This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Doubly Excited Magnetic Systems".

1. Which of the following are examples of doubly-excited magnetic systems?
a) Synchronous Machines
b) Loudspeakers and Tachometers
c) D.C Shunt Machines
d) All of the mentioned

Answer: d
Explanation: All of the above applications require two independent sources of excitation.

2. Most of the electromagnetic energy conversion devices belong to ___________
a) singly excited magnetic systems
b) doubly excited magnetic systems
c) multiply excited magnetic systems
d) both doubly excited magnetic systems and multiply excited magnetic systems

Answer: d
Explanation: Widely used motor/generators such as synchronous and induction machines belong to doubly excited systems, and many other practical applications require multiply excited magnetic systems.

3. In a doubly excited magnetic system with salient pole type stator and rotor, if the rotor is not allowed to move, then the equation for magnetic field stored energy in establishing the currents from zero to i_s and i_r is ___________

a) $W_{fld} = 1/2\, i_s^2 L_s + 1/2\, i_r^2 L_r$

b) $W_{fld} = 1/2\, i_s^2 L_s + M_{rs} i_s i_r$

c) $W_{fld} = 1/2\, i_s^2 L_s + 1/2\, i_r^2 L_r + M_{rs} i_s i_r$

d) $W_{fld} = 1/2\, i_r^2 L_r + M_{rs} i_s i_r$

Answer: c
Explanation: As the rotor is not allowed to move, $dW_{mech} = 0$, thus $dW_{elec} = 0 + dW_{fld} = i_s\, d\Psi_s + i_r\, d\Psi_r$, if in this equation, we introduce the self and mutual inductance terms, ($\Psi_s = L_s i_s$) and integrate the resulting equation from 0 to i_s, 0 to i_r and 0 to $i_r i_s$, the respective terms, finally we get $W_{fld} = 1/2\, i_s^2 L_s + 1/2\, i_r^2 L_r + M_{rs} i_s i_r$.

4. In a doubly excited magnetic system of salient pole stator and rotor, the magnetic torque (T_e) depends on which of the following statements?

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(i) the instantaneous values of currents is and ir
(ii) the angular rate of change of inductances
(iii) the differential changes of current dis and dir
(iv) only the instantaneous values of self inductance
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a) (i), (iii)
b) (i), (ii)
c) (iii), (iv)
d) (i), (iv)

Answer: b
Explanation: $T_e = 1/2 i_s^2\, dL_s/d\theta_r + 1/2 i_r^2\, dL_r/d\theta_r + i_s i_r\, dM_{sr}/d\theta_r$.

5. In a doubly excited magnetic systems, the magnetic torques and forces act in such a direction as to tend to ____________
a) decrease the field energy at constant currents
b) decrease the field co-energy at constant currents

c) increase the field energy at constant currents
d) none of the mentioned

Answer: c

Explanation: $T_e = \partial W_{fld}(i_s, i_r, \theta_r)/\partial\theta_r = \partial W_{fld}^1(i_s, i_r, \theta_r)/\partial\theta_r$

$f_e = \partial W_{fld}(i_s, i_r, x)/\partial x = \partial W_{fld}^1(i_s, i_r, x)/\partial x$

The positive sign in the formula indicates that force/torque acts in a direction as to tend to increase both field energy and co-energy.

6. In a doubly excited magnetic system of salient pole type stator and rotor, the reluctance torque is present only when ______________
a) both stator and rotor currents are acting
b) stator current is acting alone
c) rotor current is acting alone
d) any of the stator or rotor currents acting alone

Answer: d

Explanation: Equation for magnetic torque is $T_e = 1/2 i_s^2 dL_s/d\theta_r + 1/2 i_r^2 dL_r/d\theta_r + i_s i_r dM_{sr}/d\theta_r$, if $i_r = 0$, $T_e = 1/2 i_s^2 dL_s/d\theta_r$ and if $i_s = 0$, then $T_e = 1/2 i_r^2 dL_r/d\theta_r$, and these equations for torque are called reluctance torques.

7. Which component of torque in the following equation is called the electromagnetic torque of electromagnetic energy conversion device?

$$T_e=1/2i_s^2dL_s/d\theta_r+1/2i_r^2dL_r/d\theta_r+i_si_rdM_{sr}/d\theta_r$$

a) $1/2 i_s^2 dL_s/d\theta_r$
b) $1/2 i_r^2 dL_r/d\theta_r$
c) $i_s i_r dM_{sr}/d\theta_r$
d) all of the mentioned

Answer: c

Explanation: The torque developed by the interaction of stator and rotor magnetic fields is the electromagnetic torque or interaction torque.

8. Which components of torque in the following equation are called the reluctance torque terms?

$$T_e=1/2i_s^2dL_s/d\theta_r+1/2i_r^2dL_r/d\theta_r+i_si_rdM_{sr}/d\theta_r$$

a) $1/2 i_s^2 dL_s/d\theta_r$ and $i_s i_r dM_{sr}/d\theta_r$
b) $1/2 i_s^2 dL_s/d\theta_r$ and $1/2 i_r^2 dL_r/d\theta_r$
c) $1/2 i_r^2 dL_r/d\theta_r$ and $i_s i_r dM_{sr}/d\theta_r$
d) $1/2 i_s^2 dL_s/d\theta_r$, $1/2 i_r^2 dL_r/d\theta_r$ and $i_s i_r dM_{sr}/d\theta_r$

Answer: b

Explanation: Because the change of reluctance (Rl_s or Rl_r) are responsible for the production of these torques.

9. Which of the following statements are true about electromagnetic torques and reluctance torques?

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(i) electromagnetic torque can exist only if both windings carry current
(ii) reluctance torque depend on the direction of current in stator or rotor windings
(iii) reluctance torque doesn't depend on the direction of current in stator or rotor win
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(iv) electromagnetic torque depend on the direction of currents i_s and i_r
(v) electromagnetic torque doesn't depend on the direction of currents i_s and i_r

a) (i), (ii), (iii)
b) (ii), (iii), (v)
c) (i), (iii), (iv)
d) (ii), (iii), (iv)

Answer: c
Explanation: Reluctance torque:
Explanation: $1/2 i_s^2 \, dL_s/d\theta_r$ and $1/2 i_r^2 \, dL_r/d\theta_r$
Positive or negative value of current doesn't affect the torque direction. The interaction/ electromagnetic torque = $i_s i_r \, dM_{sr}/d\theta_r$, here the direction of i_s and i_r changes the torque.

10. Singly and doubly excited magnetic systems applications are respectively _________
a) loud speakers and tachometers
b) synchronous motors and moving iron instruments
c) DC shunt machines and solenoids
d) reluctance motors and synchronous motors

Answer: d
Explanation: Reluctance motors can work on single excitation, and synchronous motors require double excitation.

11. Electromagnetic torque in rotating electrical machinery is present when _________
a) stator winding alone carries current
b) rotor winding alone carries current
c) air gap is uniform
d) both stator and rotor windings carry current

Answer: d
Explanation: Electromagnetic torque = $i_s i_r \, dM_{sr}/d\theta_r$ and if either i_s or $i_r = 0$, then $T_e = 0$.
Answer: d
Explanation: As the energy storing capacity of the magnetic field is higher, magnetic field as coupling medium is most common in electromechanical energy conversion devices.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Elementary Synchronous Machines".

1. Consider a single phase synchronous machine of cylindrical rotor type. A single phase supply is given to the stator winding and a voltmeter is connected across rotor winding. For what value of θ_r, the voltmeter reads maximum?
a) 90°
b) 0°
c) 45°
d) 30°

Answer: b
Explanation: When $\theta_r = 0$, the flux linkages with the rotor are maximum, and this is indicated by a maximum voltmeter reading.

2. Consider a single phase synchronous machine of cylindrical rotor type. A single phase supply is given to the stator winding, and a voltmeter is connected across rotor winding. For what value of θ_r the voltmeter reads a zero?
a) 0°
b) 30°
c) 45°
d) 90°

Answer: d
Explanation: When θ_r =90°, the voltmeter reading is zero, because the stator winding axis is perpendicular to the rotor winding axis, and the mutual inductance M_{sr} is zero.

3. Which of the following equation best represents the mutual inductance between stator and rotor in a single phase cylindrical rotor synchronous machine? (where θ_r = space angle between stator and rotor field axis)
a) $M_{sr} = 0$
b) $M_{sr} = M_{max}$
c) $M_{sr} = M_{max} \cos\theta_r$
d) $M_{sr} = M_{max} \sin\theta_r$

Answer: c
Explanation: In a single phase cylindrical rotor synchronous machine, the M_{sr} is maximum, when θ_r =0, and is zero when θ_r =90° and cosine function represents it.

4. In a single phase cylindrical rotor synchronous machine, the torque T_e tends to _____________ the space angle θ_r .
a) reduce
b) increase
c) maintain constant
d) all of the mentioned

Answer: a
Explanation: $W_{fld}(i_s, i_r, \theta_r) = 1/2\, i_s^2 L_s + 1/2\, i_r^2 L_r + i_s i_r M_{max} \cos\theta_r$
Torque, $T_e = \partial W_{fld}(i_s, i_r, \theta_r)/\partial\theta_r = -i_s i_r M_{max} \sin\theta_r$
Negative sign indicates that the torque T_e tends to reduce angle θ_r .

5. The following torque expression: $T_e = -i_s i_r M_{max} \sin\theta_r$ is applicable in a single phase cylindrical rotor synchronous machine when the rotor is ___________
a) revolving
b) stationary
c) revolving or stationary
d) none of the mentioned

Answer: c
Explanation: The torque expression is applicable whether the rotor is revolving or stationary.

6. In a two phase cylindrical rotor synchronous machine, the self inductances L_α , L_β for phases α,β respectively are ___________
a) constant and equal
b) constant and unequal
c) varying and equal
d) varying and unequal

Answer: a
Explanation: Constant and equal, as the reluctance offered to the fluxes produced by phase α and β winding doesn't vary with rotor movement.

7. In a two phase cylindrical rotor synchronous machine, the mutual inductance $M_{\alpha\beta}$ between α phase and β phase winding is ___________
a) M_{max}
b) 0
c) M_{min}
d) any of the mentioned

Answer: b
Explanation: Since the axes of phase α and phase β windings are normal to each other and air gap is uniform, the mutual inductance $M_{\alpha\beta}$ between α,β winding is zero.

8. In a two phase cylindrical rotor synchronous machine, torque T_e is _______________
a) constant at some instant of time
b) changing at every instant of time
c) constant at every instant of time
d) changing at some instant of time

Answer: c
Explanation: $T_e = I_f I_m M_{max} \sin\delta$
We can observe that it remains constant at every instant of time.

9. Which of the following equation represents the reluctance torque of a salient pole synchronous machine?
a) $T_{e(av)} = 1/4\, I_m^2 (L_d - L_q)\sin 2\delta$
b) $T_{e(av)} = 2\, I_m^2 (L_d - L_q)\sin\delta\cos\delta$
c) $T_{e(av)} = 1/8\, I_m^2 (L_d - L_q)$
d) $T_{e(av)} = 1/8\, I_m^2 (L_d - L_q)\sin 2\delta$

Answer: d
Explanation: $T_{e(av)} = 1/8\, I_m^2 (L_d - L_q)\sin 2\delta + 1/2\, I_f I_m M_{max} \sin\delta$
If field current I_f is reduced to zero, the reluctance torque $T_{e(av)} = 1/8\, I_m^2 (L_d - L_q)\sin 2\delta$.

10. Which component of torque equation, $T_{e(av)} = 1/8\, I_m^2 (L_d - L_q)\sin 2\delta + 1/2\, I_f I_m M_{max} \sin\delta$ represents the electromagnetic/interaction torque in single phase salient pole synchronous machine?
a) $1/2\, I_f I_m M_{max} \sin\delta$
b) $1/8\, I_m^2 (L_d - L_q)\sin 2\delta$
c) $1/8\, I_m^2 (L_d - L_q)\sin 2\delta + 1/2\, I_f I_m M_{max} \sin\delta$
d) none of the mentioned

Answer: a
Explanation: The torque developed by the interaction of both stator and rotor magnetic fields is the electromagnetic/interaction torque.

11. An electromechanical energy conversion device has cylindrical stator but salient pole rotor. If δ is the angle between stator field and rotor field, the average torque developed is proportional to (A and B are constants) ___________
a) Asinδ
b) Asin2δ
c) Asinδ+Bsin2δ
d) δ

Answer: c
Explanation: $T_{e(av)} = 1/8\, I_m^2 (L_d - L_q)\sin 2\delta + 1/2\, I_f I_m M_{max} \sin\delta = A\sin\delta + B\sin 2\delta$.

12. An electromechanical energy conversion device has cylindrical stator but salient pole rotor. Rotor is not excited. If δ is the angle between stator field and rotor long axis, then average torque developed is proportional to (A and B are constants).
a) Asinδ
b) Asin2δ
c) Asinδ + Bsin2δ
d) zero

Answer: b

Explanation: We know, $T_e = 1/8\ I_m^2\ (L_d - L_q)\sin 2\delta + 1/2\ I_f I_m M_{max} \sin\delta$, rotor is not excited implies $I_f = 0$, and thus $T_e = 1/8\ I_m^2\ (L_d - L_q)\sin 2\delta = A\sin 2\delta$.

13. The self and mutual inductances of a doubly excited magnetic system are $L_s = 0.6+0.20\cos 2\theta_r$ H and $L_r = 0.75+0.30\cos 2\theta_r$ H and $M_{sr} = 0.8\cos\theta_r$ H. For a stationary rotor at an angular position of $\theta_r = 60°$,what is the magnitude of torque when the currents $i_s = 20$A DC and $i_r = 10$A DC?

a) -233.88N-m
b) +233.88N-m
c) -467.76N-m
d) +467.76N-m

Answer: a

Explanation: For $\theta_r = 60°$; L_s, L_r, M_{sr} and their derivatives with respect to θ_r have the following values:

$L_s = 0.50$H, $L_r = 0.60$H, $M_{sr} = 0.40$H, $dL_s/d\theta_r = -0.3464$, $dL_r/d\theta_r = -0.52$, $dM_{sr}/d\theta_r = -0.693$

Substituting the numerical values in $T_e = 1/2 i_s^2\ dL_s/d\theta_r + 1/2 i_r^2\ dL_r/d\theta_r + i_s i_r\ dM_{sr}/d\theta_r = -233.88$N-m.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Principle of Energy Conversion".

1. An electro-mechanical energy conversion device is one which converts ________
a) Electrical energy to mechanical energy only
b) Mechanical energy to electrical energy only
c) Electrical to mechanical and mechanical to electrical
d) None of the mentioned

Answer: c

Explanation: The operating principles of electrical to mechanical and mechanical to electrical conversion devices are similar, hence, the common name electro-mechanical device. However, their structural details differ depending on their function.

2. What is the coupling field used between the electrical and mechanical systems in energy conversion devices?
a) Magnetic field
b) Electric field
c) Magnetic field or Electric field
d) None of the mentioned

Answer: c

Explanation: Either electric field or magnetic field can be used, however most commonly we use magnetic field because of its greater energy storage capacity.

3. The energy storing capacity of magnetic field is about _________ times greater than that of electric field.
a) 50,000
b) 25,000
c) 10,000
d) 40,000

Answer: b

Explanation: As the energy storage capacity of the magnetic field is higher, it is most commonly used as coupling medium in electro-mechanical energy conversion devices.

4. The formula for energy stored in the mechanical system of linear motion type is _______
a) $1/2\ J w_r^2$
b) $1/2\ mv^2$

c) 1/2 mv
d) Jw_r^2

Answer: b
Explanation: Energy stored is kinetic energy, since the system is of linear motion.

5. In an electro-mechanical energy conversion device, which of the following statements are correct regarding the coupling field?

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(i) electrical side is associated with emf and current
(ii) electrical side is associated with torque and speed
(iii) mechanical side is associated with emf and current
(iv) mechanical side is associated with torque and speed
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a) (i) & (ii)
b) (ii) & (iii)
c) (iii) & (iv)
d) (i) and (iv)

Answer: d
Explanation: The coupling field will be associated with the electrical quantities on electrical side and vice versa.

6. A coupling magnetic field must react with which of the following statements?

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(i) electrical system in order to extract energy from mechanical system
(ii) mechanical system in order to extract energy from mechanical system
(iii) electrical system in order to extract energy from electrical system
(iv) mechanical system in order to extract energy from electrical system
(v) electrical or mechanical system for electro-mechanical energy conversion
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a) (i), (ii) & (iii)
b) (ii), (iii) & (v)
c) (ii), (iii) & (iv)
d) (ii), (iii) & (v)

Answer: b
Explanation: To convert electrical to mechanical, the coupling magnetic field must take energy from input, the electrical system and vice versa.

7. The developed electromagnetic force and/or torque in electromechanical energy conversion system, acts in such a direction that tends to ____________
a) increase the stored energy at constant mmf
b) decrease the stored energy at constant mmf
c) decrease the co-energy at constant mmf
d) increase the stored energy at constant flux

Answer: b
Explanation: $f_e = -(\partial W_{fld} (\varphi,x))/\partial x = -(\partial W_{fld} (\varnothing,x))/\partial x$ and $T_e = -(\partial W_{fld} (\varphi,\theta))/\partial\theta = -(\partial W_{fld} (\varnothing,\theta))/\partial\theta$.

8. The developed electromagnetic force and/or torque in electromechanical energy conversion systems, acts in a direction that tends to ____________

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(i) increase the co-energy at constant flux
(ii) increase the co-energy at constant mmf
(iii) decrease the stored energy at constant mmf
(iv) decrease the stored energy at constant flux
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Which of the above statements are correct?
a) (ii), (iv)
b) (i), (iii)
c) (ii), (iii)
d) (i), (iv)

Answer: a
Explanation: $f_e = -(\partial W_{fld}(\varphi,x))/\partial x$ and $f_e = (\partial W_{fld}^1(F,x))/\partial x$.

9. A physical system of electromechanical energy conversion, consists of a stationary part creating a magnetic field with electric energy input, and a moving part giving mechanical energy output. If the movable part is kept fixed, the entire electrical energy input will be ________
a) stored in the magnetic field
b) stored in the electric field
c) divided equally between the magnetic and electric fields
d) zero

Answer: a
Explanation: As the movable part is fixed, $W_{mech} = 0$, we know, $W_{elec} = W_{mech} + W_{fld}$, therefore, $W_{elec} = W_{fld}$.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Singly Excited Magnetic Systems".

1. For a toroid to extract the energy from the supply system, the flux linkages of the magnetic field must be _________
a) zero
b) changing or varying
c) constant
d) any of the mentioned

Answer: b
Explanation: $dW_{elec} = id\varphi = eidt$, where dW_{elec} = differential electrical energy to coupling field, and if the flux linkages are either constant or zero, i.e, $d\varphi=0$, then $dW_{elec} = 0$.

2. Magnetic stored energy density for iron is given by _______
a) $1/2\ B/\mu$
b) $1/2\ B^2 \mu$
c) $1/2\ \varnothing^2 Rl$
d) $1/2\ B^2/\mu$

Answer: d
Explanation: Magnetic stored energy density for iron is given as
$w_{fld} = W_{fld}$/((Length of the magnetic path through Iron)*(Iron area normal to the magnetic flux))=1/2 (F∅)/(length*Area)=1/2 F/length ∅/area=1/2 H*B
Also, $H = B/\mu$,thus $w_{fld} = 1/2\ B^2/\mu$.

3. The energy stored in a magnetic field is given by _____________ where L=self-inductance and Rl=reluctance.
a) $1/2\ Li^2$
b) $1/2\ (mmf*Rl)^2$
c) 1/2∅Rl
d) $1/2\ \varphi^2 i$

Answer: a
Explanation: We know that $W_{fld} = 1/2\ \varphi i$ and $L=\varphi/i$, thus $W_{fld} = 1/2\ Li^2$.

4. When a current of 5A flows through a coil of linear magnetic circuit, it has flux linkages of 2.4 wb-turns. What is the energy stored in the magnetic field of this coil in Joules?
a) 6
b) 12
c) 1.2
d) 2.4

Answer: a
Explanation: $W_{fld} = 1/2\ \varphi*i = 1/2*2.4*5 = 6$ Joules.

5. For a linear electromagnetic circuit, which of the following statement is true?
a) Field energy is less than the Co-energy
b) Field energy is equal to the Co-energy
c) Field energy is greater than the Co-energy
d) Co-energy is zero

Answer: b
Explanation: $W_{fld} = W_{fld}^1 = 1/2\ \varphi*i = 1/2\ F*\varnothing$.

