9. Analog Electronics

Question:
In a common-emitter amplifier, if the voltage gain is 50 and the input voltage is 0.1 V, what is the output voltage?

Solution:
V_{out} = Voltage gain × $V_{in} = 50 \times 0.1 =$ **5 V**.

---

10. Digital Electronics

Question:
The Boolean expression A + AB simplifies to?

Solution:
A + AB = A(1 + B) = A × 1 = **A**.
