

# EEE 3352

## Electromechanics & Electrical Machines



## Lecture 5: Examples

## Examples:

5.1

For the generator shown in the caption (slip ring output),  $ab = cd = 20 \text{ cm}$  and assume a uniform magnetic field  $B = 0.5 \text{ T}$ . For a peripheral speed of the coil sides of  $12 \text{ m/s}$ , what is the maximum voltage appearing at the slip rings?


$$l = 20\text{cm}; B = 0.5 \text{ T}, u = 12 \text{ m/s}$$

$$V_{in} = "Blu" = B(2l)u = 0.5 \times (2 \times 0.2) \times 12 = \underline{\underline{2.4 \text{ V}}}$$



## 5.2

A 60-kW, 4-pole generator has a lap winding placed in 48 armature slots, each slot containing 6 conductors. The pole flux is 0.08 Wb and the speed of rotation is 1040 r/min

$$P = 60 \text{ kW}, Z_s = 48, N = 6, \phi = 0.08 \text{ Wb}, n = 1040 \text{ r/min}$$



a) what is the generated voltage?

$$V = \frac{2pZ}{c} n\phi \quad c = 2p$$

$$V = \frac{2 \times 2 \times (48 \times 6)}{2 \times 2} \times \frac{1040}{60} \times 0.08 = \underline{\underline{400 \text{ V}}}$$

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- b) what is the current flowing in the armature conductors when the generator delivers full load?

$$I = \frac{P}{V} = \frac{60 \times 10^3}{400} = 150 \text{ A} \quad \rightarrow \text{supply}$$

# of parallel paths =  $2p = 4$

$$I_{\text{conductor}} = \frac{150}{4} = \underline{\underline{37.5 \text{ A}}}$$



### 5.3

The armature of a dc motor has 320 conductors, only 70% of which lie directly under poles, where the flux density is 1.1 T. The armature diameter is 26 cm and its length is 18 cm. The conductor current is 12 A.

$$Z_{total} = 320, 70\% \text{ under poles}, B = 1.1 \text{ T},$$

$$R = 26/2 = 13 \text{ cm}, l = 18 \text{ cm}, I = 12 \text{ A}$$



Find

a) the total force created by the conductors

$$F = Bli = 1.1 \times 0.18 \times 12 = 2.376 \text{ N}$$

For 320 conductors, with 70 % effective

$$F_{\text{total}} = 2.376 \times 320 \times \frac{70}{100} = \underline{\underline{532 \text{ N}}}$$



Find

b) the shaft torque developed

$$T = F \cdot R = 532 \times 0.13 = \underline{\underline{69.2 \text{ Nm}}}$$