6. The electromagnetic force and/or torque, developed in any physical system, acts in such a direction as to tend to _____________
a) decrease the magnetic stored energy at constant mmf
b) decrease the magnetic stored energy at constant flux
c) increase the magnetic stored energy at constant flux
d) increase the magnetic stored energy at constant current

Answer: b
Explanation: $f_e = -(\partial W_{fld}(\varphi,x))/\partial x = -(\partial W_{fld}(\varnothing,x))/\partial x$ and $T_e = -(\partial W_{fld}(\varphi,\theta))/\partial\theta = -(\partial W_{fld}(\varnothing,\theta))/\partial\theta$
The negative sign before ∂W_{fld} indicates that f_e acts in a direction as to tend to decrease the stored energy at constant mmf.

7. The electromagnetic force developed in any physical system acts in such a direction as to tend to ______________
a) decrease the co-energy at constant mmf
b) increase the co-energy at constant flux
c) decrease the co-energy at constant flux
d) increase the co-energy at constant mmf

Answer: d
Explanation: $f_e = (\partial W_{fld}^1(i,x))/\partial x = (\partial W_{fld}^1(F,x))/\partial x$, the positive sign before ∂W_{fld}^1 indicates that force f_e acts in a direction as to tend to increase the co-energy at constant mmf.

8. Consider a magnetic relay with linear magnetization curve in both of its open and closed position. What happens to the electrical energy input to the relay, when the armature moves slowly from open position to closed position?
a) $W_{elec} = W_{fld}$
b) $W_{elec} = W_{mech}$
c) $W_{elec} = W_{mech}/2 + W_{fld}/2$
d) $W_{elec} = 0$

Answer: c
Explanation: For the above mentioned case, $W_{fld} = W_{mech}$ and $W_{fld} = W_{elec}/2$ hence, option "c" is the correct answer.

9. The electromagnetic torque developed in any physical system, and with magnetic saturation neglected, acts in such a direction as to tend to _____________
a) decrease both the reluctance and inductance
b) increase both the reluctance and inductance
c) decrease the reluctance and increase the inductance
d) increase the reluctance and decrease the inductance

Answer: c
Explanation: $f_e = 1/2\ \varnothing^2\ dRl/dx$, $T_e = -1/2\ \varnothing^2\ dRl/d\theta = 1/2\ i^2\ dL/d\theta$.

10. Electromagnetic force and/or torque developed in any physical system, acts in such a direction as to tend to _____________

a) increase both the field energy and co-energy at constant current
b) increase the field energy and decrease the co-energy at constant current
c) decrease both the field energy and co-energy at constant current
d) decrease the field energy and increase the co-energy at constant current

Answer: a
Explanation: $f_e = (\partial W_{fld}^1 (i,x))/\partial x = (\partial W_{fld} (i,x))/\partial x$.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Reluctance Motor".

1. What is the angle between stator direct axis and quadrature axis?
a) 90°
b) 0°
c) 45°
d) 60°

Answer: a
Explanation: In reluctance motor, direct axis is horizontal axis and quadrature axis is at 90° to the direct axis.

2. Space angle, θ_r is measured between stator d-axis and ________________
a) quadrature axis
b) direct d-axis
c) long rotor axis
d) none of the mentioned

Answer: c
Explanation: Space angle is measured between stator direct axis and long rotor axis.

3. The reluctance offered to the stator flux by two very large air gaps in series with high permeability iron, in reluctance machine is maximum, when the space angle θ_r = ____________
a) 0°
b) 45°
c) 90°
d) 180°

Answer: c
Explanation: Only when θ_r = 90°, the long rotor axis is perpendicular to the stator d-axis, and thus reluctance is maximum.

4. The reluctance offered to the stator flux by two small air gaps in series with high permeability iron, in reluctance machine is minimum, when the space angle θ_r = ____________
a) 0°
b) 45°
c) 90°
d) 270°

Answer: a
Explanation: Only when θ_r = 0°, the long rotor axis is coincident with the stator d-axis, and thus reluctance is minimum.

5. The variation of reluctance Rl with space angle θ_r depends on the shape of ___________
a) stator poles
b) rotor poles
c) stator or rotor poles
d) both stator and rotor poles

Answer: d
Explanation: Also, the variation is assumed to be a function of space angle θ_r.

6. Reluctance motor can produce torque at _________
a) any speed less than synchronous speed
b) synchronous speed only
c) any speed greater than synchronous speed
d) all of the mentioned

Answer: b
Explanation: $T_{e(av)} = -1/4 \varnothing_{max}^2 (Rl_q - Rl_d)(1/2 \sin(-2\delta))$, w = synchronous speed
if $w_r \neq w$ then $T_{e(av)} = 0$, and if $w_r = w$ then $T_{e(av)} \neq 0$, as the last term in the equation 1/2 sin(-2δ) does not vary with time, and hence average torque is not equal to zero.

7. For a reluctance motor, the maximum average torque occurs when δ = ___________
a) 45°
b) 90°
c) 0°
d) 180°

Answer: a
Explanation: The equation for average torque is $T_{e(av)} = 1/8 \varnothing_{max}^2 (Rl_q - Rl_d)\sin(2\delta)$, and it is maximum when δ=45°.

8. For a given reluctance motor, Rl_d and Rl_q are _________
a) constant
b) varying
c) zero
d) all of the mentioned

Answer: a
Explanation: Rl_d and Rl_q are constant for a given motor, as they depend on the geometry of the magnetic circuit.

9. The single phase reluctance machine acts as a generator when angle δ is ________
a) positive
b) negative
c) zero
d) any of the mentioned

Answer: b
Explanation: If δ is positive, then the machine acts as a motor and if δ is negative, the machine acts as a generator.

10. Single phase reluctance motors are extensively used in _________
a) grinder applications
b) driving electric clocks and other timing devices
c) welding applications
d) lifts/ elevators

Answer: b
Explanation: The single phase reluctance motors operate at constant synchronous speed, in case the supply frequency remains constant, and hence timing devices mostly use these motors.

11. If the salient pole rotor in a single phase reluctance motor is replaced by a cylindrical rotor, then Which of the following statements are true?

```
(i) reluctance offered to stator flux remains constant for all rotor positions
(ii) no reluctance torque will be developed
(iii) reluctance torque will be developed
(iv) reluctance offered to stator flux changes for all rotor positions
```

a) (i), (ii)
b) (ii), (iii)
c) (iii), (iv)

d) (i), (iv)

Answer: a
Explanation: The reluctance torque is developed only when the reluctance is seen but the stator flux varies with rotor movement, and it depends on the air gap. For a cylindrical rotor, the air gap remains same, and hence no change in reluctance and no torque is developed.

12. Which of the following are applications of singly excited magnetic systems?
a) electromagnets, relays
b) moving-iron instruments
c) reluctance motors
d) all of the mentioned

Answer: d
Explanation: All of the applications mentioned above needs singly excited magnetic systems.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Singly Excited Electric Field Systems".

1. A parallel plate capacitor has a capacitance of 10µF. If the linear dimensions of the plates are doubled and distance between them is also doubled, the new value of capacitance would be ___________
a) 10µF
b) 20µF
c) 5µF
d) 40µF

Answer: b
Explanation: $C_1 = 10\mu F = \varepsilon_0 A_1 / x_1$
$C_2 = \varepsilon_0 A_2 / x_2$, $A_2 = 4A_1$ (as the linear dimensions are doubled, area increases by 4 times) and $x_2 = 2x_1$
$\Rightarrow C_2 = \varepsilon_0 4A_1 / 2x_1 = 2*10\mu F = 20\mu F$

2. A parallel plate capacitor is changed and then the DC supply is disconnected. Now plate separation is allowed to decrease due to force of attraction between the two plates. As a consequence which of the following statements are correct?

```
(i) charge on the plate increases
(ii) charge on the plates remain constant
(iii) capacitance C increases
(iv) capacitance C remains constant
(v) potential difference increases
(vi) potential difference decreases
(vii) energy stored decreases
(viii) energy stored increases
```

a) (i), (iii), (vi)
b) (ii), (iv), (viii)
c) (ii), (iii), (vi), (vii)
d) (ii), (iv), (v), (viii)

Answer: c
Explanation: C = εA/x and as separation is decreased, capacitance increases. Also, C=q/v and as charge remains constant, voltage decreases. Similarly, energy stored, $W_{fld} = 1/2q^2/c(x)$ and it decreases.

3. A parallel plate capacitor is charged and then the DC supply is disconnected. The plate separation is then increased. Between the plates which of the following statements are correct?

```
(i) electric field intensity is unchanged
(ii) flux density decreases
```

```
(iii) potential difference decreases
(iv) energy stored increases
```

a) (i), (iv)
b) (ii), (iv)
c) (ii), (iii), (iv)
d) (i), (iii), (iv)

Answer: a
Explanation: We know $C=\varepsilon_0 A/x$, as x increases, C decreases.

Charge(q) on plate remains constant and q=Cv implies v increases.

Energy stored, $W_{fld} = 1/2q^2/C(x)$, as C decreases, W_{fld} increases.

Similarly as q=DA and q, A remains constant, D doesn't change and as electric field intensity is given by, $E=D/\varepsilon_0$, E also doesn't change.

4. The area of two parallel plates is doubled and the distance between these plates is also doubled. The capacitor voltage is kept constant. Under these conditions, force between the plates of this capacitor ___________
a) decreases
b) increases
c) reduce to half
d) gets doubled

Answer: c
Explanation: $A_2 =2A_1$, $x_2 =2x_1$, $v_2 =v_1$, $f_{e_2} =1/2v^2 dC(x)/dx_2$, $C_2 =\varepsilon_0 A_2/x_2 \Rightarrow dC_2/dx_2 = -\varepsilon_0 A_2/x_2^2$

$dC_2/dx_2 = -2\varepsilon_0 A_1/4x_1^2 = -\varepsilon_0 A_1/2x_1^2 \Rightarrow f\&_{e_2} = -1/2v_1^2 \varepsilon_0 A_1/2x_1^2 = -1/2(f_{e_1})$
$\Rightarrow$ force reduces to half.

5. A parallel plate capacitor has an electrode area of 1000 mm^2, with a spacing of 0.1 mm between the electrodes. The dielectric between the plates is air with a permittivity of $8.85*10^{-12}$ F/m. The charge on the capacitor is 100 v. The stored energy in the capacitor is _____________
a) 44.3 J
b) 444.3 nJ
c) 88.6 nJ
d) 44.3 nJ

Answer: d
Explanation: $W_{fld} = 1/2\ q^2/C(x)$

$C(x) = \varepsilon_0 A/x = 8.85*10^{-12} *100*(10^{-3})^2/0.1*10^{-3} = 8.85*10^{-12}$ F

$W_{fld} = 1/2*Cv = 1/2*100^2 *8.85*10^{-12} = 44.3nJ$

6. A parallel plate capacitor is connected to a DC source. Now the plates are allowed to move a small displacement under the influence of force of attraction between the two plates. As a result _____________

```
(i) charge on the plates increases
(ii) charge on plates remains constant
(iii) energy stored increases
(iv) energy stored remains constant
(v) electric field intensity is unchanged
(vi) flux density increases
```

Which of the above statements are correct?
a) (ii), (iv), (v)
b) (ii), (iii), (vi)
c) (i), (iii), (v)

d) (i), (iii), (vi)

Answer: d
Explanation:$C = \varepsilon_0 A/x \Rightarrow C \propto 1/x \Rightarrow$ If the force if of attraction type, then x decreases and C increases.
q=Cv, v constant⇒ as C increases, q also increases. We also know that q=DA and if q increaes, D increases.
Finally, $W_{fld} = 1/2\ D^2/\varepsilon_0$ and as D is increasing, W_{fld} increases.

7. The force produced by electric field in a singly excited energy conversion device, using electric field as coupling medium can be obtained by ____________
a) use of field energy function only
b) use of coenergy function only
c) use of field energy or coenergy function
d) none of the mentioned

Answer: c
Explanation: $f_e = -\partial W_{fld}(q,x)/\partial x$
$f_e = -\partial W_{fld}^1(q,x)/\partial x$.

8. Charge and voltage associated with electric field are analogous, respectively to ___________ and ____________ in magnetic field.
a) flux linkages and current
b) flux density and current
c) flux linkages and voltage
d) MMF and current

Answer: a
Explanation: In magnetic field, the basic terms are flux linkages and current, which are responsible for energy conversion and in electric field, charge and voltage are basically responsible for energy conversion.
$dW_{elec} = \psi i$, for magnetic field
$dW_{elec} = vidt = vdq$, for electric field.

9. Two parallel plates, each of area $A = 1m^2$ are separated by a distance g. The electric field intensity between the plates is $3*10^6$ v/m. What is the force between the two plates?
a) $1/2\pi*10^3$ N
b) $1/8\pi*10^3$ N
c) $8\pi*10^3$ N
d) 0 N

Answer: b
Explanation: When electric field is applied, the plates move towards each other because of force of attraction by a distance $x \Rightarrow C = \varepsilon_0 A/(g-x)$
$W_{fld}(q,x) = 1/2\ q^2/C = 1/2\ q^2(g-x)/A\varepsilon_0$
$f_e = -\partial W_{fld}(q,x)/\partial x = 1/2q^2 x/A\varepsilon_0$
We know, $q = DA = \varepsilon_0 EA$ and $\varepsilon_0 = 10^{-9}/36\Pi$
$f_e = 1/2\ E^2 \varepsilon_0 A = 1/2*(3*10^6)^2 *10^{-9}/36\Pi*1 = 1/8\pi*10^3$ N

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Rotating Magnetic Field – 2”.

1. If F_1 is the constant amplitude of fundamental rotating MMF wave, the for the space harmonics of order 6K-1 (where K=1,2,3….), the harmonic MMF wave is of ______________
a) Constant amplitude and stationary in space
b) Constant amplitude and rotates along F_1

c) Varying amplitude and rotates along F_1
d) Constant amplitude and rotates against F_1

Answer: b
Explanation: Space harmonics of the order of 6K-1(5,11,17,…) have their constant amplitude equal to $1/(6K-1)F_1$ and rotate in the direction of fundamental component F_1 at a speed of $1/(6K+1)$ of the fundamental synchronous speed.

2. Which of the following harmonics are present in the resultant MMF produced by 3 phase currents flowing in the 3 phase windings?
a) Triplen harmonics (3K), where K is an integer
b) 6K+1 harmonics only, where K is an integer
c) 6K-1 harmonics only, where K is an integer
d) 6k+1 and 6K-1 harmonics, where K is an integer

Answer: d
Explanation: Space harmonics of the order 3,9,15,… i.e, triplen harmonics are absent.

3. When a single-phase winding is excited by an alternating current, then which of the following statements are correct?
a) It produces one stationary MMF wave
b) Produced MMF wave pulsates along its magnetic axis
c) It doesn't produce two counter rotating MMF wave
d) All of the mentioned

Answer: d
Explanation: It is the decomposition of the MMF of a single phase winding into two counter rotating MMF waves, but are not actually produced and only one stationary MMF wave pulsating along its magnetic axis is produced.

4. What does the space angle α in the equation $F_r(\alpha,t)=3/2F_m \cos(\alpha-\omega t)$ for MMF produced when 3-phase balanced windings excited by three phase balanced currents represent?
a) MMF wave at any moment is sinusoidally distributed in space
b) Entire MMF waveform is travelling at (constant angular speed) synchronous speed
c) MMF wave is of constant amplitude
d) None of the mentioned

Answer: a
Explanation: The space angle α means that MMF wave at any moment is sinusoidally distributed in space along the air-gap periphery.

5. Three phase voltages are applied to the three windings of an electrical machine. If any two supply terminals are interchanged, then the rotating MMF wave ______________
a) Direction reverses, amplitude alters
b) Direction reverses, amplitude unaltered
c) Direction remains same, amplitude alters
d) Direction remains same, amplitude unaltered

Answer: b
Explanation: The direction of rotating MMF wave is reversed, though its amplitude remains unaltered.

6. The rotating MMF wave of constant amplitude can be produced, only if the time angle displacement between currents is ______________
a) Less than the space angle displacement between winding axis
b) More than the space angle displacement between winding axis
c) Equal to the space angle displacement between winding axis
d) All of the mentioned

Answer: c
Explanation: If the time angle displacement between currents and space angle displacement between winding axis are not equal, the magnitude of resultant MMF wave is always zero.

7. A 3 phase star connected winding is fed from symmetrical 3 phase supply with their neutrals connected together. If one of the 3 supply lines gets disconnected, then the revolving MMF wave will have a ___________
a) Constant amplitude but sub synchronous speed
b) Varying amplitude but synchronous speed
c) Constant amplitude but super synchronous speed
d) Varying speed and a speed fluctuating around the synchronous speed

Answer: d
Explanation: With one supply phase disconnected, a rotating MMF wave of varying amplitude is produced, but at a speed fluctuating around the synchronous speed.

8. In case of the 3 phase winding with delta or star connection without neutral, if one of the supply lines gets disconnected, then the MMF becomes __________
a) Stationary and pulsating
b) Rotating with synchronous speed
c) Rotating with sub synchronous speed
d) Rotating with super synchronous speed

Answer: a
Explanation: Disconnection of one of the supply leads, results in single-phase operation of the machine.

9. If φ_m is the maximum value of flux due to any one phase, then resultant flux in 2 phase and 3 phase AC machines would respectively be given by _________
a) φ_m and $1.5\varphi_m$, both rotating
b) φ_m and $1.5\varphi_m$, both stand still
c) φ_m stand still and $1.5\varphi_m$ rotating
d) $1.5\varphi_m$ and $2\varphi_m$, both rotating

Answer: a
Explanation: In a 2 phase and 3 phase AC machine, rotating MMF is produced with magnitudes of φ_m and $3/2\varphi_m$.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Rotating Magnetic Field – 1”.

1. For a p-pole machine, which of the following statements are correct regarding the rotating field speed?
a) The rotating field speed is 1/(p/2) revolutions in one cycle
b) f/(p/2) revolutions in f cycles
c) f/(p/2) revolutions in one second
d) Any of the mentioned

Answer: d
Explanation: f/(p/2) revolutions in one second is also correct because f cycles are completed in one second. n_s (rotating field speed in revolutions per second) = 2f/p or N_s = 120f/p r.p.m.

2. The speed at which rotating magnetic field revolves is called?
a) Induction speed
b) Synchronous speed
c) Relative speed
d) Rotating speed

Answer: b
Explanation: Rotating field speed (N_s) = 120f/(p r.p.m) = synchronous speed.

3. What is the amplitude of rotating MMF produced as a result of m-phase currents flowing in m-phase windings? (where F_m is maximum MMF in any one phase, when current is maximum in that phase.)
a) $(2/m)F_m$

b) mF_m
c) $(m/2)F_m$
d) F_m

Answer: c
Explanation: In general m phase current flowing in m phase winding results in rotating MMF wave of constant amplitude, equal to $m/(2F_m)$.

4. The peak of rotating MMF wave (F_R) is directed along which of the following axis?
a) The axis of that phase which carries the maximum current at that instant
b) The axis of that phase which carries half of the maximum current at that instant
c) The axis of that phase which carries minimum current at that instant
d) All of the mentioned

Answer: a
Explanation: The resultant MMF $F_R = 3/(2F_m)$ is directed along the axis of that phase, which carries the maximum current at that instant.

5. If the phase sequence of supply currents are reversed, then the direction of rotation of the resultant MMF wave will ____________
a) Be reversed
b) Remains unchanged
c) Cannot be determined
d) None of the mentioned

Answer: a
Explanation: A reversal of the phase sequence of supply currents will reverse the direction of rotation of the resultant MMF wave.

6. Which of the following statements are correct regarding individual phase MMF in rotating machines?
a) It is a rotating MMF wave
b) It is not a rotating MMF wave and its amplitude doesn't alternate along its own phase axis
c) It is not a rotating MMF wave but its amplitude merely pulsates
d) None of the mentioned

Answer: c
Explanation: It should be remembered that individual phase MMF is not a rotating MMF wave, its amplitude merely pulsates or alternates along its own phase axis.

7. The effect of poly phase currents in poly phase winding can be compared to ________________
a) Mechanical rotation of permanent magnets at synchronous speed
b) Mechanical rotation of DC excited field poles at synchronous speed
c) Mechanical rotation of either permanent magnets or DC excited field poles, at synchronous speed
d) None of the mentioned

Answer: c
Explanation: The speed at which rotating magnetic field revolves is called the synchronous speed and this effect is equivalent to mechanical rotation of permanent magnets or DC excited field poles.

