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Continuing Education Course #630
Motors/Generators and the NEC:
Course II: AC Rotating Machinery

1. What is NOT one of the benefits of a wye connected three-phase motor?

- a. higher order harmonic terms are shorted
- b. neutral ground part of circuit
- c. starting current is higher, thus more torque
- d. starting current is lower

2. What is the phase voltage of a wye-connected motor with a terminal voltage of 208 V?

- a. 70 V
- b. 120 V
- c. 208 V
- d. 220 V

3. What most nearly is the torque supplied by a 200 Hp motor turning at 1800 rpm?

- a. 105 ft-lbf
- b. 180 ft-lbf
- c. 220 ft-lbf
- d. 584 ft-lbf

4. The service factor on the nameplate of a small motor is 1.4.

What is most nearly the safe load on the given motor in W?

- a. 2.8 W
- b. 745 W
- c. 1050 W
- d. 2100 W

5. What motor classification means a motor can handle up to 211°F?

- a. Class A
- b. Class B
- c. Class F
- d. Class H

6. An old single-phase generator has four poles. The armature is simplex lap wound and has a total of 240 armature conductors. The effective armature length and radius are 16.7 cm and 5 cm, respectively. The armature rotates at 1800 rpm.

What is most nearly the horsepower of the driving motor if the rated output is 1 kW and the conversion efficiency is 90%?

- a. 0.75 hp
- b. 0.85 hp
- c. 1.12 hp
- d. 1.5 hp

7. A small 120V transformer has a voltage regulation specification of 4%.

What is most nearly the full load voltage?

- a. 114 V
- b. 115 V
- c. 119 V
- d. 130 V

8. What is the full-load phase current drawn by a 440 V (rms), 20 hp (per phase) induction motor having a full-load efficiency of 86% and a full-load power factor of 76%?

- a. 7 A
- b. 40 A
- c. 45 A
- d. 52 A

9. A no-loaded shunt-wired generator has a terminal (line) current of _____ and an armature current equal to the _____ current.

- a. 0 A / I_f
- b. I_f / 0 A
- c. I_f / I
- d. I_a / 0 A

10. The induced voltage in a machine is commonly called the _____ force.

- a. armature
- b. output
- c. electromotive
- d. resultant

11. An old single-phase generator has four poles. The armature is simplex lap wound and has a total of 240 armature conductors. The effective armature length and radius are 16.7 cm and 5 cm, respectively. The armature rotates at 1800 rpm.

If the uniform magnetic flux density per pole is 1.0 T, what is most nearly the maximum voltage induced?

- a. 60 V
- b. 120 V
- c. 378 V
- d. 440 V

12. What is the rotational speed of a 24-pole alternator that produces a 60 Hz sinusoid?

- a. 300 rpm
- b. 600 rpm
- c. 1800 rpm
- d. 3600 rpm

13. A two-pole alternator produces a 60 Hz potential.

What is the angular velocity of the 60 Hz potential and the angular velocity of the armature?

- a. 377 rad/s / 188.5 rad/s
- b. 188.5 rad/s / 377 rad/s
- c. 188.5 rad/s / 188.5 rad/s
- d. 377 rad/s / 377 rad/s

14. The rotor of a single-phase, two-pole alternator rotates at 2400 rpm. The effective diameter and length of the 20-turn (loop) coil are 0.12 m and 0.24 m, respectively. The magnetic flux density is 1.2 T.

What most nearly is the effective voltage produced?

HINT: See Table 1

- a. 120 V
- b. 240 V
- c. 420 V
- d. 440 V

15. What reason(s) are large alternators usually designed with rotating magnetic fields?

- a. easier connections through slip rings
- b. lower voltages on rotating windings
- c. less structural bracing
- d. all of the above

16. A six-pole motor is connected to a three-phase, 240 V (rms), 60 Hz line. Its stator windings are connected in a wye configuration. The motor has a synchronous reactance of 2 Ω per phase and is rated at 20 kVA at its synchronous speed and 100% power factor.

What is most nearly the line current?

- a. 4.0 A
- b. 5.0 A
- c. 36 A
- d. 72 A

17. A six-pole motor is connected to a three-phase, 240 V (rms), 60 Hz line. Its stator windings are connected in a wye configuration. The motor has a synchronous reactance of 2 Ω per phase and is rated at 20 kVA at its synchronous speed and 100% power factor. Assume the current per phase is 36 A.

