

Easy

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A transformer has core loss = 500 W and full-load copper loss = 500 W. 1. Maximum efficiency occurs at full load condition. 2. At half load, copper loss becomes 125 W.

A

1, 2 and 3 only

B

1, 2, 3 and 4

Correct

C

2 and 3 only

D

1, 2 and 4 only

Correct Answer: B

Full Detailed Explanation

Correct Answer: B - 1, 2, 3 and 4 Quick Concept Explanation At x p.u. load, transformer output is proportional to x while copper loss is proportional to x^2 and iron loss remains approximately constant. The given losses make the maximum-efficiency load $x = \sqrt{500/500} = 1$ p.u. Every statement follows numerically, so B is correct. Key relation: $P_{cu}(x) = x^2 P_{cu,FL}$. Here $P_{cu}(0.5) = 0.25 \times 500 = 125$ W. Maximum efficiency: $x = 1$. Exam focus: If core loss equals full-load copper loss, maximum efficiency is at full load - an instant result. Common trap: Scaling copper loss linearly with load instead of with load squared. Statement-wise Verification Statement 1 - Correct. Maximum efficiency occurs at full load condition. Maximum efficiency occurs when $P_{cu} = P_i$; this equality is given at full load. Statement 2 - Correct. At half load, copper loss becomes 125 W. Copper loss scales with current/load squared, so at 0.5 load it is $0.5^2 \times 500 = 125$ W. Statement 3 - Correct. Efficiency at half load is lower than full load efficiency. Full load is the maximum-efficiency operating point in this case, so moving to half load gives lower efficiency (for the same power factor assumption). Statement 4 - Correct. Condition for maximum efficiency is that copper loss equals core loss. If core loss equals full-load copper loss, maximum efficiency is at full load - an instant result. Core