8. The magnitude of rotating flux ______________ at all instants of time.
a) Changes
b) Remains constant
c) Pulsates
d) Any of the mentioned

Answer: b
Explanation: $F_R = 3/(2F_m)$ (for a 3 phase machine). A constant amplitude rotating MMF or rotating field is produced in the air gap of a three phase machine.

9. The amplitude of rotating MMF wave is proportional to ____________
a) N_{ph} and P
b) I and P
c) N_{ph} and I
d) N_{ph}, I and P

Answer: c
Explanation: $F_R = 3/(2F_m) = 3/(2\ 4\sqrt{2}/(\Pi K_w N_{ph} I/P)$
where N_{ph} = series turns per phase and I = RMS current.

10. If F_1 is the constant amplitude of fundamental rotating MMF wave, the space harmonics of order 6K+1 (where K=1,2,3….), the harmonic MMF wave is of ______________
a) Constant amplitude and stationary in space
b) Constant amplitude and rotates along F_1
c) Varying amplitude and rotates along F_1
d) Constant amplitude and rotates against F_1

Answer: b
Explanation: Space harmonics of the order of 6K+1(7,13,19,…) have their constant amplitude equal to $1/(6K+1)F_1$ and rotate in the direction of fundamental component F_1 at a speed of 1/(6K+1) of the fundamental synchronous speed.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Torque Production and Dynamic Equations".

1. The magnitude of electromagnetic or interaction torque, in all rotating machines, is given by _____________
a) $T_e \propto$ (stator field strength)sinδ
b) $T_e \propto$ (rotor field strength)sinδ
c) $T_e \propto$ (stator field strength)(rotor field strength)sinδ
d) $T_e \propto$ sinδ

Answer: c
Explanation: The tendency of two fields (stator field and rotor field), to align themselves in the same direction, is called interaction torque, and it also depends on the torque angle & delta;.

2. In a rotating electrical machine with 2 poles on the stator and 4 poles on the rotor, spaced equally, the net electromagnetic torque developed is _____________
a) maximum
b) zero or no torque is developed
c) minimum
d) none of the mentioned

Answer: b
Explanation: In a machine with 2 stator poles and 4 rotor poles spaced equally, the force of attraction will be cancelled due to the force of repulsion, and hence the net electromagnetic torque will be zero.

3. For the development of electromagnetic torque in a rotating electrical machine, the number of rotor poles must be _____________
a) greater than the stator poles
b) less than the stator poles
c) equal to the stator poles
d) either greater or lesser than the stator poles

Answer: c
Explanation: If the rotor poles are not equal to the stator poles, the net electromagnetic torque will be zero as the force of attraction will be cancelled by the force of repulsion.

4. Torque angle ‘δ’ is the angle between _____________
a) rotor field axis and resultant field axis
b) stator field axis and rotor field axis
c) stator field axis and mutual field axis
d) stator field axis and resultant field axis

Answer: b
Explanation: The angle between the stator field axis and rotor field axis is called as torque angle.

5. The interaction torque in a rotating electrical machine depends on which of the following components?

```
(i) sinδ
(ii) cosδ
(iii) torque angle δ
(iv) stator field strength
(v) rotor field strength
```

a) (i), (iv), (v)
b) (ii), (iii), (v)
c) (i), (iii), (v)
d) (ii), (iv), (v)

Answer: a
Explanation: Interaction torque $T_e \propto$(stator field strength)(rotor field stregth)sinδ.

6. The basic torque and EMF expression of rotating electrical machines are _____________
a) applicable to DC machines only
b) applicable to AC machines only
c) applicable to both AC and DC machines
d) none of the mentioned

Answer: c
Explanation: Basic torque and EMF expressions are same for both AC and DC machines as the fundamental principles underlying the operation of AC and DC machines are same.

7. The final forms of the expression for generated EMF and torque,for AC and DC machines differ, because _____________
a) the fundamental principles underlying their operation are same
b) the fundamental principles underlying their operation are different
c) their construction details are same
d) their construction details are different

Answer: d
Explanation: Though AC and DC machine have same operating fundamental principles, their construction details differ.

8. The voltage equation for the electrical system, in an electromechanical energy conversion device is as follows:
$v_t = ir+L di/dt+i(dL/d\theta_r)\omega_r$ = (i)+(ii)+(iii)
What does the (ii) and (iii) terms represent respectively?
a) transformer voltage term and speed/rotational voltage term
b) speed/rotational voltage term and transformer voltage term
c) force voltage term and transformer voltage term
d) none of the mentioned

Answer: a
Explanation: (ii) term = Ldi/dt is known as transformer voltage because it involves the time derivative of current.
(iii) term = $i(dL/d\theta_r)\omega_r$ is the speed/rotational voltage term because of the presence of speed ω_r in it.

9. For an inductor made from magnetic core, with two air gaps of equal length g, exciting coil with 1000 turns, A=5cm*5cm and g=1cm, what will be the coil inductance?
a) 0.314H
b) 0.157H
c) 0.078H
d) 0.628H

Answer: b
Explanation: Reluctance $Rl=2g/\mu_0 A$ and coil Inductance $L=N^2/Rl = N^2 \mu_0 A/2g = (1000)^2 (4\pi*10^{-7})(0.05)^2/(2*0.01) = 0.15708H$.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Terms Pertaining to Rotating Machines".

1. For a P-pole machine, the relation between electrical and mechanical degrees is given by ______________
a) $\theta_{elec} = 2/P\ \theta_{mech}$
b) $\theta_{elec} = 4/P\ \theta_{mech}$
c) $\theta_{mech} = P/2\ \theta_{elec}$
d) $\theta_{elec} = P/2\ \theta_{mech}$

Answer: d
Explanation: For a P-pole machine, P/2 cycles of EMF will be generated in one revolution, and thus $\theta_{elec} = P/2\ \theta_{mech}$.

2. What is the relation between 'ω', angular speed in electrical radians per second and 'ω_m', angular speed in mechanical radians per second, for a P-pole machine?
a) $\omega = 2/P\omega_m$
b) $\omega = 4/P\omega_m$
c) $\omega_m = P/2\omega$
d) $\omega = P/2\omega_m$

Answer: d
Explanation: We know $\theta_{elec} = P/2\theta_{mech} \Rightarrow d/dt(\theta_{elec}) = P/2 d/dt(\theta_{mech}) \Rightarrow \omega = P/2\omega_m$.

3. A pole pitch in electrical machine ______________
a) = 180° electrical
b) = 180° mechanical
c) > 180° electrical
d) < 180° electrical

Answer: a
Explanation: Pole pitch is always expressed in electrical degrees, rather than in mechanical degrees.
pole pitch = 180 electrical degrees or π electrical radians.

4. The part of the coil in which EMF is generated is known as ______________
a) end connection
b) coil sides
c) coil span
d) none of the mentioned

Answer: b
Explanation: The EMF is generated in the active lengths only, and these active lengths are called the coil-sides of a coil.

5. A coil consists of ______________
a) two conductors
b) two coil sides
c) two turns

d) four turns

Answer: b
Explanation: One coil is made up of two coil sides.

6. One turn consists of ______________
a) two coil sides
b) two conductors
c) four conductors
d) four coil sides

Answer: b
Explanation: One turn consists of two conductors, and one coil is made up of two coil-sides.

7. In a full pitch coil, the two coil sides are how many electrical space degrees apart?
a) 180 electrical degrees
b) 90 electrical degrees
c) 45 electrical degrees
d) none of the mentioned

Answer: a
Explanation: A coil, with two coil-sides 180 electrical space degrees apart (or one pole-pitch apart), is called a full pitch coil.

8. A chording angle ε is defined as the angle by which coil span departs from ___________
a) 90° electrical space degrees
b) 180° electrical space degrees
c) 360° electrical space degrees
d) all of the mentioned

Answer: b
Explanation: If chording angle is ε°, chorded coil has a coil span = 180°-ε.

9. If B_p = peak value of sinusoidal flux density wave, L = armature core length, D = armature diameter, P = number of poles, then which of the following statements are correct?

(i) flux per pole, $\Phi=2/PB_pLD$
(ii) Average flux density, $B_{av}=2/\pi B_p$
(iii) $\Phi=4/PB_pLD$
(iv) $B_{av}=3/\pi B_p$
(v) $B_{av}=P\Phi/\pi DL$
(vi) $B_{av}=P\Phi/\pi rL$

a) (i), (ii), (v)
b) (ii), (iii), (v)
c) (ii), (iii), (vi)
d) (iii), (iv), (v)

Answer: a
Explanation: Total flux per pole = $4/PB_p rL$
we know, $r=D/2 \Rightarrow \Phi=2/PB_p LD$ and $B_{av}=2/\pi B_p$.
As Φ = (Average value of constant amplitude flux density wave under one pole)∗ (Area pertaining to one pole of the flux density wave), $\Phi = (B_{av})(2\pi rL/P)$and average value of the positive or negative half cycle of a sine wave = 2/π(peak value of sine wave).

10. In a 4 pole machine, what is the flux per pole produced, if the armature length is l and radius is r and B_p is peak value of sinusoidal flux?
a) $4B_p lr$
b) $2B_p lr$
c) $B_p lr$

d) $B_p lr/2$

Answer: c
Explanation: Total flux per pole = $4/PB_p lr$, since P=4, $\Phi=B_p lr$.

11. The equation for flux per pole $\Phi=4/PB_p lr$, is valid for _______________
a) for salient pole rotor only
b) for cylindrical pole rotor only
c) for both cylindrical and salient pole rotor
d) none of the mentioned

Answer: c
Explanation: It does not make any difference whether the field winding is on cylindrical pole structure or salient pole structure.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Constructional Features of Rotating Electrical Machines-1”.

1. Which of the following two windings produces/induces the working flux and working EMF respectively?
a) field winding and armature winding
b) armature winding and field winding
c) both are produced in field winding
d) both are produced in armature winding

Answer: a
Explanation: Field winding produces the working flux and armature winding has the working EMF, which is induced by the working flux.

2. Armature winding carries which of the following current?
a) magnetizing current only
b) load current only
c) both magnetizing current and load current
d) none of the mentioned

Answer: b
Explanation: The winding on the machine that carries only load current is called armature winding.

3. Field winding carries which of the following current?
a) exciting current only
b) load current only
c) both exciting current and load current
d) none of the mentioned

Answer: a
Explanation: The winding that handles only exciting current is called field winding.

4. Which of the following statements are correct regarding exciting current?

```
(i) exciting current varies with the load
(ii) exciting current doesn't vary with load
(iii) exciting current produces only a working magnetic flux
(iv) exciting current is not responsible for the production of working  magnetic flux
```

a) (i) & (iv)
b) (ii) & (iii)
c) (i) & (iii)
d) (ii) & (iv)

Answer: c
Explanation: The current that produces only a working magnetic flux, and does not vary with the load on the machine is called exciting current, magnetizing current or field current.

5. Current in the field winding is ____________
a) AC always
b) DC always
c) Both AC and DC
d) Either AC or DC

Answer: b
Explanation: Field winding is always given DC supply and hence current is also DC.

6. The rating of the armature winding is ____________
a) 1/2 to 2% of the rated power of the machine
b) less than the power rating of the machine
c) greater than the power rating of the machine
d) equal to the power rating of the machine

Answer: d
Explanation: The armature winding handles all the power that is being converted or transformed.

7. The power rating of the field winding is ____________
a) equal to the power rating of the machine
b) 1/2 to 2% of the rated power of the machine
c) greater than the power rating of the machine
d) less than the power rating of the machine

Answer: b
Explanation: The power input to the DC field winding is dissipated as i^2R loss in the field winding (once the required field current is established).

8. What is the reason behind armature structure for both DC and AC machines being laminated?
a) reduce i^2R losses
b) reduce the leakage flux
c) reduce the eddy current losses
d) for better operating power factor

Answer: c
Explanation: The armature windings of both the DC and AC machines have to deal with alternating current only; this is the reason why the armature structure of all rotating machines are laminated in order to reduce the eddy current losses.

9. Armature winding is one in which working ____________
a) flux is produced by field current
b) flux is produced by the working emf
c) emf is produced by the working flux
d) emf is produced by the leakage flux

Answer: c
Explanation: In an electrical machine, armature winding is one in which the working emf is induced by the working flux.

10. Why is the air gap between stator and rotor should be kept as small as mechanically possible in induction motor?
a) to reduce the leakage flux between stator and rotor
b) as it leads to better operating power factor of the induction motor
c) reduce the eddy current losses
d) both, to reduce leakage flux between stator and rotor, and also for better operating power factor

Answer: d
Explanation: The leakage flux and power factor depend on the air gap and it should be as small as possible.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Constructional Features of Rotating Electrical Machines-3”.

1. How many poles should the alternators, driven by the steam and gas turbines prime movers must have, for better operation?
a) fewer number of poles
b) large number of poles
c) medium number of poles
d) any of the mentioned

Answer: a
Explanation: Steam and gas turbines have best operating characteristics at relatively high speeds, therefore, alternators driven by these must have a fewer number of poles, say 2 or 4, as $f \propto 1/N$.

2. In a synchronous machine, cylindrical pole construction has been found to suit best for ____________
a) low speed prime movers
b) high speed prime movers
c) medium speed prime movers
d) any of the mentioned

Answer: b
Explanation: For high speed prime movers, if salient pole construction is used, the rotor structure may not be able to withstand the enormous centrifugal forces, developed by the salient poles. Therefore, cylindrical rotor construction is best suited from mechanical considerations.

3. Commercially, which of the following generators is called turbo-alternators or turbo-generators?
a) salient pole rotor synchronous generators
b) cylindrical pole rotor induction generators
c) salient pole rotor induction generators
d) cylindrical rotor synchronous generators

Answer: d
Explanation: Cylindrical rotor synchronous generators are used commercially at high speed, driven by steam and gas turbines.

4. For relatively large sizes of synchronous machines, which of the following are used for providing closed circuit cooling?
a) air
b) water
c) hydrogen/helium
d) any of the mentioned

Answer: d
Explanation: For synchronous machines of large sizes, adequate cooling arrangements must be incorporated to dissipate the heat produced by various losses.

5. In a synchronous generator, the frequency of the generated EMF depends on ____________
a) rotational speed
b) poles
c) both rotational speed and poles
d) none of the mentioned

Answer: c
Explanation: $f = PN/120$ Hz

6. A synchronous machine can be connected to an energy system only when ____________
a) frequency/rotational speed matches
b) voltage matches
c) current matches
d) power matches

Answer: a
Explanation: For successful operation, the rotational speed/frequency of the synchronous

machine must synchronize with the frequency of the energy system, and this is the reason for calling it a synchronous machine.

7. In larger DC machines, the reason behind using fabricated steel instead of cast iron in the manufacture of yoke is?
a) economical considerations
b) permeability considerations
c) mechanical considerations
d) insulation considerations

Answer: b
Explanation: Fabricated steel has higher permeability than cast iron.

8. Which of the following statements are correct in a DC machine, when the pole core is usually of smaller cross section than the pole shoe?

```
(i) smaller cross section requires less copper
(ii) larger pole shoe increases the air gap reluctance
(iii) larger pole shoe increases the flux per pole entering the armature
(iv) larger pole shoe reduces the mechanical strength
(v) larger pole shoe supports the field winding
```

a) (i), (ii), (v)
b) (ii), (iii), (v)
c) (i), (iii), (v)
d) (ii), (iv), (v)

Answer: c
Explanation: Larger pole shoe area increases the flux per pole entering the armature, due to the reduction in air gap reluctance, and it also provides mechanical strength.

9. In a DC generator, the commutator serves as a __________
a) mechanical rectifier for alternating EMF to direct EMF
b) mechanical inverter to invert the direct applied voltage to alternating voltage
c) all of the mentioned
d) none of the mentioned

Answer: a
Explanation: A DC generator is equivalent to an AC machine plus a mechanical rectifier, i.e, commutator.

10. In a DC motor, the commutator serves as a ____________
a) mechanical rectifier for alternating EMF to direct EMF
b) mechanical inverter to invert the direct applied voltage to alternating voltage
c) all of the mentioned
d) none of the mentioned

Answer: b
Explanation: A DC motor is equivalent to an AC machine plus a mechanical inverter, i.e, commutator.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Constructional Features of Rotating Electrical Machines-2”.

1. Which type of slots are used in the construction of large size and small size induction motors respectively?
a) open slots and semiclosed slots
b) semiclosed slots and open slots
c) open slots and open slots
d) semiclosed slots and semiclosed slots

Answer: a
Explanation: Large size motors use open slots, so that already prepared and properly insulated coils can be inserted in open slots. Small size induction motors use semiclosed slots, so as to reduce the effective gap length between stator and rotor.

2. In which of the following applications, wound rotor type of induction motor is used?
a) where the driven load requires speed control
b) where high starting torque is required
c) when external resistance is to be inserted
d) any of the mentioned

Answer: d
Explanation: Only in wound rotor type of induction motor, external resistance can be inserted in series with the rotor winding, for speed and starting torque control.

3. For an induction motor, Which of the following statements are correct?

```
(i) squirrel cage type is simpler and more economical in construction
(ii) wound rotor type requires less maintenance
(iii) squirrel cage type is more rugged and requires less maintenance
(iv) no external resistance can be inserted in the rotor circuit of squirrel cage inducti
(v) no external resistance can be inserted in the rotor circuit of a wound rotor inductio
```

a) (ii), (v), (iii)
b) (ii), (iii), (v)
c) (i), (iii), (iv)
d) (i), (ii), (iv)

Answer: c
Explanation: The squirrel cage type is simpler and more economical in construction, requires less maintenance than wound rotor type, since the former doesn't require slip rings and carbon brushes.

4. What are the advantages of providing the field winding on rotor and armature winding on the stator?
a) more economical
b) more efficient
c) efficient cooling
d) all of the mentioned

Answer: d
Explanation: If the armature winding is on the stator, only two slip rings are required which implies less losses, more efficiency and more economy. Also, stationary armature winding can be cooled more efficiently.

5. The stator frame and end covers in synchronous and induction machines are designed to ____________
a) carry the magnetic flux
b) to serve as a mechanical support
c) to provide cooling or to carry induced EMF
d) any of the mentioned

Answer: b
Explanation: The stator frame and end covers serve merely as a mechanical support to the stator core, and are not designed to carry the magnetic flux.

6. What is the advantage of connecting two coils in parallel?
a) reduce the amount of copper required
b) increase the current per parallel path to double the value
c) increase the voltage capacity
d) all of the mentioned

Answer: b
Explanation: The parallel connection of two coils will increase the current per parallel path to double the value.

7. In a synchronous machine, salient pole construction has been found to suit best for ____________
a) low speed prime movers
b) high speed prime movers

c) medium speed prime movers
d) any of the mentioned

Answer: a
Explanation: For accommodating large number of poles, the rotor diameter must be comparatively increased, and from mechanical considerations, salient pole construction has been found to suit best for low speed prime movers.

8. What is the equation for frequency of generated EMF?
a) f = PN/120 Hz
b) f = 120/PN Hz
c) f = P/120 Hz
d) f = N/120 Hz

Answer: a
Explanation: f = PN/120 Hz in India and many other countries, alternators feeding the power system generates at a frequency of 50 Hz.

9. How many poles should the alternators driven by the oil engines and hydraulic turbine prime movers must have, for better operation?
a) fewer number of poles
b) larger number of poles
c) medium number of poles
d) any of the mentioned

Answer: b
Explanation: Oil engines and hydraulic turbines operate best at relatively low speeds, therefore, the alternators driven by these prime movers must have relatively large number of poles, as $f \propto 1/N$.

10. Large synchronous machines are constructed with armature winding on the stator because stationary armature winding. Which of the following statements are correct?

```
(i) can be insulated satisfactorily for higher voltages
(ii) can be cooled more efficiently
(iii) would lead to reduced slip ring losses
(iv) would have no slot harmonics
(v) would have reduced armature reactance
```

a) (i), (ii), (iii), (iv)
b) (i), (ii), (iii), (v)
c) (i), (ii), (iii), (iv), (v)
d) (i), (ii), (iv), (v)

Answer: b
Explanation: If the armature winding is on the stator, only two slip rings are required, which implies less losses, more efficiency and more economy. Also, stationary armature windings can be cooled more efficiently.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Generated EMF”.

1. Which of the following statements is/are correct regarding the generation of EMF in rotating electrical machines in the armature winding? EMF is generated _____________
a) by rotating armature windings through a magnetic field
b) by rotating magnetic field with respect to the armature windings
c) by designing the magnetic circuit to have variable reluctance with rotor rotation
d) all of the mentioned

Answer: d
Explanation: All of the above mentioned methods will produce EMF in the armature windings.