What is most nearly the voltage drop across each winding?

- a. 70 V
- b. 80 V
- c. 120 V
- d. 220 V

18. A six-pole motor is connected to a three-phase, 240 V (rms), 60 Hz line. Its stator windings are connected in a wye configuration. The motor has a synchronous reactance of 2 Ω per phase and is rated at 20 kVA at its synchronous speed and 100% power factor. Assume the current per phase is 36 A and the voltage per phase is 72 V.

What is most nearly the generated back emf?

HINT: Rearrange Eq. 26

- a. 100 V $\angle 45^\circ$
- b. 120 V $\angle 45^\circ$
- c. 240 V $\angle 0^\circ$
- d. 240 V $\angle 45^\circ$

19. An induction motor operates at a synchronous speed of 1800 rpm with the rotor turning at 1750 rpm during loading.

What most nearly is the slip in percent?

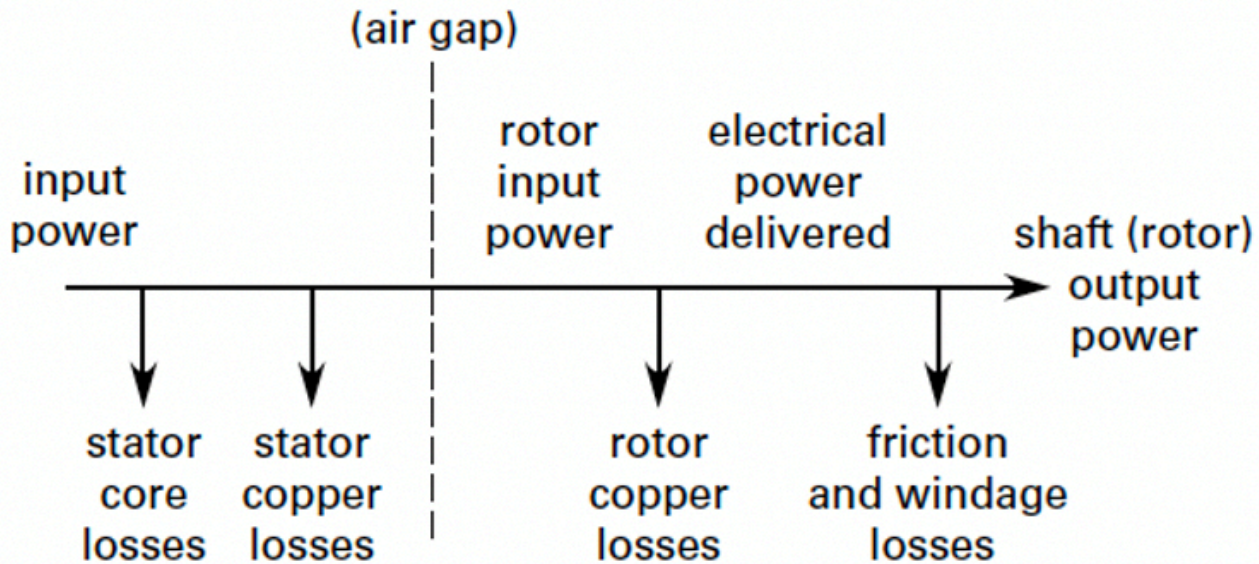
- a. 1%
- b. 2%
- c. 3%
- d. 5%

20. A 200 hp, three-phase, four-pole, 60 Hz, 440 V (rms) squirrel-cage induction motor operates at full load with an efficiency of 85%, a power factor of 91%, and 3% slip.

What is most nearly the torque developed?

- a. 60 ft-lbf
- b. 580 ft-lbf
- c. 600 ft-lbf
- d. 3800 ft-lbf

21. For an induction motor the following represents the process.



Which of the losses shown is constant?

- a. core losses
- b. copper losses
- c. friction losses
- d. windage losses

22. What is the major difference in operating characteristics between a capacitor-start motor versus a split-phase motor?

- a. greater starting torque
- b. less running torque
- c. fewer windings
- d. less cost

23. What is a disadvantage of single-phase motors in general?

- a. cost
- b. operation

- c. theory
- d. vibration

24. How would one recognize a shaded-pole motor from a visual inspection?

- a. copper rings
- b. salient poles
- c. slip rings
- d. rotor

25. What type of motor can operate on AC or DC and have a high-starting torque?

- a. commutator
- b. hysteresis
- c. reluctance
- d. universal

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