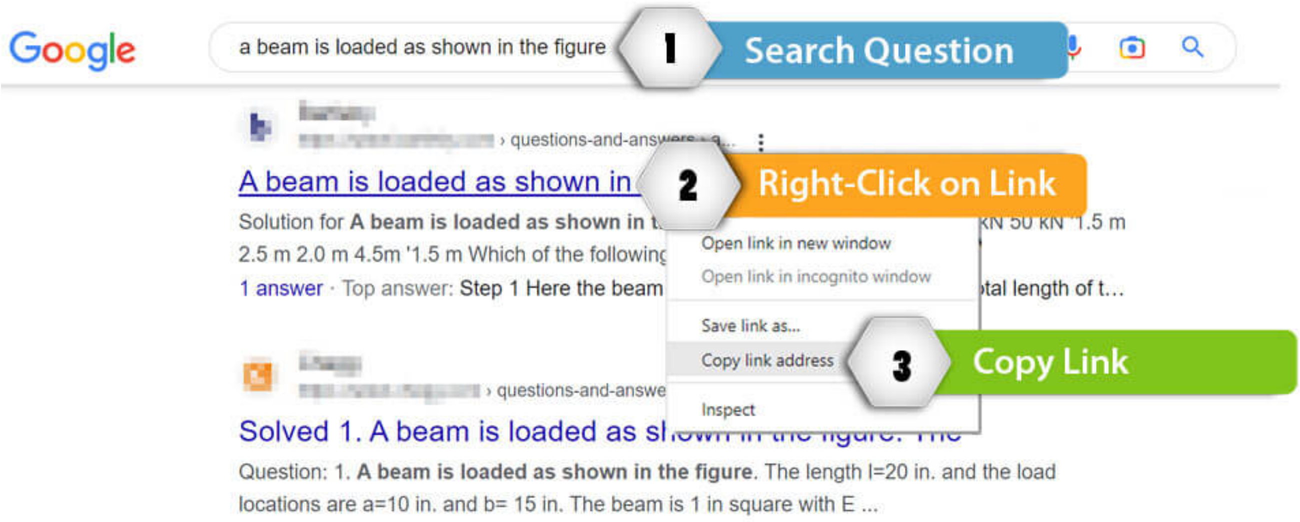
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Solution for A beam is loaded as shown in t
kN 50 kN '1.5 m
2.5 m 2.0 m 4.5m '1.5 m Which of the following
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Solved 1. A beam is loaded as sl
Question: 1. A beam is loaded as shown in the figure. The length l=20 in. and the load
locations are a=10 in. and b= 15 in. The beam is 1 in square with E ...

Answer

solution:- Given $P=4$, $f=50\,Hz$ $V=400\,V$ Turns ratio $=\frac{N_2}{N_1}=\frac{1}{4}$

$N=1455$ rpm, $R_2=0.3\,\Omega$ $X_2=1\,\Omega$.

stator loss $=100\,W$, Mech loss $=50\,W$. (Friction and windage loss)

(i) stator Induced emf per phase,

$$E_1=V_L=400\,V \text{ (delta Connected)}.$$

$$\text{Now, } \frac{E_2}{E_1}=\frac{N_2}{N_1}=\frac{1}{4}$$

Blocked rotor voltage per phase

$$E_2=\frac{400}{4}=100\,V.$$

(ii) $N_S=\frac{120f}{P}=\frac{\overset{30}{\cancel{120}}\times 50}{\cancel{4}}=1500$ rpm

$$\text{slip}(S)=\frac{N_S-N_r}{N_S}=\frac{1500-1455}{1500}=\frac{45}{1500}=0.03$$

$$\text{Rotor Current, } I_2=\frac{SE_2}{\sqrt{R^2+(SX_2)^2}}$$

$$=\frac{0.03\times 100}{\sqrt{(0.3)^2+(0.03\times 1)^2}}$$

$$\boxed{I_2=9.95\,A}$$

(iv) Rotor copper loss $=3I_2^2R_2=3\times 9.95^2\times 0.3=89.10\simeq 89\,W.$

(iii) Power Input to rotor $=\frac{\text{Rotor Copper loss}}{\text{slip}}=\frac{89}{0.03}$

$$=2966.66\simeq 2967\,W.$$

(iii) Input to the motor = Rotor input loss + stator loss

$= 2967 + 100 = 3067 W.$

output at the shaft = Rotor input − Rotor copper loss − Mech loss (friction and windage loss)

$= 2967 - 89 - 50 = 2828 W.$

(v) Efficiency $= \frac{\text{Output}}{\text{Input}} \times 100 = \frac{2828}{3067} \times 100 = 92.2\%$

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