2. The EMF equation $e = N\omega_r \Phi \sin\omega_r t$ is applicable to _____________
a) AC systems with time variant field flux
b) DC systems with time variant field flux

c) Both AC and DC systems with time invariant field flux
d) Both AC and DC systems with time variant field flux

Answer: c
Explanation: $e = N\omega_r \Phi\sin\omega_r t - Nd\Phi/dt\cos\omega_r t$, for time invariant field flux $d\Phi/dt = 0 \Rightarrow e = N\omega_r \Phi\sin\omega_r t$, is the general equation, and is applicable to both AC and DC systems.

3. In the equation for RMS value of the generated EMF in a full pitched coil of an AC machine, $E = E_{max}/\sqrt{2} = \sqrt{2}\pi f_r N\Phi$, f_r depends on _____________
a) rotating speed of the armature coil
b) rotating speed of the flux density wave
c) relative velocity between the flux density wave and armature coil
d) all of the mentioned

Answer: c
Explanation: f_r is called the rotational or speed frequency, since its value depends upon the relative velocity between the flux density wave and the armature coil.

4. In AC rotating machines, the generated or speed EMF ____________
a) leads Φ by 90°
b) lags Φ by 90°
c) is in phase with working flux
d) lags Φ by 180°

Answer: b
Explanation: $e = E_{max}\cos(\omega_r t - \pi/2)$
$\psi = N\Phi\cos\omega_r t$
It reveals that the speed or generated EMF lags by 90° the flux that generates it, and is true when flux is time invariant and is sine distributed in space.

5. In a short pitched coil, the coil pitch factor k_p, is given by _____________
a) $k_p = \cos\varepsilon$
b) $k_p = \cos\varepsilon/2$
c) $k_p = \sqrt{2}\pi f_r N\Phi\cos\varepsilon$
d) $k_p = \cos\varepsilon/2\cos\omega_r t$

Answer: b
Explanation: The effect of short pitched coil is to reduce the generated EMF, and this reduction factor is $\cos\varepsilon/2$, and is referred to as coil pitch factor.

6. Which of the following equations represents the RMS value of the generated EMF in a short-pitched N-turn armature coil of an AC machine _____________
a) $E = \sqrt{2}\pi k_p f_r N\Phi$
b) $E = 2\pi k_p f_r N\Phi$
c) $E = N\Phi\omega_r k_p \sin\omega_r t$
d) None of the mentioned

Answer: a
Explanation: EMF induced = $N\Phi\omega_r k_p \sin\omega_r t$,
$E_{max} = N\Phi\omega_r k_p$ when $\sin\omega_r t = 1$
RMS value, $E = E_{max}/\sqrt{2} = \sqrt{2}\pi f_r k_p N\Phi$

7. The effect of short pitched coil on the generated EMF is ______________
a) increasing
b) decreasing
c) either increasing or decreasing
d) none of the mentioned

Answer: b
Explanation: The effect of short pitched coil is to reduce the generated EMF and this reduction factor is cosε/2 and is referred to as coil pitch factor.

8. A winding is distributed in the slots along the air gap periphery. Which of the following statements are true?

```
(i) to add mechanical strength to the winding
(ii) to reduce the amount of conductor material required
(iii) to reduce the harmonics in generated EMF
(iv) to reduce the size of the machine
(v) for full utilization of iron and conductor materials
```

a) (i), (iii), (iv), (v)
b) (i), (ii), (iv), (v)
c) (i), (ii), (iii), (v)
d) (i), (iii), (v)

Answer: d
Explanation: In rotating electrical machines, the armature turns are usually distributed in slots rather than concentrated in single slot. This is essential from the view point of utilizing the armature periphery completely, and add mechanical strength.

9. In an AC machine, the effect of distributing the turns in different slots, results in a further reduction of generated EMF by the factor k_d. This factor is called _____________
a) distribution/speed factor
b) coil pitch factor
c) winding factor
d) all of the mentioned

Answer: a
Explanation: $E = \sqrt{2}\pi k_p k_d f_r N\Phi$, k_d is the distribution factor.

10. A polyphase induction motor of the slip ring or wound rotor type can be used _____________
a) for high start-up torque applications
b) as a frequency converter
c) any of the mentioned
d) none of the mentioned

Answer: c
Explanation: A polyphase induction motor can be used as a frequency converter (or changer) for changing the supply frequency f to other frequencies sf and (2-s)f at the slip ring terminals.

11. The equation for slip speed is _____________
a) $(\omega-\omega_r)/\omega$
b) $\omega-\omega_r$
c) $(\omega_r-\omega)/\omega$
d) ω_r

Answer: b
Explanation: The relative speed between rotor and rotating flux wave, i.e, $(\omega-\omega_r)$ is referred to as the slip speed in rad/sec
slip speed = $(\omega-\omega_r)$ rad/sec.

12. If the rotor of an induction motor is made to revolve in a direction opposite to the rotating flux wave, then RMS value of EMF induced in one phase of rotor E is proportional to _____________
a) 2-s
b) s
c) 1-s
d) 2+s

Answer: a
Explanation: Relative velocity between rotor winding and rotating flux wave becomes
$(\omega+\omega_r) = \omega+\omega(1-s) = \omega(2-s)$ and
$E = 2\pi f(2-s)N_{phr} k_w \Phi$.

13. In an alternator, frequency per revolution is equal to ____________
a) number of poles
b) twice the number of poles
c) speed in rps
d) number of pole-pairs

Answer: d
Explanation: For a P-pole machine, in n rev/sec, P/2n cycles/second are generated and cycles per second is referred to as frequency f of the EMF wave. Here in this question n=1
⇒ frequency per revolution = P/2
⇒ number of pole pairs.

14. The EMF generated in an alternator depends upon which of the following statements are correct?

```
(i) speed
(ii) maximum flux per pole
(iii) series turns per phase
(iv) phase spread
(v) coil-span
(vi) type of alternator
```

a) (i), (ii), (iii), (iv), (v), (vi)
b) (i), (iii), (iv), (v)
c) (i), (ii), (iii), (v), (vi)
d) (i), (iii), (iv), (v), (vi)

Answer: b
Explanation: $E_{ph} = \sqrt{2}\pi f k_w N_{ph} \Phi$, here Φ = total flux per pole.

15. If the dimensions of all the parts of a synchronous generator and the number of field and armature turns are doubled, then the generated voltage will change by a factor of _________
a) 1
b) 2
c) 4
d) 8

Answer: d
Explanation: $E = \sqrt{2}\pi f_r N\Phi$, Φ = flux per pole = $4/pB_p l_r$
dimensions are doubled ⇒ $l^1 = 2l$ and $r^1 = 2r$ ⇒ $\Phi^1 = 4\Phi$
No. of turns doubled ⇒ $N^1 = 2N$, f_r changes only when the poles are changed ⇒ $f_r^1 = f_r$
⇒ $E^1 = \sqrt{2}\pi f_r (2N)(4\Phi) = 8E$
The generated voltage will change by a factor of 8.

16. A 6 pole machine is rotating at a speed of 1200rpm. This speed in mechanical rad/sec and electrical radians per second is respectively?
a) 40π, 40π/3
b) 120π, 40π
c) 20π, 60π
d) 40π, 120π

Answer: d
Explanation: N = 1200rpm,P = 6 and f = PN/120 = 60 cycles per sec.
1cycle = 360° electrical degrees = 2π electrical radians
f in electrical radians per sec = 60∗2π electrical radians/sec = 120π elect radians/sec
speed in mechanical radians/sec = 2/P(speed in electrical rad/sec) = 2/P(120π)=40π mechanical rad/sec.

17. The short pitch winding for an alternator gives which of the following statements?

```
(i) improved wave form of the generated EMF per phase
(ii) reduced value of self inductance of the winding
(iii) increased rating of machine
(iv) reduced tooth ripples
(v) increased total generated EMF
(vi) saving in winding copper
```

a) (i), (ii), (iv), (v), (vi)
b) (i), (ii), (vi)
c) (i), (ii), (iv), (vi)
d) (i), (iii), (vi), (iv)

Answer: b
Explanation: The effect of short pitched coil is to reduce the generated EMF, and it improves waveform of EMF generated per phase, and as the windings are placed closed to each other, copper will be saved.

18. The DC machines are designed with flat topped flux density waves because ________________

a) average value of brush voltage is more for a flat topped B-wave
b) average value of brush voltage is less for a flat topped B-wave
c) losses for flat topped B-wave are less
d) none of the mentioned

Answer: a
Explanation: For the same value of peak flux density B_p, it is easy to see that average value of brush voltage could be more for a flat topped B-wave than for a sinusoidal flux density wave.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Losses and efficiency".

1. For the given traction application using a dc series motor for a starting time 't' is applied. If this method is replaced by a series-parallel control, giving 50% time for each series and parallel. The saving in the starting energy of __________
a) 25%
b) zero
c) 50%
d) 75%

Answer: a
Explanation: Initially let the energy utilized was 100% for time t.Then for 50% duration for series, energy used is 50%. For parallel operation for the same circuit, the resistance gets halved assuming the same machine. So, for 50% of the parallel operation, 25% of energy is only utilized. Hence total saving is 25%.

2. If two series motors are identically coupled. One is running as motor while other as generator. For this combination, the iron losses and frictional losses are found identical for __________
a) identical speed and excitation
b) identical speed
c) identical rating and construction
d) none of the mentioned

Answer: a
Explanation: For same iron and frictional losses, same frequency should be there. For that same speed must be run.

3. Hysteresis loss in a dc machine is _____ of rate of flow of air and _____ on frequency of _____

a) independent, dependent, magnetic reversal
b) independent, dependent, operation
c) dependent, independent, magnetic reversal
d) none of the mentioned

Answer: a
Explanation: Hysteresis loss in a dc machine is independent of rate of flow of air and depends on frequency of magnetic reversal.

4. In dc machine iron losses cause __________
a) heating in core
b) loss in efficiency
c) rise in temperature of ventilating air
d) all of the mentioned

Answer: a
Explanation: The iron losses cause heating of the core which causes reduction inefficiency and cooling air gets heated up.

5. For squirrel cage and slip ring induction motor, cooling methods is efficient in __________
a) squirrel cage induction motor
b) slip ring induction motor
c) both of the motors
d) none of the mentioned

Answer: a
Explanation: As the squirrel cage induction motor has more ventilation and more space as compares to slip ring induction motor, there will be more efficient ways to cool down the squirrel cage motor.

6. If one of the phases of the supply breaks down, then the connected three phase induction motor __________
a) continues to run as a single phase induction motor, provided load does does not increase beyond 57.7%
b) stops operating after few seconds
c) continues to run as single phase induction motor
d) continues to run as two phase induction motor

Answer: a
Explanation: When one of the phases breaks down then the other two phases will supply the rated current but the load should be reduced to 57.7%.

7. If one of the phases of RYB supply gets broken, then the temperature rise of the induction motor __________
a) remains same as before
b) reduces as compared to the normal operating temperature
c) reduces to temperature rise of corresponding single phase induction motor
d) increases

Answer: a
Explanation: The current flowing in the armature will remain same so to maintain the flux requirements of the machine. Hence the temperature rise will also remain same as the current remains same.

8. A three phase induction motor is connected to the infinite bus operating at the normal conditions. There occurs an unbalancing in the supply, leading to __________
a) unequal heating losses
b) stopping of motor
c) increase in lower
d) none of the mentioned

Answer: a
Explanation: The unbalancing in the supply phase will create an unbalanced distribution of the current in the phases, thereby unequal heating.

9. A peaky voltage supply is given to the 3 phase power transformer of the connection power system. These results in __________
a) reduction in iron losses
b) reduction in copper losses
c) increase in iron losses

d) reduction in noise

Answer: a
Explanation: The flux wave will be sinusoidal in nature as the emf is peaky in nature. Sine wave has least losses when compared to other wave forms.

10. The iron losses in a saturated three phase alternator is lesser than the non-saturated three phase alternator.
a) True
b) False

Answer: a
Explanation: The non-saturated reactance is greater than saturated reactance. So the reactive losses or iron losses will reduce due lesser contribution of the same.

11. The hydroelectric plants in the industry are best suited with __________
a) closed circuit air cooling
b) hydrogen gas
c) direct water
d) all of the mentioned

Answer: a
Explanation: The closed circuit is so used to reuse the air in the system so that to save water again in the cooling system.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Losses and Efficiency – 2".

1. A consideration of the power losses in electrical machines is essential for which of the following reasons?
a) Operating cost
b) Temperature rise
c) Voltage drops
d) All of the mentioned

Answer: d
Explanation: A machine with lower efficiency has more losses, and therefore increased operating cost. Also, losses cause heating of the machine and therefore, its temperature rise. Similarly, voltage drop IR is associated with ohmic loss.

2. To determine the efficiency of the machine, direct load test is not advantageous because of which of the following reasons?
a) Cost of providing large inputs
b) Difficulty of dissipating the large outputs
c) Both cost of providing large inputs and difficulty in dissipating the large outputs
d) None of the mentioned

Answer: c
Explanation: Also, a small error in the measurement of either output or input causes the same amount of error in the computed efficiency.

3. Which of the following statements are correct regarding brush contact losses?
a) In DC machine: proportional to armature current
b) In synchronous machine: neglected
c) In induction machine: neglected
d) Any of the mentioned

Answer: d
Explanation: There is brush contact loss at the contacts between the brushes and commutator (in DC machine) or between the brushes and slip rings (synchronous and induction machines). However, in practical, the brush contact loss is neglected for synchronous and induction machines.

4. In rotating electrical machines, when the armature rotates, there are continuous magnetic reversals and power required for their reversals is called ______________
a) Eddy current loss

b) Hysteresis loss
c) Resistance or ohmic losses
d) Mechanical loss

Answer: b
Explanation: Hysteresis loss is directly proportional to the number of magnetic reversals per second or the speed.

5. The usual lamination thickness selected to minimize the eddy current loss in rotor is _______________
a) 0.1 mm to 0.2 mm
b) 0.3 mm to 0.4 mm
c) 0.4 mm to 0.5 mm
d) 0.9 mm to 0.10 mm

Answer: c
Explanation: If lamination thickness is made less than 0.4 mm, the reduction in eddy current losses is achieved, but at the cost of additional labor charges in assembling the rotor.

6. In an induction motor, which of the following is correct?
a) Stator core loss < rotor core loss
b) Stator core loss = rotor core loss
c) Stator core loss > rotor core loss
d) Any of the mentioned

Answer: c
Explanation: The rotor core loss is almost negligible because of reduced frequency of the flux reversals (equal to slip frequency, sf) in the rotor, and $P_e \propto f^2$ and $P_h \propto f$. (P_e = eddy current losses, P_h = hysteresis losses).

7. The pole shoes in DC and synchronous machines are laminated to reduce _______________
a) Resistance losses
b) Pulsation or pole-face losses
c) Mechanical losses
d) None of the mentioned

Answer: b
Explanation: The pulsations in flux density wave arising from slot openings cause losses in the field iron, particularly in the pole faces. This loss occurring due to relative motion, between field poles and slotted armature, is referred to as pulsation loss.

8. What percentage of the rated output for DC machine and synchronous machine is taken as stray load losses respectively?
a) 1% and 0.5%
b) 0.5% and 1%
c) 3% and 0.1%
d) 0.1% and 5%

Answer: a
Explanation: Stray load losses cannot be determined accurately. In DC machine, by convention, it is taken as 1% of the rated output for rating above 150 KW. For synchronous and induction machine, it is taken as 0.5% of their rated output.

9. Which of the given losses are directly proportional to square of speed?
a) Windage loss
b) Eddy current loss
c) Both Windage and eddy current loss
d) Hysteresis loss and brush loss

Answer: c
Explanation: The windage loss includes the power required to circulate air through the machine and ventilating ducts, and is approximately proportional to the square of speed. Also, eddy current losses are proportional to square of speed.

10. Which of the following statements regarding efficiency of electrical machines are true?

```
(i) efficiency should be calculated by measuring output and input
(ii) efficiency is maximum when constant losses = variable losses
(iii) electrical machines are designed to have maximum efficiency at full load
(iv) electrical machines are designed to have maximum efficiency at near about full load
(v) efficiency should be calculated by measuring their losses
(vi) efficiency is maximum when constant losses = x times of (variable losses)
```

a) (i), (iii), (vi)
b) (ii), (iv), (v)
c) (i), (ii), (iii)
d) (iv), (v), (vi)

Answer: b
Explanation: The machine efficiency rises with load. but at a particular load, efficiency is maximum and beyond this load, efficiency diminishes. Also, for both motors and generators, machine efficiency is maximum when variable loss = constant loss.

11. The electromechanical energy conversion devices used in power systems are never operated to deliver maximum power output because at maximum power output ______________
a) Efficiency is less than 50%
b) Temperature of the power devices is much more than the specified allowable temperature rise
c) Half of the power input appears as losses
d) Any of the mentioned

Answer: b
Explanation: In practice, devices are operated at a load somewhat less than rated load, at which the efficiency is maximum.

12. For the same rating machines, which of the following statement is correct regarding the efficiency (η)?
a) η of low speed machine > η of high speed machine
b) η of low speed machine < η of high speed machine
c) η of low speed machine = η of high speed machine
d) Any of the mentioned

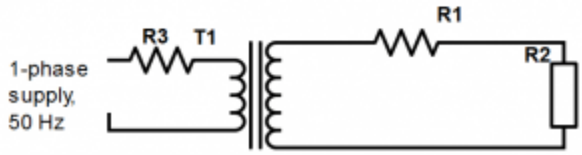
Answer: b
Explanation: The amount of conductor and iron materials required for a machine of given rating is inversely proportional to its speed. Also, more iron and conductor would entail more losses.

13. No load rotational losses in electrical machine consists of ______________
a) Friction and windage losses
b) Stator core, friction and windage losses
c) Rotor core, friction and windage losses
d) No load core, friction and windage losses

Answer: d
Explanation: The sum of friction and windage loss under no load is called no load rotational losses.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Machine Ratings”.

1. Refer the diagram; a single-phase supply of 100V, 50Hz is fed to the step-up transformer having primary impedance of 1 ohms and secondary impedance 20 ohms. What is the power consumed by the load of 5 ohms?



a) 20 W
b) 40 W
c) 10 W
d) 100 W

Answer: a

Explanation: The referred resistance to the secondary, Z2=1*(5^2) = 25 ohms
Total resistance at secondary = 25+20 = 45 ohms
Total resistance seen by source = 45+5 = 50 ohms
Hence, current in secondary = 100/50 = 2 A
Power consumed by the load = I^2*R = 4*5 = 20 W.

2. If the dimension of a single phase transformer is made sqrt(3) times less than the original structure, then what is new no load current rating of the transformer?
a) 1/sqrt(3)
b) sqrt(3)
c) 3
d) 1/3*sqrt(3)

Answer: a
Explanation: The no load current of the transformer is directly proportional to the dimension of the transformer.

3. For a single phase, 50 Hz transformer, if the open circuit test is conducted at 40 Hz. What is the variation in the no-load power factor of the transformer?
a) Decreases
b) Increases
c) Remains constant
d) None of the mentioned

Answer: a
Explanation: If the frequency reduces then flux density increases, so the flux and then the magnetizing current. When magnetizing current increases power factor angle increases so the power factor decreases.

4. The desired voltage regulation for a single phase, 50 Hz transformer is zero. Its pu ohmic drop is 4% and pu reactive drop is 4%. The required power factor angle for the operation in degrees is?
a) 45
b) 90
c) 30
d) 60

Answer: a
Explanation: The power factor angle is, tan(phi)=pu resistive drop/pu reactive drop
= 4/4 = 1.

5. While conducting lab experiments on DC machine loading, the students are given a machine with its rating as 100 kW maximum rating. Then the ______________

a) machine can't be overloaded after 100 kW
b) machine can be overloaded after 100 kW
c) machine can be overloaded by 5% for a small time duration
d) machine can be overloaded by 10%

Answer: a
Explanation: As the maximum rating is specified and operation condition are also same, it cannot be overloaded beyond the maximum.

6. A 3-phase, five limbed shell type transformer, star connected, 200V, 50 Hz, 100 kVA will have ____________
a) no third harmonic current in its phase but has sinusoidal flux
b) third harmonic current in its phase but has flat-topped flux
c) no third harmonic current in its phase but has flat-topped flux
d) third harmonic current in its phase but has sinusoidal flux

Answer: a
Explanation: Star connection in three phase has no closed path for the flow of the third harmonic current.

7. For a separately excited dc machine of 25 kW, 250 V and armature resistance of 0.25 ohms, is running at 3000 rpm with supply of 255 V. The electromagnetic power produced at the armature in kilo watts is?
a) 5
b) 10
c) 0.5
d) 8

Answer: a
Explanation: The current in armature, Ia = 255-250/0.25 = 20 A
Power = Eb*Ia = 250*20 = 5000 W.

8. If two alternators A and B are operated in parallel having per unit synchronous reactance as 0.02 ohms and 0.05 ohms respectively.Then what the ratio of contributing loading of machine A to B?
a) 2.5
b) 0.4
c) 1
d) can not be operated in parallel

Answer: a
Explanation: The load shared by the alternators is inversely related to their pu reactance.

9. A 200V, 10 hp, 4 poles, 60 Hz, Y-connected induction motor had full load slip of 5%. Then the rotor speed of the motor with respect to stator is?
a) 1710 rpm
b) 1800 rpm
c) 90 rpm
d) 3510 rpm

Answer: a
Explanation: Synchronous speed, Ns = 120*f/P = 120*60/4 = 1800 rpm
Rotor speed = (1-slip)*Ns = 0.95*1800 = 1710 rpm.

10. Auto transformer rating is chosen so as to have best performance when the analogous two winding transformer has ____________
a) two voltage levels fairly close to each other
b) very high transformation ratio
c) any voltage levels
d) step down purpose

Answer: a
Explanation: The auto transformer is best suited with the voltage levels of same rating for a two winding transformer.

11. In the lab, two students X and Y conducted the experiments to verify the name plate ratings of the transformer.But student X conducted the same at higher frequency. The kVA reading of student X will be ____________
a) higher than Y’s reading
b) lower than Y’s reading
c) same as Y’s reading
d) none of the mentioned

Answer: a
Explanation: As rating is directly proportional to the frequency of operation.

This set of Electrical Machines online test focuses on “Cooling (Loss Dissipation)”.

1. For the given traction application using a dc series motor for a starting time ’t’ is applied. If this method is replaced by a series-parallel control, giving 50% time for each series and parallel. The saving in the starting energy of _____________
a) 25%
b) zero
c) 50%
d) 75%

Answer: a
Explanation: Initially let the energy utilized was 100% for time t.Then for 50% duration for series, energy used is 50%. For parallel operation for the same circuit, the resistance gets halved assuming the same machine. So, for 50% of the parallel operation, 25% of energy is only utilized. Hence total saving is 25%.

2. If two series motors are identically coupled. One is running as motor while other as generator. For this combination, the iron losses and frictional losses are found identical for _____________
a) identical speed and excitation
b) identical speed
c) identical rating and construction
d) none of the mentioned

Answer: a
Explanation: For same iron and frictional losses, same frequency should be there. For that same speed must be run.

3. Hysteresis loss in a dc machine is _____ of rate of flow of air and _____ on frequency of _____

a) independent, dependent, magnetic reversal
b) independent, dependent, operation
c) dependent, independent, magnetic reversal
d) none of the mentioned

Answer: a
Explanation: Hysteresis loss in a dc machine is independent of rate of flow of air and depends on frequency of magnetic reversal.

4. In dc machine iron losses cause _____________
a) heating in core
b) loss in efficiency
c) rise in temperature of ventilating air
d) all of the mentioned

Answer: a
Explanation: The iron losses cause heating of the core which causes reduction inefficiency and cooling air gets heated up.

5. For squirrel cage and slip ring induction motor, cooling methods is efficient in _____________
a) squirrel cage induction motor
b) slip ring induction motor
c) both of the motors
d) none of the mentioned

Answer: a
Explanation: As the squirrel cage induction motor has more ventilation and more space as compares to slip ring induction motor, there will be more efficient ways to cool down the squirrel cage motor.

6. If one of the phases of the supply breaks down, then the connected three phase induction motor _____________
a) continues to run as a single phase induction motor, provided load does does not increase beyond 57.7%
b) stops operating after few seconds
c) continues to run as single phase induction motor
d) continues to run as two phase induction motor

Answer: a
Explanation: When one of the phases breaks down then the other two phases will supply the rated current but the load should be reduced to 57.7%.

7. If one of the phases of RYB supply gets broken, then the temperature rise of the induction motor _____________
a) remains same as before
b) reduces as compared to the normal operating temperature
c) reduces to temperature rise of corresponding single phase induction motor
d) increases

Answer: a
Explanation: The current flowing in the armature will remain same so to maintain the flux requirements of the machine.Hence the temperature rise will also remain same as the current remains same.

8. A three phase induction motor is connected to the infinite bus operating at the normal conditions. There occurs an unbalancing in the supply, leading to _____________
a) unequal heating losses
b) stopping of motor
c) increase in lower
d) none of the mentioned

Answer: a
Explanation: The unbalancing in the supply phase will create an unbalanced distribution of the current in the phases, thereby unequal heating.

9. A peaky voltage supply is given to the 3 phase power transformer of the connection power system. These results into _____________
a) reduction in iron losses
b) reduction in copper losses
c) increase in iron losses
d) reduction in noise

Answer: a
Explanation: The flux wave will be sinusoidal in nature as the emf is peaky in nature. Sine wave has least losses when compared to other wave forms.

10. The iron losses in a saturated three phase alternator is lesser than the non-saturated three phase alternator.
a) True
b) False

Answer: a
Explanation: The non-saturated reactance is greater than saturated reactance. So the reactive losses or iron losses will reduce due lesser contribution of the same.

11. The hydroelectric plants in the industry are best suited to _____________
a) closed circuit air cooling
b) hydrogen gas
c) direct water
d) any of the mentioned

Answer: a
Explanation: The closed circuit is so used to reuse the air in the system so that to save water again in the cooling system.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Machine applications”.

1. Synchronous-induction coupled motors are required for _____________
a) high starting torque applications
b) high pull out torque applications
c) high running torques applications
d) none of the mentioned

Answer: a
Explanation: Induction motor provides high starting torque with proper values of slip ring terminal resistance. Coupled along with the synchronous motor it acts as an independent set and be employed in high torque application.

2. Which of the following can be used for braking purposes in electric trains?
a) Induction generator
b) Induction motor
c) Dc series motor
d) Dc differentially compounded generator

Answer: a
Explanation: Induction generator runs at a speed greater than the synchronous speed. To apply in braking purposes the induction generator can be run in the opposite direction to that of the operating machine direction and stopped.

3. A synchronous motor absorbing 60 kW is connected in parallel with an continuous load of 240 kW operating at 0.8 power factor lag.What is the kVAR supplied by the synchronous motor to obtain a total power factor of 0.9 lagging?
a) 35, leading
b) 35, lagging
c) 145, leading
d) None of the mentioned

Answer: a
Explanation: Total power = 240 + 60 = 300 kW
cos(phi) = 0.90. Total reactive power = P*tan(phi) = 300*tan(25.8) = 180 kVAR Load kVAR = 240*tan(36.87) = 180 kVAR
kVAR supplied by the motor = 145-180 = -35 or k3 kVAR leading.

4. The most widely used application of ac series motor is _____________
a) electric traction upto 1600 kW
b) paper mills
c) welding
d) none of the mentioned

Answer: d
Explanation: Ac series motor is dc series motor connected to ac supply having an unidirectional torque, which is not very high in magnitude.It is widely applicable for small torque requirements like portable drilling machines, mixers etc.

5. Universal motor is used in vacuum cleaners, table fans and portable drilling machine.
a) True
b) False

Answer: a
Explanation: The universal motor is dc series motor with ac supply with smaller torque. So it can be used for lower torque applications.

6. ________ generator is used in arc welding purposes.
a) Differential compound dc
b) Dc series

c) Cumulative compounded dc
d) Shunt

Answer: a
Explanation: The external characteristics of the differentially compound generator have minimum voltage for the high current voltages. This is best harnessed feature for a high current requirement by the welding application.

7. The dc series generator is employed as _____________
a) a booster to maintain constant voltage at the end of the feeder
b) for supplying traction load
c) for battery bank charging
d) none of the mentioned

Answer: a
Explanation: Referring to the external characteristics of dc series generator shows that the terminal end voltage increases as the loading increases from no load to full load. In feeders due to variable requirements the voltage drops while transferring when loading is raised.

8. If it asked by the customer to provide tappings on the transformer, the most efficient and economical way to provide it at _____________
a) middle of hv winding
b) phase end of hv winding
c) neutral end of hv winding
d) middle of lv winding

Answer: a
Explanation: Tappings are provided to tap different levels of voltages at the high voltage end of the transformer. Providing it as low voltage side has no use and it is not economical.

9. In a single phase induction regulator, the voltage boost is maximum when armature mmf and rotor mmf make an angle of _____________
a) zero degrees
b) 45 degrees
c) 90 degrees
d) 180 degrees

Answer: a
Explanation: To obtain a maximum of the voltage in induction regulator, the stator mmf and rotor mmf should be stationary and aligned to each other.

10. An alternator is to be used for generation purpose in an aircraft. The most suited operating frequency of the alternator should be _____________
a) of 400 Hz to remove extra bulk
b) of 400 Hz to reduce losses
c) of 50 Hz to remove extra bulk
d) none of the mentioned

Answer: a
Explanation: The components to be used in aircrafts are made to operate at very high frequencies so that the size of the components to be used is reduced.

11. A 3-phase synchronous alternator is connected to the infinite bus is over excited, that corresponds to _______________
a) capacitor
b) inductor
c) variable inductor
d) any of the mentioned

Answer: a
Explanation: As the machine is over excited, it will act as source of reactive power and it is positive.
Q=V (Ecos (delta)-V)/X.

This set of Electrical Machines Interview Questions and Answers focuses on “EMF Generated in the Armature”.

1. If the speed of rotation of a separately excited dc machine is halved and the filed strength is also reduced to half of the original. Then the emf induced in the armature _______________
a) reduces to 1/4th of original
b) reduces to half of original
c) remains same
d) doubles

Answer: a
Explanation: Emf is proportional to speed of rotation and flux.

2. If the speed of rotation for a four pole, 220V dc machine is 1 m/s, flux density as 2T having length of bore as 0.1m and radius of 0.5m. The emf induced under pole faces will be _________
a) 0.2 V
b) 0.1 V
c) 0.2*pi V
d) 220 V

Answer: a
Explanation: E = B*l*v
= 2*0.1*1
= 0.2 Volts.

3. The induced emf in the armature of a 4-pole dc machine is _________
a) directly proportional to speed and field strength applied to it
b) directly proportional to speed
c) directly proportional to field strength applied to it
d) inversely proportional to speed and inversely proportional to field strength applied to it

Answer: a
Explanation: Emf is proportional to speed of rotation and flux.

4. If the armature current is by mistake increased to 50% for the dc machine then _________
a) the induced emf remains unchanged
b) the induced emf doubles
c) the induced emf halves
d) none of the mentioned

Answer: a
Explanation: Emf is proportional to speed of rotation and flux.

5. For a four pole, 16 slot armature with two coil-side/slot having lap connected progressive winding has single turn coils. The same machine is then wave wound, the emf induced in the lap wound dc machine to that of wave wound will be _________
a) 2
b) 0.5
c) 1
d) 4

Answer: b
Explanation: E = 1/(P/2)
= 1/(4/2) = 1/2 V.

6. A duplex lap wound armature is used in six pole dc machine with six brush set. The number of current paths in this machine is?
a) 12
b) 6
c) 3
d) 2

Answer: a
Explanation: The number of parallel paths for a lap wound machine is number of parallel paths. As it is a duplex winding, it will have 6*2 = 12 parallel paths.

7. For a four pole, 16 slot armature with two coil-side/slot having wave connected progressive winding has single turn coils has simplex winding. The number of current paths is?
a) 2
b) 6
c) 3
d) 4

Answer: a
Explanation: The number of parallel path for a wave wound machine is equal to two.

8. For a four pole, 200 V dc shunt generator having armature resistance of 1 ohms. The current flowing in the armature is 10 A. What is the back emf generated if the terminal voltage of 220 V supply is fed?
a) 230 Volts
b) 210 Volts
c) 190 Volts
d) 200 Volts

Answer: a
Explanation: E = V+I*ra
= 220+10*1
= 230 Volts.

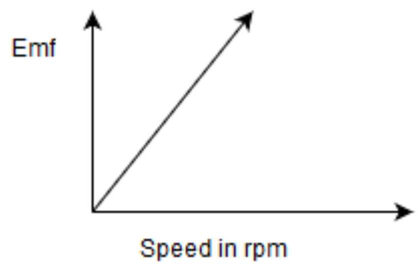
9. For a 4 pole 200 V, 20 A dc generator running at the rated rpm with no load will be _________
a) zero no load losses
b) 4000 W no load losses
c) negligible no load losses
d) none of the mentioned

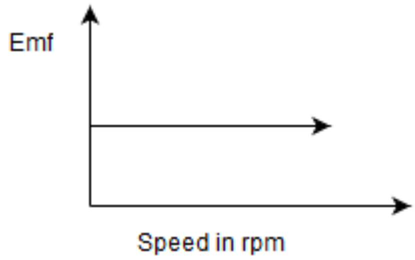
Answer: a
Explanation: As there is no load and assuming no armature resistance, the no load losses should ideally be zero.

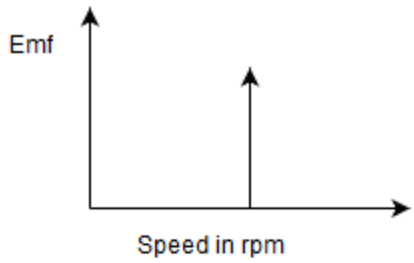
10. Which of the following cannot reduce the terminal voltage of a dc shunt generator?
a) Commutation
b) Armature reaction
c) Armature ohmic losses
d) Any of the mentioned

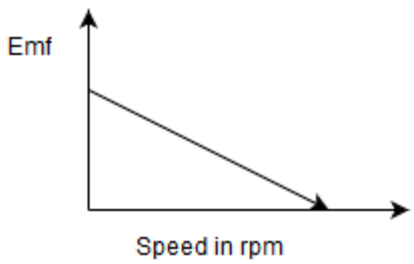
Answer: a
Explanation: Commutation ideally does not reduce the terminal voltage of a dc machine. If it takes place properly at desired timings, the losses can be avoided. Armature reaction, ohmic losses contribute to the losses in the terminal voltage.

11. The emf vs speed characteristics of a dc generator is?

a) 

b) 

c) 

d) 

Answer: a
Explanation: Emf is proportional to speed of rotation.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Action of commutator".

1. What is Commutator?
a) rotating segment to which brushes are attached
b) stationary segment to which rotating brushes are attached
c) rotating segment to which rotating brush segment is attached
d) any of the mentioned

Answer: a
Explanation: Commutator is a rotating segment to which brushes are attached.

2. Commutator action is analogous to __________ in analog electronics.
a) full wave rectifier
b) half wave rectifier
c) comparator
d) amplifier

Answer: a
Explanation: Commutator converts the alternating voltage induced at the armature to the unidirectional voltage at the slip rings.

3. What is Inductive kick?
a) reactance voltage in commutator segments
b) reactance voltage in shorted commutator segments
c) impulsive voltage in commutator segments
d) none of the mentioned

Answer: a
Explanation: Inductive kick is the name given to the reactance voltage which occurs at the commutation taking place in the commutator.It occurs due to the high circulating current during the commutation.

4. Inductive kick causes _________
a) sparking at the brushes of the machine

b) similar problems when neutral phase shift takes place in the armature
c) large current to flow in the equalizer rings
d) none of the mentioned

Answer: a
Explanation: Inductive kick is the name given to the reactance voltage which occurs at the commutation taking place in the commutator.It occurs due to the high circulating current during the commutation.

5. Operation of a dc machine will ________
a) not be affected by commutating poles
b) be affected by commutating poles
c) be affected significantly upto 30% spread of commutating poles
d) none of the mentioned

Answer: a
Explanation: Commutating poles are placed under the armature poles and it compensates only poles under these regions.

6. A 200 V dc machine working at rated speed. Voltage across the commutating terminals should ideally be ________
a) zero
b) 2 V
c) 1 V
d) 200 V

Answer: a
Explanation: The commutating poles undergoing commutation should have zero voltage across it so that there is no reactive voltage induced.
So it will not cause large circulating current in the winding.

7. For a four pole, 16 slot armature with two coil-side/slot having lap connected progressive winding has single turn coils. Then number of commutator segment is?
a) 16
b) 32
c) 4
d) 8

Answer: a
Explanation: Commmutator segment is equal to number of coil slots.

8. For a four pole, 16 slot armature with two coil-side/slot having wave connected progressive winding has single turn coils. The commutator pitch for the machine should be ________
a) 1
b) -1
c) +1 and 1
d) none of the mentioned

Answer: a
Explanation: Commutator pitch for the wave connected progressive winding should be 1.

9. The brushes in dc machine are normally placed electrically in interpolar region to ________
a) make an angle of 90 deg. electrical
b) make an angle of 90 deg. mechanical
c) make an angle of 0 deg. electrical
d) none of the mentioned

Answer: a
Explanation: To obtain proper commutation without any sparks, the magnetic neutral axis and geometrical neutral axis should be aligned to each other,such that coils undergoing commutation experience zero emf across them.

10. The armature rotation in the dc machine and the magnetic field are independent of each other and obey laws of conservation of energy.
a) True

b) False

Answer: a
Explanation: The armature rotation does not affect the stored magnetic energy at the steady state of operation.

11. Under commutation results _________
a) sparking at the trailing edge of brush
b) sparking at the leading edge of brush
c) sparking at the middle of brush
d) any of the mentioned

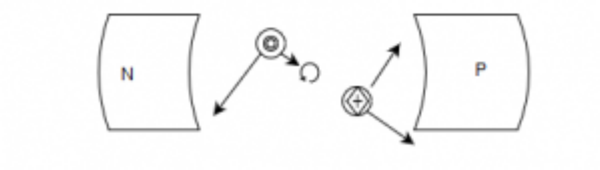
Answer: a
Explanation: Under commutation takes place when the commutation speed is slow and it takes more time than critical defined time for commutation. Because of this the trailing edge of the brush still remains under the commutation.

12. While the operation of dc motor, there are sparkings at the commutation observed. These can be happening due to _________
a) under commutation
b) over commutation
c) too rapid reversal of the current
d) any of the mentioned

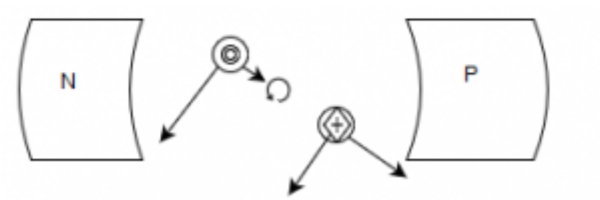
Answer: d
Explanation: The over commutation, over commutation or rapid reversal of the current, any of these reasons can lead to sparking at the brushes.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Torque in DC Machines".

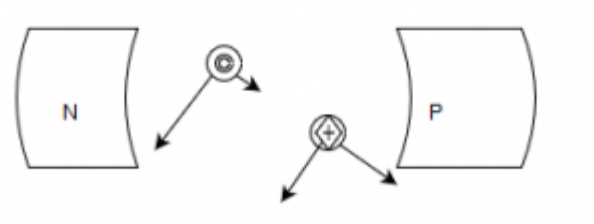
1. Choose the correct representation, which depict a non-zero torque in the armature?



a)



b)

c) 

d) any of the mentioned

Answer: a
Explanation: Torque is produced when the net force is zero and there is a couple generated. The directions must obey Lorentz’s law and vector product.

2. What is the principle of torque production in a dc machine?
a) Lorentz’s law
b) Lenz’s law
c) Faraday’s law
d) Self inductance

Answer: a
Explanation: Though all the mentioned laws contribute towards the torque generation, but primarily its the Lorentz’s forces which initiate and define the torque direction.

3. The torque induced beyond the pole shoes in the DC machine is?
a) 0
b) 2/pi *phi *i
c) 4/pi *phi *i
d) none of the mentioned

Answer: a
Explanation: The magnetic field vanishes at the pole terminals and thus the cross product with the magnetic field yields zero.

4. The simple rotating loop between pole faces connected to a battery and resistor through a switch, the specifications of this machine are radius = 0.5m, length 1m, resistance = 0.3 ohms and magnitude strength = 0.25T is supplied with 120V. Suddenly the switch is closed at t=0, what is observed in the circuit?
a) Current will flow but zero induced EMF
b) Current will not flow and zero induced EMF
c) Current will not flow but EMF is induced
d) Current will flow and EMF will also be induced

Answer: a
Explanation: Initially the induced emf in the armature is zero. But the current will flow as there is terminal source voltage.

5. The simple rotating loop between pole faces connected to a battery and resistor through a switch, the specifications of this machine are radius = 0.5m, length 1m, resistance = 0.3 ohms and magnitude strength = 0.25T is supplied with 120V. What will be the magnitude of the following current at t=0+?
a) 400A
b) 200A
c) 0
d) any of the mentioned

Answer: a
Explanation: I = (V-E)/r
= (120-0)/0.3
= 400 A.

6. If the torque induced is zero in the dc machine, it can be said that _____________
a) current is zero
b) flux can be zero
c) current or flux=0
d) any of the mentioned

Answer: a
Explanation: The torque at steady state of operation is zero as the emf induced is equal to the source voltage. Also the the very much starting the current will be zero which will not let the emf to get induced.

7. The simple rotating loop between pole faces connected to a battery and resistor through a switch, the specifications of this machine are radius = 0.5m, length 1m, resistance = 0.3 ohms and magnitude strength = 0.25T is supplied with 120V. What is the steady state angular velocity at no-load?
a) 480 rad/s
b) 960 rad/s
c) 320 rad/s
d) 490 rad/s

Answer: a
Explanation: v = V/(2*r*l*B)
= 120/(2*0.0005*1*0.25)
= 480 rad/s.

8. If the torque is in the direction of rotation, the DC machine acts as _________
a) generator
b) motor
c) amplidyne
d) any of the mentioned

Answer: a
Explanation: The electromagnetic torque generated in the dc generator is in the direction in which the prime mover is rotated.It is produced due to the action of armature current and stator field.

9. The cogging torque is absent in the permanent magnet dc machine is due to _________
a) non-magnetic nature of rotor

b) magnetic nature of rotor
c) absence of ac supply
d) any of the mentioned

Answer: a
Explanation: It is due to the fact that no field poles are induced in PMDC to create magnetic flux leading to harmonics.

10. DC Motor torque depends on _________
a) geometry
b) magnetic properties
c) any of the mentioned
d) both geometry and magnetic properties of the structure

Answer: d
Explanation: The torque will indeed depend on the geometry as well the magnetic materials used in the construction of the dc machine. Though this remains constant with the machine.

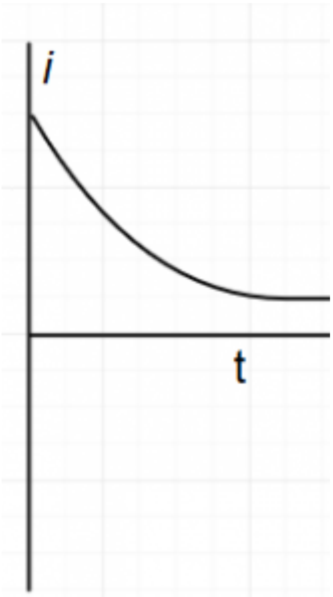
11. For a universal motor, the rated supply current is 10A giving a rated torque of 100 N-m. If a current of 5A is applied, what will be generated torque vary to?
a) 250 N-m
b) 400 N-m
c) 500 N-m
d) 1000 N-m

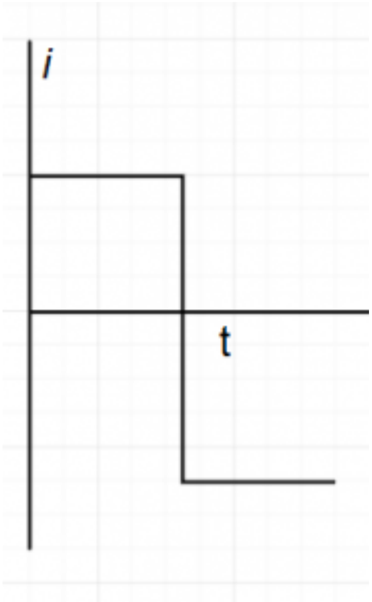
Answer: b
Explanation: The torque is proportional to the square of the current.
So the new torque will be 100*(2^2) = 400 N-m.

12. Pulsating torque frequency in universal motor is _________
a) 2f
b) f
c) f/2
d) 4f

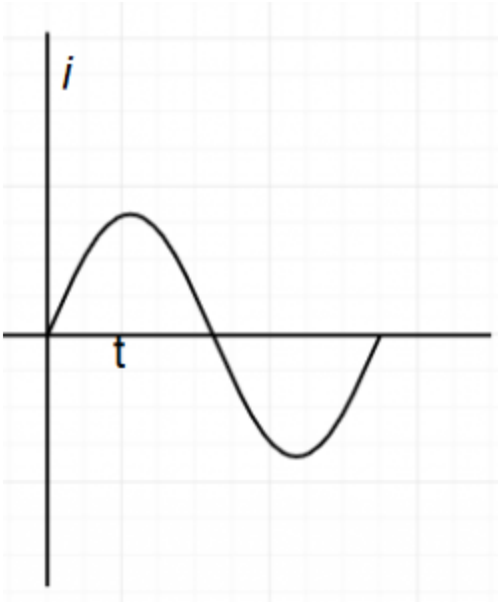
Answer: a
Explanation: The torque reverses its direction in the negative cycle of the ac supply and thus it always unidirectional.

13. The variation of current in the armature can be best expressed by which of the below curves?

a) 



b)

c) 

d) An impulse signal

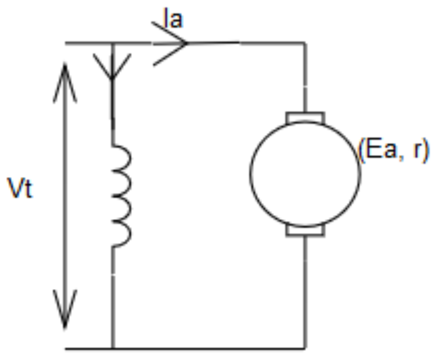
Answer: a
Explanation: The emf induced is initially zero which causes a high current in the begining and slowly as the emf is build up, the current reduces to zero at steady state.

14. The velocity of the dc machine at the final state is ________
a) E/Bl
b) Bl/E
c) EBl
d) None of the mentioned

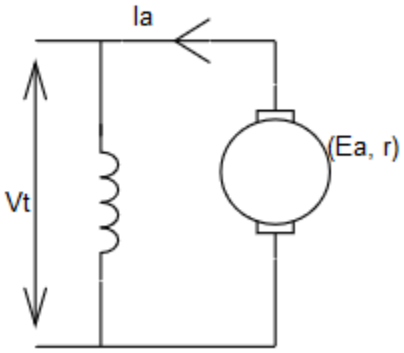
Answer: a
Explanation: The velocity at steady state is E/Bl.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Circuit Model of DC Machines".

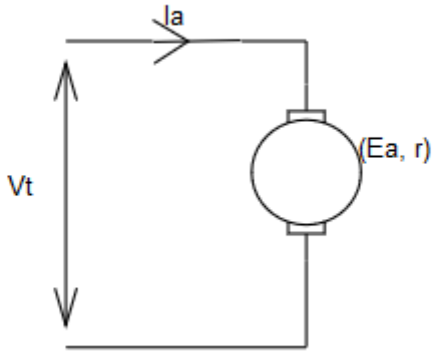
1. The circuit depicting the equation V=Ea + I*Ra.



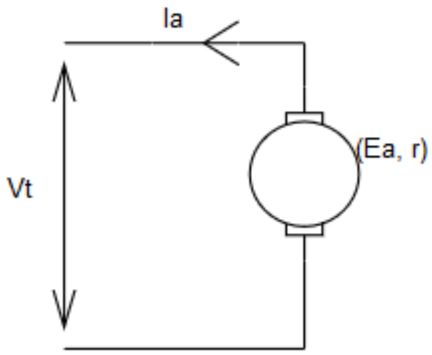
a)



b)



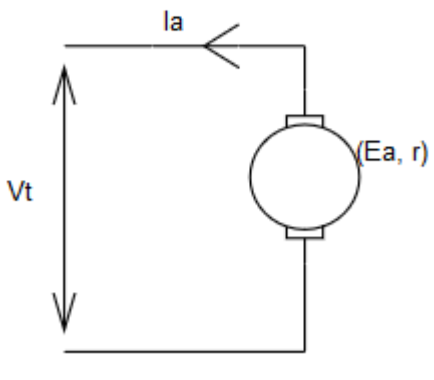
c)



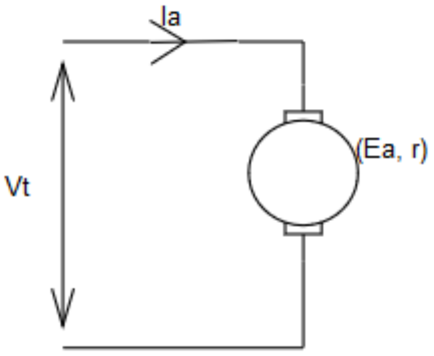
d)

Answer: a
Explanation: This is a motor performance equation.

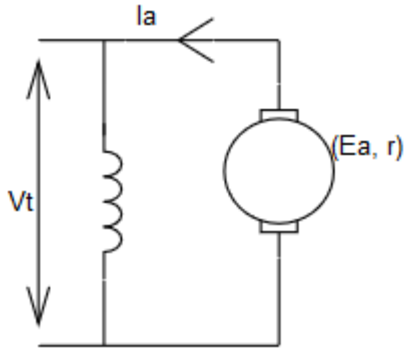
2. The circuit depicting the equation V=Ea – I*Ra.



a)



b)



c)

d) None of the mentioned

Answer: a
Explanation: This is a generator performance equation.

3. If the terminal voltage of 220-V dc generator having armature resistance of 1 ohms. The induced emf produced is 200-V. The armature current for the above machine is?
a) 20 A
b) -20 A
c) -10 A
d) 10 A

Answer: a
Explanation: I = V-E/r
= 220-200/1
= 20 A.

4. The voltage drop at brush-commutator contact is variable (1-2V) and dependent of armature current.
a) True
b) False

Answer: b
Explanation: The voltage drop at brush-commutator contact is variable (1-2V) and independent of armature current.

5. What is the shaft power at the DC Generator?
a) sum of mechanical power and rotational losses
b) only mechanical losses
c) no-load losses and mechanical power
d) any of the mentioned

Answer: a
Explanation: The shaft power is sum of mechanical power and rotational losses.

6. If the electromagnetic torque in a DC shunt-generator is opposite, what can be further concluded?
a) Mechanical power is absorbed by the machine
b) Mechanical power is delivered by the machine
c) Electromagnetic torque is in same direction of prime mover
d) None of the mentioned

Answer: a
Explanation: When the electromagnetic torque is in opposite direction, it is of motoring nature.

7. The conductor EMF and current are in ______ direction and developed torque is in ______ for generating mode.
a) same, opposite
b) same, same
c) opposite, same
d) opposite, opposite

Answer: a
Explanation: The conductor emf and current will be in same direction and the developed torque is in opposite direction for a generator.

8. If the armature terminal voltage is more that its induced EMF, the DC machine given is _________
a) motoring mode
b) generating mode
c) regenerative mode
d) none of the mentioned

answer: a
Explanation: As the terminal voltage is lesser than armature voltage, the supply is fed to the machine and so it will be acting like a motor.

9. Consider a 200V, 25kW, 30A DC machine lap connected with armature resistance of 0.4 ohms. If the machine is later wave wound, then the developed power is?
a) 25 kW
b) 12.5 kW
c) 20 kW
d) 50 kW

Answer: a
Explanation: The power of the machine remains unaltered by the type of connections.

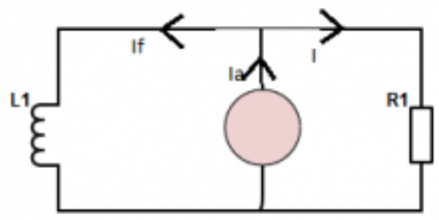
10. If the DC machine is held constant at 3000 rpm. The DC voltage is 250V. If the field is held constant with 250V. Is this machine generator or motor?
a) Motor
b) Generator
c) None of the mentioned
d) Any of the mentioned

Answer: a
Explanation: From the speed and emf relation, E = 250*2950/3000
= 245.8 V
This is less than the terminal voltage. Hence it is a motor.

11. A shunt generator has an induced voltage on open circuit of 127 V. When the machine is on load the terminal voltage is 120 V. The load current if the field resistance be 15 ohm and

armature resistance be 15 ohm.
a) 342 A
b) 350 A
c) 358 A
d) 8 A

Answer: a
Explanation: Ia*Ra = E-V
= 127 – 120
= 7 V
Ia = 350 A
Ish = 120/15
= 8 A
I = 350 – 8
= 342 A



This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Methods of Excitation in DC Machines”.

1. Consider a DC generator running at the rated speed of 2000 rpm, suddenly there is an insulator falls on the field circuit and breaks it. Then ___________
a) the motor stops in a few rounds
b) it continues to run but as dc motor
c) it continues to run as a motor
d) none of the mentioned

Answer: a
Explanation: As the field circuit gets broken there is interruption in the flux to the dc machine, and as a result the motor stops in few seconds.

2. If a self excited DC generator is failed to run, this refers to __________________
a) zero residual voltage
b) field MMF, that it is not cumulative
c) resistance is greater than critical resistance
d) any of the mentioned

Answer: a
Explanation: Any of the reasons are valid for no build up of an emf.

3. The self-excited dc generator with gradual build up of residual voltage and EMF corresponds to ___________
a) positive feedback
b) negative feedback
c) saturation
d) any of the mentioned

Answer: a
Explanation: It responds to a positive feedback because the gain is always more than one in the linear region.

4. The critical resistance refers to ___________
a) the resistance above which machine does not excite
b) the resistance below which machine does not excite
c) the resistance at which machine does not excite
d) any of the mentioned

Answer: a
Explanation: After taking a glance at the magnetization curve, it can be concluded that the emf will not build up if the resistance is greater than critical resistance.

5. If a DC shunt generator fails to start, the most primitive action would be ___________
a) reversing field connection to armature
b) reversing direction of rotation
c) any of the mentioned applicable ways
d) none of the mentioned

Answer: a
Explanation: The first measure is to check if the field winding as properly connected with additive polarity so that the flux is aiding in nature.

6. Flashing is used to ___________
a) temporarily excited field from a battery source for large DC generator
b) temporarily excited field from a battery source for small DC generator
c) temporarily excited field from a battery source for large DC motor
d) temporarily excited field from a battery source for large DC motor

Answer: a
Explanation: It is a method to give a kick start to dc machine when its residual magnetism is vanished.

7. A series generator, having external characteristics which is a straight line through 0 to 50 V at 200 A is connected as a booster, between a station bus-bar and feeders of 0.5 ohm resistors. The voltage at the far end of feeder at current of 50 A is?
a) 25 V
b) 17 V
c) 8 V
d) 50 V

Answer: a
Explanation: V = voltage drop-voltage added up by boosters
= (0.3*50 – 50*50/200)
= 15-12.50
= 2.5 V.

8. The number of parallel paths in the armature is increased by ___________
a) increasing number of magnetic poles
b) decreasing number of magnetic poles
c) lap number of magnetic poles
d) using more brushes

Answer: a
Explanation: It is increased by increasing magnetic poles which give parallel path to the magnetic circuit.

9. A dc series generator as armature and field connections are reversed, the generator ___________
a) stops
b) opposite direction
c) same direction
d) none of the mentioned

Answer: a
Explanation: It happens due to non build up voltage.

10. ______________ is responsible for mechanical power output of a DC motor.
a) Electrical input power
b) Any of the mentioned
c) Air-gap flux
d) Armature emf

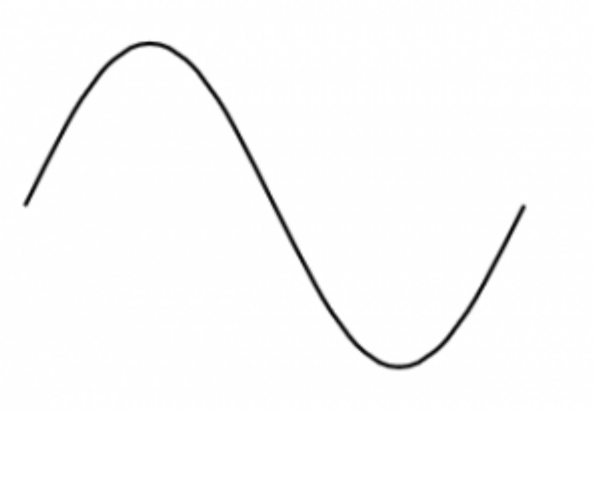
Answer: a
Explanation: Primarily it is the electrical input power that starts the motoring action.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Mmf and Flux Density wave forms in dc machines".

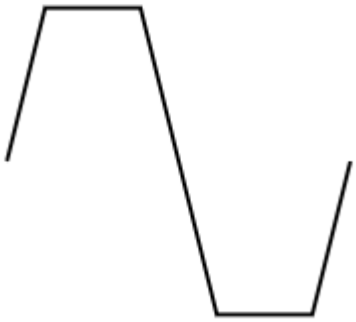
1. The armature mmf affects ___________
a) commutation
b) generated voltage
c) torque
d) any of the mentioned

Answer: a
Explanation: Armature reaction thus armature mmf affects all of the mentioned above.

2. The space distribution of flux produced in a DC machine is?



a)



b)

c)

d) None of the mentioned

Answer: d
Explanation: Distorted triangular waveform shape is that of flux distribution under poles, which is due to the armature reaction.

3. Armature reaction in a dc machine is ___________
a) cross magnetizing in nature
b) magnetizing in nature
c) demagnetizing in nature
d) none of the mentioned

Answer: a
Explanation: It is cross magnetizing in nature which happens due to interaction between stator and field mmf.

4. The air-gap flux density waveform has decreased flux under one pole tip and measured under the other is due to ___________
a) cross magnetization
b) magnetization
c) demagnetization
d) saturation of iron magnetic circuit

Answer: a
Explanation: The flux density increases under one pole tip while it decreases under the other due to the saturation of iron magnetic circuit.

5. The flux distortion caused by cross magnetizing armature reaction is more pronounced in a ___________
a) dc shunt motor
b) dc series motor
c) any of the mentioned
d) differential Compound Motors

Answer: a
Explanation: Since field excitation remains substantially constant, while aarmature mmf reaches higher values at loading.

6. Which method needed to limit cross-magnetizing effect?
a) by increasing reluctance of cross flux path
b) by chamfering the pole faces

c) by compensating winding
d) any of the mentioned

Answer: a
Explanation: By ultimately increasing the reluctance of the magnetic circuit at the pole tips so that the armature reaction effect is neutralized.

7. The brushes of a dc motor, are shifted by 5′, from the main field axis, then ___________
a) demagnetizing or magnetizing effect may occur depending on machine
b) cross-magnetization will be pronounced
c) both cross-magnetization as well as magnetization and demagnetization will occur
d) none of the mentioned

Answer: a
Explanation: When the brushes are shifted from GNA, there will either be magnetizing or demagnetizing effect will be observed.

8. A 100KW, 250 V, 400 A, a long shunt compound generator has an armature resistance of 0.025 ohms. There are 1000 shunt fields turns per pole and 3 series field turns per pole. The series field is connected in a such a fashion that positive armature current produces direct-axis MMF which adds to that of the shunt field. Compute the gross MMF at the rated terminal current when shunt field current is 4.7A and speed is 1150 rpm.
a) 5.9AT
b) 3.5AT
c) 4.7AT
d) 1.2AT

Answer: a
Explanation: Series field current = Is = I(l)+I(f)
= 400+4.7
= 405 A(approx)
Main field mmf = I(f)+(Ns/Nf)*I(s)
= 4.7+(3/1000)*405
= 5.9 AT.

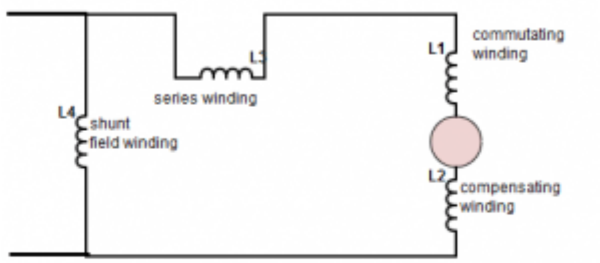
9. Compensating windings are embedded in pole faces and having the same polarity as that of adjoining armature winding.
a) True
b) False

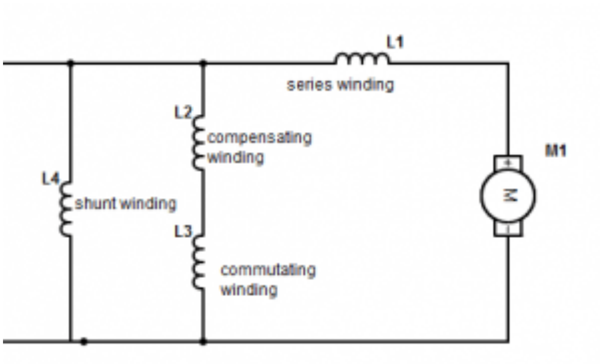
Answer: b
Explanation: Compensating windings are embedded in pole faces and having an opposite polarity as that of adjoining armature winding.

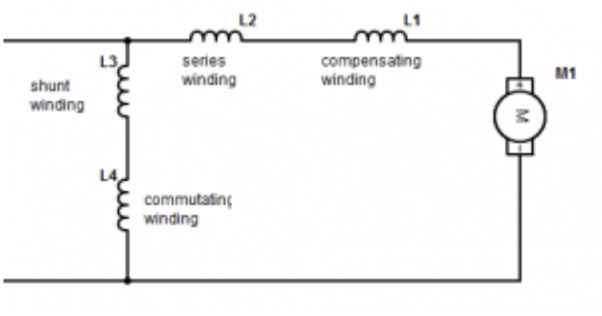
10. Compensating winding has an advantage of ___________
a) eliminating flux distortion
b) importing speed of response
c) protecting overloading
d) any of the mentioned

Answer: a
Explanation: Any of the corrective measures will be applicable.

11. The correct positioning of the windings in the below diagrams is?

a) 


L1
series winding
L2
compensating
winding
L4
shunt winding
L3
commutating
winding
M1
b)



c)

d) Any of the mentioned

Answer: a
Explanation: Commutating and compensating fields act along armature axis. Shunt and series fields act along main field axis.

12. A dc shunt motor is connected to the source through 3-point starter. If the field id kept open and starter handle is moved from off to on position, then ___________
a) motor will not start
b) armature will draw large current from source
c) no sparking would occur
d) all of the mentioned

Answer: d
Explanation: Leaving the field winding open, the machine will not start as the exciting flux is zero.

13. A dc shunt motor is running at 1000 rpm at the rated load torque. If we reverse the filed winding terminals, then the ___________
a) direction of rotation reverses and commutation will be unaffected
b) direction of rotation will be same and commutation will be unaffected
c) direction of ration reverses and commutation will be affected
d) direction of ration will be same and commutation will be affected

Answer: a
Explanation: Reversing the field will change the direction of rotation but will not affect the commutation.

14. A dc shunt motor is running at 1000 rpm at the rated load torque. If we reverse the supply terminals, then the ___________
a) direction of rotation reverses and commutation will be unaffected
b) direction of rotation will be same and commutation will be unaffected

c) direction of ration reverses and commutation will be affected
d) direction of ration will be same and commutation will be affected

Answer: b
Explanation: Reversing the supply in dc machine will not change the direction of rotation and will not affect the commutation too.

15. A dc shunt motor is running at 1000 rpm at the rated load torque. If few of the field windings get shot circuited then the ___________
a) motor speed will increase and more armature current is drawn
b) motor speed will decrease and more armature current is drawn
c) motor speed will increase and lesser armature current is drawn
d) motor speed will decrease and lesser armature current is drawn

Answer: a
Explanation: If field winding get short circuited, field excitation reduces causing rise in speed and more armature current.

This set of Electrical Machines MCQs focuses on “Effect of Brush Shift and Compensation Windings”.

1. The brushes are placed ___________
a) along geometrical neutral axis
b) perpendicular to geometrical neutral axis
c) along magnetic neutral axis
d) perpendicular to magnetic neutral axis

Answer: a
Explanation: The brushes are placed along geometrical neutral axis so that in ideal conditions commutations take place without sparking. Also placing brushes along the magnetic neutral axis requires consistent variations as load varies which is not desirable.

2. The brushes should be shifted in ________ direction in generator for the satisfactory operation of commutation.
a) forward
b) reverse to rotation
c) all of the mentioned
d) none of the mentioned

Answer: a
Explanation: For the generator, the electromagnetic torque produced is in the opposite direction and so the induced current. So to eliminate the sparking the brushes should be shifted in the forward direction of rotation.

3. With no commutating poles used the brushes are given backward lead in the dc motor.
a) True
b) False

Answer: a
Explanation: The armature reaction flux at the trailing edge weakens the flux and at the leading edge is strengthens the flux in the dc motor.

4. If the critical commutation time is 2 ms but it was observed that the practical commutation took 2.5 ms. This is the case of ___________
a) under commutation
b) over commutation
c) critical commutation
d) none of the mentioned

Answer: a
Explanation: Since the time taken is more than the prescribed time limit for the commutation, it is under commutation.

5. The coil under going commutation lies along ______ while the coil getting short circuited lies along _____ for a practical dc machine.
a) gna, mna

b) mna, gna
c) gna, gna
d) mna, mna

Answer: a
Explanation: In a practical dc machine, the coil undergoing commutation lies along GNA so as the brushes and the coils which actually get short circuited lies along mna. This lead to sparking as a voltage difference is created at the coils.

6. The principle contributors to magneto motive force is/are ___________
a) field current and armature current
b) field excitation
c) electromagnetic torque
d) all of the mentioned

Answer: a
Explanation: The interaction between the field excitation and armature supply create the mmf and the interconnected behaviour creates the emf.

7. The absence of compensating winding lead to ___________
a) statically induced emf in armature
b) fluctuations in supply
c) reduction in the flux
d) any of the mentioned

Answer: a
Explanation: The static emf induced inside gets reduced due to the armature reaction in large machines when there is no compensating winding present.

8. The number of compensating conductors/pole faces is ________ (where Z is the number of active armature conductors/pole; A is number of parallel paths; Ia is the armature current).
a) Z/A*Ia
b) 2*A*Ia/Z
c) Z*Ia/A
d) Z/2A*Ia

Answer: a
Explanation: Compensating conductors per pole face is Z/A*Ia.

9. A 400-V, 1000-A, lap wound dc machine has 10 poles, 860 armature conductors. The number of conductors in the pole face to give full compensation if pole face covers 70% of pole span is?

a) 3010
b) 4300
c) 2400
d) 2800

Answer: a
Explanation: AT/pole for the compensating winding = 0.7*(Z*I/2P)
= 0.7*(860*100/2*10)
= 3010 AT.

10. Each of the following is valid for interpoles except ___________
a) they are connected in parallel with the armature so that they carry part of armature current
b) they are small yoke fixed poles spaced in between main poles
c) their polarity, in case of generator is same as that of main poles ahead
d) they automatically neutralize not only reactance voltage but cross-magnetization also

Answer: a
Explanation: All the options are valid for the interpoles except a because they are connected in series not in parallel.

11. Mark the most incorrect. In dc generator, commutation can be improved by ___________
a) using interpoles
b) using carbon brushes

c) shifting brush axis in direction of armature rotation
d) none of the mentioned

Answer: a
Explanation: All the given measures are used to eliminate the effect of armature reaction and hence improves commutation also.

12. The commutation process involves basically reversal of current in armature coil as it crosses MNA.
a) True
b) False

Answer: a
Explanation: By reversing the current direction in the MNA the current can be limited in the coils to avoid sparking.

13. The armature reaction is produced mainly by ___________
a) load current in armature
b) load current in field
c) all of the mentioned
d) none of the mentioned

Answer: a
Explanation: The armature reaction is initiated by the loaded conditions of the machine because an unloaded dc machine does not armature flux to get distorted.

14. The compensating winding in dc generator is provided to ___________
a) neutralize cross-magnetizing flux
b) neutralize demagnetizing flux
c) neutralize armature mmf
d) maintain magnetizing mmf

Answer: a
Explanation: The compensating winding functions such that to nullify the cross magnetization effects in the armature.

15. If the magnetic circuit of the dc machine is in the saturation region, the armature reaction ___________
a) does not affect flux/pole
b) increases the flux/pole
c) decreases flux/pole
d) affects the flux/pole only when armature current is small

Answer: a
Explanation: In the saturation region the flux will be constant.

This set of Electrical Machines Questions and Answers for Freshers focuses on “Efficiency and Testing of DC Machines”.

1. A dc motor is connected in the short-shunt configuration, but the series and the shunt windings get interchanged by mistake and the motor is connected to the rated voltage?
a) neither of the windings get short-circuit
b) series winding gets overloaded
c) shunt winding gets overloaded
d) both of the winding get overloaded

Answer: a
Explanation: In the short shunt configuration, the winding interchanging does not change the configuration of the set up so none of the winding get affected.

2. What is the main concern before doing hopkinson’s test for finding efficiency?
a) needs one motor and one generator is that it
b) ignores iron and stray losses
c) needs one motor
d) requires identical shunt machines

Answer: d
Explanation: It is must that both the machines are identical as required by the calculations.

3. Retardation test on DC shunt motor is used for finding ________
a) stray losses
b) copper losses
c) friction losses
d) iron losses

Answer: a
Explanation: Retardation test is used for finding the stray losses.

4. The quantities needed to complete retardation test are/is __________
a) dw/dt and moment of inertia
b) dw/dt
c) current
d) any of the mentioned

Answer: a
Explanation: We need the angular acceleration and the moment of inertia of the machine.

5. _______ test is used for determining the efficiency of a traction motor.
a) Field
b) Retardation
c) Hopkinson
d) Swineburne's

Answer: a
Explanation: Field test is used for finding efficiency of a traction motor.

6. If the field current and armature current are reversed, then the ___________
a) direction of rotation remains same
b) direction of rotation reverses
c) stops
d) none of the mentioned

Answer: a
Explanation: When both field current and armature current are reversed then the direction will not change.

7. Mark the possible causes of overheating of commutator in a DC machine.
a) Overload
b) Restricted ventilation
c) Shorted winding
d) Any of the mentioned

Answer: a
Explanation: All the factors can cause the overheating of commutator.

8. In the hopkinson's test on two DC machines. Machine A has field current of 1.4A and B has field current of 1.3A. Which machine acts as motor?
a) B
b) A
c) A, B
d) None of the mentioned

Answer: a
Explanation: Ea/Eb = 1.4/1.3
Ea = 1.077 Eb > Eb
So, the machine will act as motor.

9. In the Hopkinson's test on two DC machines. Machine A has field current of 1.4A and B has field current of 1.3A. Which machine acts as generator?
a) B
b) A
c) A,B

d) None of the mentioned

Answer: b
Explanation: Ea/Eb = 1.4/1.3
Ea = 1.077 Eb > Eb
So, the machine will act as generator.

10. Hopkinson's test is also called regenerative test due to ______________
a) energy of one machine is used to drive other
b) feedback
c) losses are least
d) extra motor is used

Answer: a
Explanation: Regenerative phenomena utilizes the energy of the running machine to tap the dynamically produced energy and use it to charge the battery.

11. Which is the most appropriate relation to find efficiency of the generator?
a) output/(output + losses)
b) (output – losses)/input
c) (output – losses)/(output + losses)
d) any of the mentioned

Answer: a
Explanation: For a generator the output can be measured and so this expression is used.

12. The efficiency in the swineburne's test can be found.
a) True
b) False

Answer: a
Explanation: Because the constant losses are known.

13. The possible assumption is/are made while doing swineburne's test.

```
(i) mechanical loss constant
(ii) Armature reaction neglected
(iii) Increases in flux
```

a) (i) and (ii)
b) (iii) and (i)
c) (i), (ii), and (iii)
d) (i)

Answer: a
Explanation: There is decrease in flux due to positive temperature coefficient of resistance in shunt machine.

14. Swineburne's test is applicable to those machines in which flux is practically ________
a) constant
b) linear
c) non-linear
d) none of the mentioned

Answer: a
Explanation: Because the constant losses are known in advance of the test is conducted.

15. Similarity between Hopkinonson's and field's test is that ________
a) both need similar mechanically coupled motor
b) both need similar electrically coupled motor
c) regenerative power
d) negligible power

Answer: a
Explanation: The machines have to be mechanically coupled together.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “DC Machine Applications”.

1. Inspite of heavy initial investments, dc motors are used due to _______________
a) flexibility and ease of control
b) lower losses
c) improved power factor of the system
d) all of the mentioned

Answer: a
Explanation: The control of dc machines is very much simplified when compared to other machines. So this makes it very useful when compared.

2. Separately excited dc generators are used in ___________
a) Ward leonard system of speed control
b) Hopkinson’s testing
c) Voltage control
d) None of the mentioned

Answer: a
Explanation: Separately excited dc generators are used in Ward leonard system of speed control.

3. Maximum torque in dc series motor is limited by ___________
a) commutation
b) heating
c) field control
d) all of the mentioned

Answer: a
Explanation: Commutation is the process which reduces the induced emf and so the torque.

4. Hoists, cranes and battery powered vehicles use __________ motors in the locomotive.
a) dc series
b) dc shunt
c) induction
d) reluctance

Answer: a
Explanation: Hoists, cranes require large starting torque which can be provided by dc series motor.

5. There is an application which required pulsating loads, punch presses. The most preferred machines would be ___________
a) compound dc machine
b) series dc machine
c) shunt dc machine
d) all of the mentioned

Answer: a
Explanation: It is compound machine whose flux can varied higher as well as lower in order to have variable torques.

6. The manufacturer has mentioned a medium starting torque and 15% speed regulation. Which is the most appropriate motor for this requirement?
a) dc shunt motor
b) induction motor
c) differential motor
d) none of the mentioned

Answer: a
Explanation: The dc shunt motor provides a medium values of the torque.

7. Centrifugal pumps, fans-blowers use ___________
a) shunt as well as induction motor
b) only shunt motors

c) only induction motor
d) none of the mentioned

Answer: a
Explanation: Centrifugal pumps, fans-blowers use shunt as well as induction motor.

8. Most commercial compound dc generator are normally supplied by manufacturers as over compound machines because ___________
a) degree of compounding can be adjusted by diverters acrosss series field
b) they have ideally best for HVDC
c) cost effective than shunt
d) zero percent regulation

Answer: a
Explanation: It is usually over compounded so that degree of compounding can be adjusted by diverters across series field.

9. Which of the following are applied with differential compound motor?
a) Hoist
b) Cranes
c) Drilling machines
d) None of the mentioned

Answer: a
Explanation: Practically it is never used as the speed can rise very high.

10. Most commercial compound dc generator are normally supplied by manufacturers as _______ compounded machines.
a) over
b) under
c) level
d) none of the mentioned

Answer: a
Explanation: Most commercial compound dc generator are normally supplied by manufacturers as over compounded.

11. Long back ago, magnetic casette were in use, having permanent magnet dc motors which had?
a) magnets on stator and armature on rotor
b) magnet on rotor and armature on stator
c) electronic commutation
d) all of the mentioned

Answer: a
Explanation: PMDC motors have field fixed on the stator and rotor has coils.

12. If a dc shunt motor is stopped by forcing starter handle back to OFF position, then the ___________
a) dangerous sparking occurs at last stud
b) dangerous sparking occurs at all stud
c) it stops normally
d) heavy sparking

Answer: a
Explanation: The sparking will occur at the last stud not all the studs of the starter.

13. Interpoles are used to start the dc motor above the base speed.
a) True
b) False

Answer: b
Explanation: Interpoles do not reduce the flux across the windings, hence the speed does not rise above base speed.

14. A 200 V dc motor has external resistances of Ra and Rf in armature and field circuits respectively. The starting current is reduced when?
a) Ra is maximum and Rf minimum
b) Rf is maximum and Ra minimum
c) Ra is minimum and Rf minimum
d) Ra is maximum and Rf maximum

Answer: a
Explanation: When Ra is maximum and Rf minimum then the current to the armature is reduced. And hence the sparkings are reduced while starting.

15. A d.c. generator has been provided tappings on the armature winding at intervals of 120 degrees from the side of commutator. The connection will be ___________
a) delta connected alternator
b) star connected alternator
c) star connected induction motor
d) any of the mentioned

Answer: a
Explanation: Dc generator if has displaced by 120 degrees physically then it will act as Ac machine.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Operating Characteristics of DC Generators”.

1. Which of the following characteristics reveal about the magnetization nature of the machine?

a) No-load characteristics
b) Load characteristics
c) Armature characteristics
d) Both no-load and load characteristics

Answer: d
Explanation: Both no-load and load characteristics are required to predict the magnetization of the machine.

2. Choose the most inappropriate out of the following for the no-load characteristics of the dc generator.
a) It is the open circuit characteristic of the machine
b) It is magnetization characteristic of the machine
c) It is conducted on the unloaded machine
d) None of the mentioned

Answer: d
Explanation: All the mentioned nature of the characteristics are correct.

3. The external characteristic is plotted between _____________
a) terminal voltage vs armature current at constant excitation
b) terminal voltage vs field current at constant armature current
c) induced armature emf vs armature current at constant excitation
d) none of the mentioned

Answer: a
Explanation: The external characteristic is plotted between terminal voltage and armature current at fixed excitation.

4. A student forgot to mark the x-y axes in his experiments but he just noted down the cause and the effect for each. How will he conclude about the armature characteristic out of the all plotted graphs?
a) By marking graph for constant terminal voltage
b) By marking graph for constant field current
c) By marking graph for constant armature current
d) By marking graph for constant speed

Answer: a
Explanation: Armature characteristic is observed at constant terminal voltage for emf vs armature current.

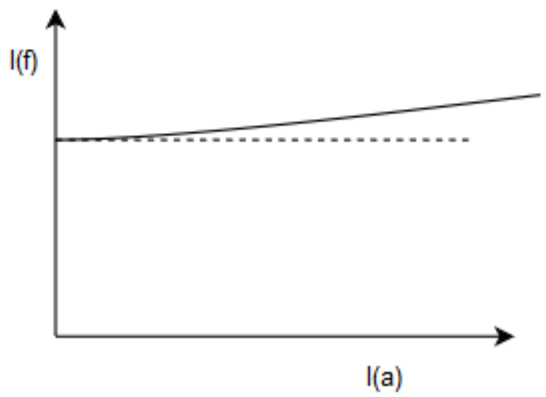
5. Armature characteristic is also known as __________
a) regulation characteristic
b) magnetization characteristic
c) external characteristic
d) load characteristic

Answer: a
Explanation: Armature characteristic is also known as regulation characteristic. It is so called due to the fact that the difference in the terminal voltage helps to determine the voltage deviation.

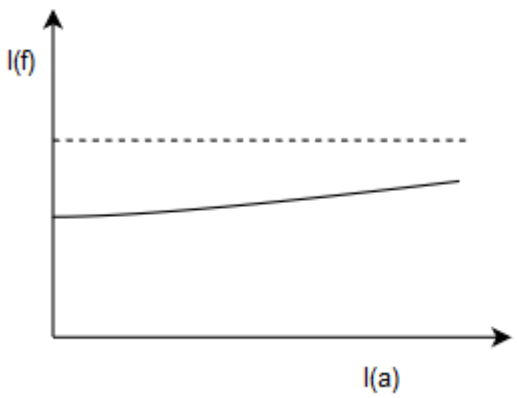
6. The air gap line represents __________
a) magnetic behaviour of the air gap of the dc machine
b) magnetic behaviour of the air gap of the induction machine
c) magnetic behaviour of the iron core
d) all of the mentioned

Answer: a
Explanation: Air gap line in the magnetization curve represents the ideal nature of the machine considering no saturation for the dc machine.

7. Identify the armature characteristic of the dc generator.



a)



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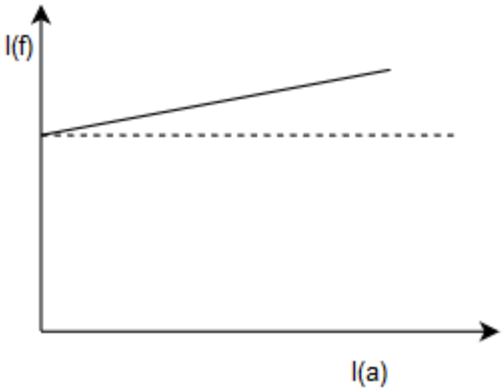

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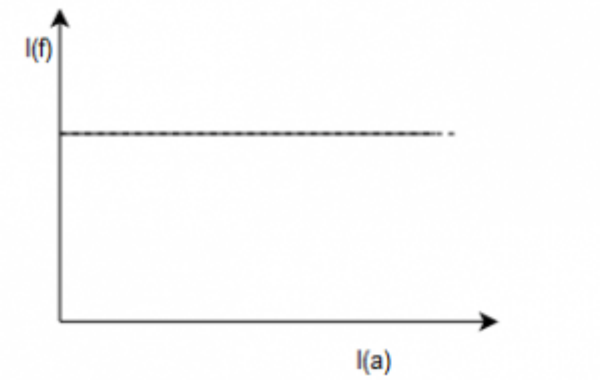


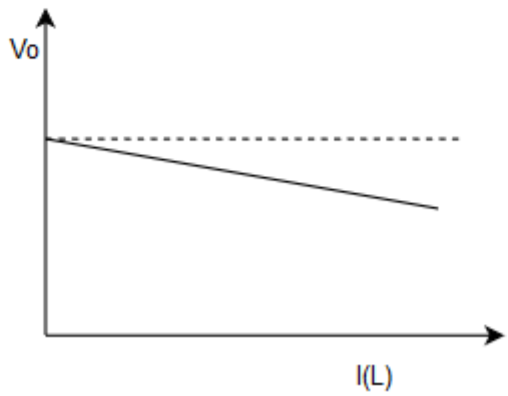
d)

Answer: a
Explanation: At low values of the armature conductor, the increase in the field current is very small to provide IaRa drop. At large armature current,field current increases sharply to compensate for the voltage drop caused by armature reaction.

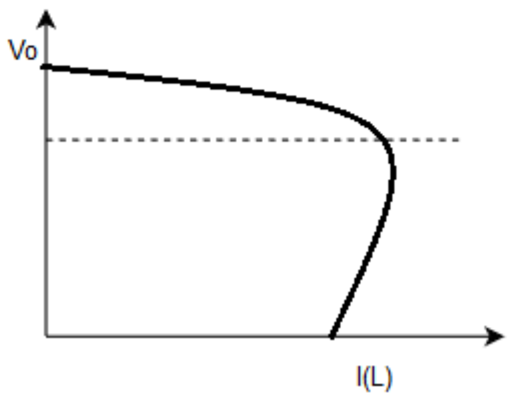
8. For a given dc generator, the external characteristic is plotted. Without using further plots, how can we obtain internal characteristic?
a) By adding the IaRa drop to the plot
b) By adding armature reaction
c) By reducing IaRa drop
d) All of the mentioned

Answer: a
Explanation: Adding the armature resistance drop we can obtain the external characteristic for a dc generator.

9. Identify the machines by observing their external characteristics for (i) and (ii) respectively.



(i)



(ii)

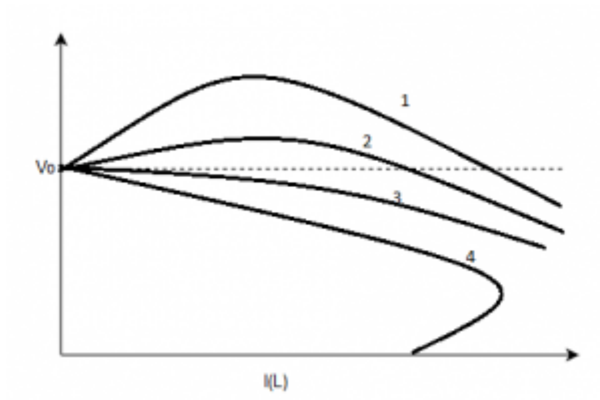
a) Separately excited dc generator, shunt generator
b) Shunt generator, separately excited dc generator
c) Differentially compound dc generator, separately excited
d) Series dc generator, shunt generator

Answer: a
Explanation: In dc shunt generator, voltage drops off much more rapidly with load due to fal in field current with terminal voltage.

10. The voltage drop in terminal voltage from no-load to full load in a shunt generator can be compenated using ___________
a) aiding series field
b) long-shunt, diferential field
c) aiding shunt field
d) any of the measures

Answer: a
Explanation: By aiding the series field the armature reaction drop can be compensated.

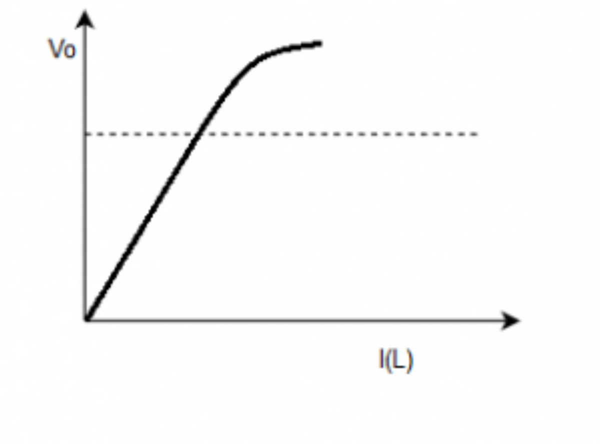
11. Mark the correct order for the external characteristics of compound generators from the below graph.



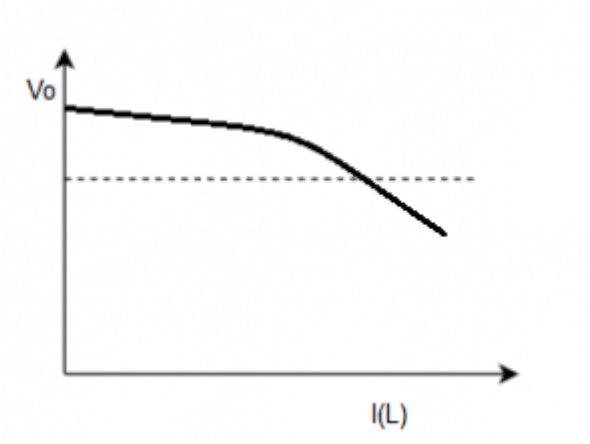
a) 1: over compound, 2: level compound, 3: under compound, 4: differential compound
b) 1: under compound, 2: level compound, 3: over compound, 4: differential compound
c) 1: differential compound, 2: level compound, 3: under compound, 4: over compound
d) 1: over compound, 2: differential compound, 3: under compound, 4: level compound

Answer: a
Explanation: Over compounding provides maximum voltage difference at no load while the differential compunding has least.

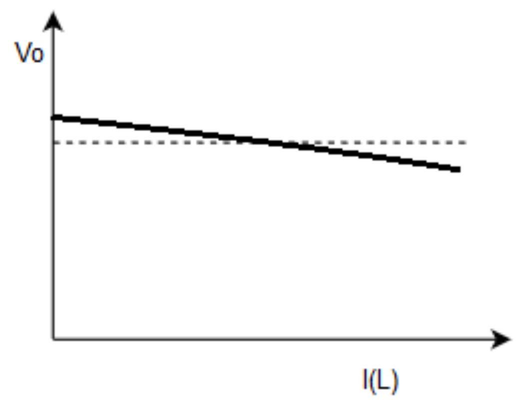
12. The external characteristic for the dc series generator is?



a)



b)



c)

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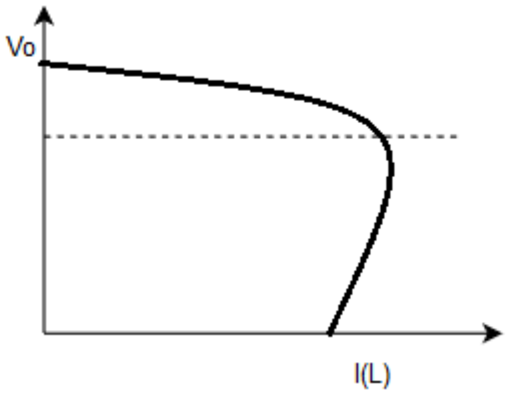


d)

Answer: a
Explanation: There is a linear behaviour till the saturation.

13. Why is armature of a dc machine made of silicon steel stampings?
a) To reduce hysteresis loss
b) To reduce eddy current loss
c) For the ease with which slots can be created
d) To achieve high permeability

Answer: a
Explanation: The silicon steel has very high permeability and makes the flux past consistent. Thereby making lesser losses.

14. What losses occur in the teeth of dc generator?
a) To reduce hysteresis loss
b) To reduce eddy current loss
c) To reduce eddy current as well as hysteresis losses
d) To achieve high permeability

Answer: c
Explanation: Teeth of the machine has both eddy current losses as well as hysteresis losses.

15. For a 220-V level compound generator the terminal voltage at the half load is?
a) more than 220-V
b) same as no-load voltage
c) more than no-load voltage
d) lesser than no-load voltage

Answer: b
Explanation: In a level compound dc generator the terminal voltage remains same as no load voltage at all the loading.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Rotating Amplifiers".

1. The rotating amplifiers are widely used in _____________
a) small amplified outputs
b) large amplified outputs
c) amplified outputs
d) large power gain outputs

Answer: b
Explanation: The rotating amplifiers are applicable in feedback systems giving large amplified outputs.

2. The quantity which make rotating amplifier applicable in large power levels is/are __________
a) high power gain and favourable transient conditions
b) favourable transient conditions
c) high power gain
d) favourable steady state conditions

Answer: a
Explanation: The rotating amplifiers have stable transient conditions, which makes them favourable to use in high power sectors.

3. The ordinary dc machines are not favourable as amplidynes due to __________
a) sluggish transient response
b) low stability
c) poor gain
d) high steady state error

Answer: a
Explanation: The sluggish transient response of the ordinary dc machines makes them inappropriate to use them in amplidynes.

4. In rotating amplifiers, armature reaction mmf of the first stage is made to act as field flux for second stage.
a) True
b) False

Answer: a
Explanation: Yes, the reaction mmf of the first stage is made to act as field flux for second stage to have faster transient response.

5. The cross field machines have __________
a) two fluxes electrically in quadrature
b) two fluxes mechanically in quadrature
c) one set of brushes per pole
d) all of the mentioned

Answer: a
Explanation: The cross field machines have two fluxes electrically in quadrature.

6. In cross field rotating amplifiers, there is __________
a) two stage of flux generators
b) three stage of flux generators
c) four stage of flux generators
d) eight stage of flux generators

Answer: a
Explanation: There are two stages for flux generators in order to have faster response in the system.

7. Metadyne is __________ feedback with respect to main ____________
a) negative, current
b) negative, voltage
c) positive, current
d) positive, voltage

Answer: a
Explanation: Metadyne is negative feedback with respect to main current flowing in the second stage set of motors.

8. An amplidyne, d-axis flux is always neutralized due to __________
a) compensating winding at all possible loads
b) interpoles at all specified loading
c) feedback at all possible loads
d) feedback at fixed loading

Answer: a
Explanation: The d-flux is neutralized by compensating winding at all possible loads as the same flux will be produced but in the opposite direction so as to cancel the flux.

9. In amplidynes, the resultant d-axis flux is __________
a) field flux
b) difference of field flux and main flux
c) sum of field flux and main flux
d) cross magnetizing flux

Answer: a
Explanation: The resultant d-axis flux lies along the main field poles and are so field flux. The d-axis is completely under the control of field winding and is unaffected by direct axis current.

10. Amplidynes are best applicable in __________
a) feedback control systems with regulated power supply.
b) power supply
c) speed control of large motors
d) All of the mentioned

Answer: a
Explanation: Amplidynes find applications in feedback systems with large power handling requirements.

11. Interpoles provide mmf more than armature mmf in a dc machine.
a) True
b) False

Answer: a
Explanation: Interpoles nullify armature cross magnetizing flux and the reactance voltage. So it is more than the armature mmf for a good efficient machine.

12. The delay of the commutation occurs due base cause of emf induced due to __________
a) self inductance, mutual inductance
b) self inductance
c) mutual inductance
d) leakage inductance

Answer: a
Explanation: The commutation in dc machines is delayed because of the emf induced in the coils and the mutual interaction of the field with neighbour coils.

13. In the following applications of the dc machines, but all are not matched correctly. Choose the wrong marking.

```
I. DC shunt motor - variable speed application
II. DC compound generator - constant supply voltage
III. Differentially compounded motor - welding purposes
```

a) III
b) II
c) I, III
d) III, II

Answer: a
Explanation: Differentially compounded generators are used for welding purposes, not motors.

14. In the following applications of the dc machines, but all are not matched correctly. Choose the wrong marking.

```
I. DC shunt motor - Lathe machine
II. DC compound generator - Drilling machine
III. Differentially compounded generator - welding purposes
```

a) II
b) III
c) I, III
d) III, II

Answer: a
Explanation: DC compound generators are used for maintaining constant voltage across the terminals.

15. Mark the order for the decreasing order of the voltage regulation for dc generators.
a) DC shunt generator > level compound generator > Differential compound generator
b) DC shunt generator < level compound generator < Differential compound generator
c) Level compound generator > DC shunt generator > Differential compound generator
d) Level compound generator < DC shunt generator < Differential compound generator

Answer: a
Explanation: Dc shunt motor is almost constant speed generator and thus its voltage regulation is very good than all and differential compound generator has most poor v.r.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "DC Motor Starting".

1. A starting resistance is inserted at the starting in an induction motor as well as dc motor.
a) Induction motor has to control starting torque whereas in dc motor, it is done to avoid large current
b) To limit starting current in both the machines
c) To limit starting speed
d) All of the mentioned

Answer: a
Explanation: For both the machines the purpose is different.

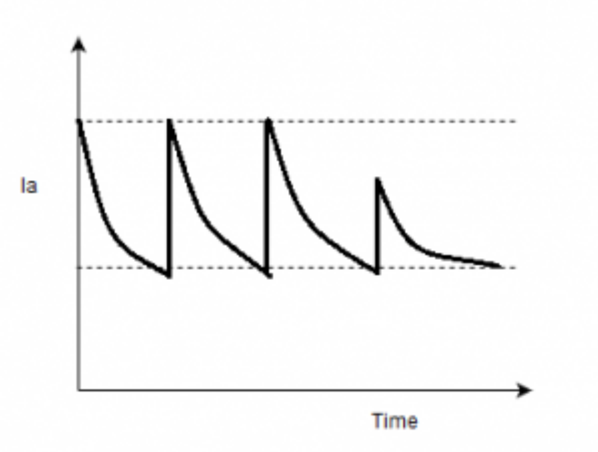
2. Considering a human handed control system for the dc motor speed control, if the resistance wire cut out too slowly, then the ______________
a) starting resistance would burn
b) field winding would burn
c) speed will rise steeply
d) any of the mentioned

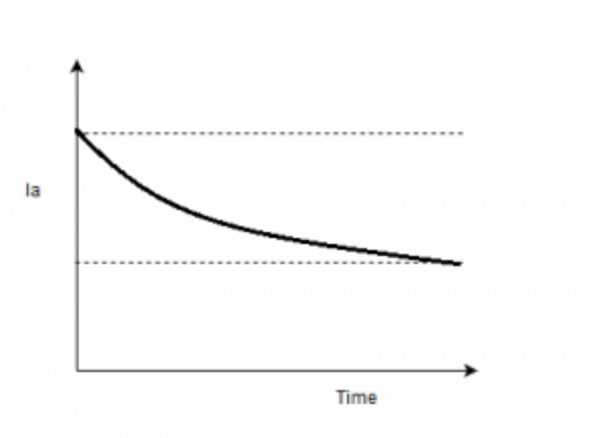
Answer: a
Explanation: Due to the slow cut off the resistance the current will be high for a large amount of time and it will cause the machine to burn.

3. A 100 hp, 250 V, 350 A shunt dc motor with an armature resistance of 0.05 ohms. To limit maximum starting current to twice the rated of its value, what will be the number of stages of starting resistances?
a) 3
b) 2
c) 4
d) 5

Answer: a
Explanation: n = log(Ra/Rt)/log(Imin/Imax); Rt = Vt/Imax = 250/700 = 0.357 ohms
= log(0.05/0.357)/log(350/700)
= 2.84
= 3 (approx).

4. Which of the following express the starting current nature of the dc motor?

a) 



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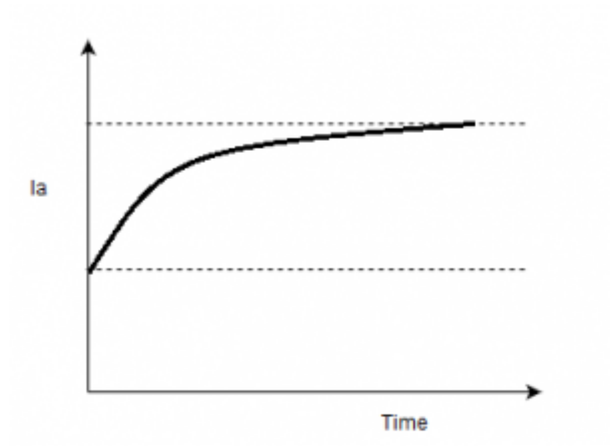
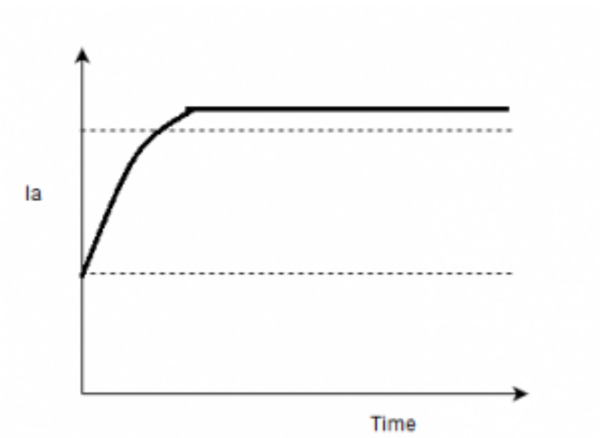


c)

d)



Answer: a
Explanation: This is due to the resistance steps used in the speed control mechanism.

5. Following are the observations due to large starting current in dc motor.

```
(i) Sparking at brushes
(ii) Mechanical shock at shaft
(iii) Source current fluctuations
(iv) Burning of the field winding
```

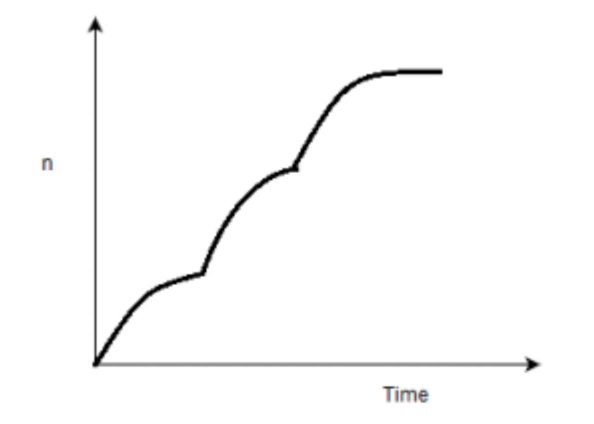
a) (i), (ii), (iii), (iv)
b) (i), (iii)
c) (ii), (iii), (iv)
d) (i), (ii)

Answer: a
Explanation: All the observations can be seen due to large starting current in dc motor.

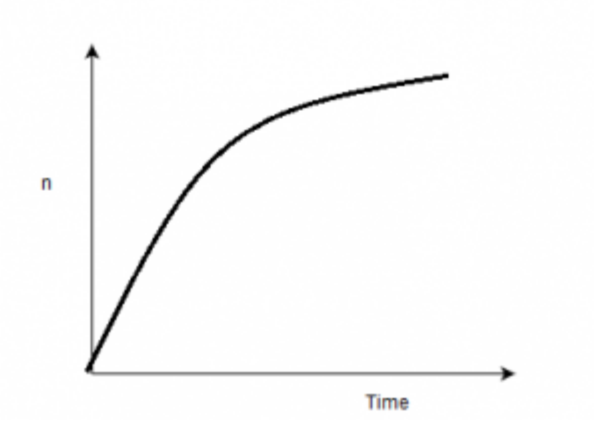
6. The shunt motor starters that can be used is/are ____________
a) 3-point and 4-point starter
b) 5-point starter
c) 4-point starter
d) 5-point and 3-point starter

Answer: a
Explanation: Both 3-point and 4-point starters can be used.

7. How does the speed build up takes place in a dc motor with time?

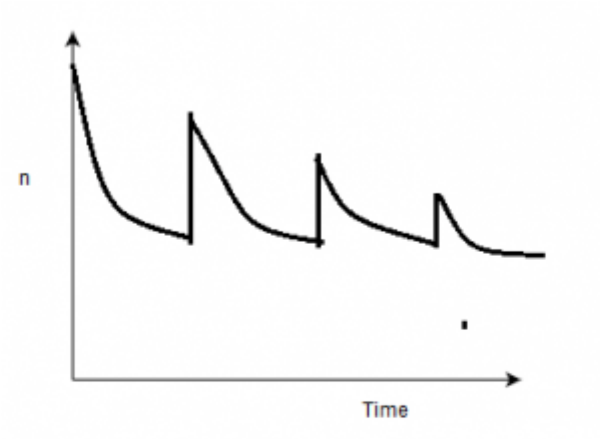


a)



b)

c)

d) 

Answer: a
Explanation: Due to subsequent addition of the step resistances in the dc motor, the speed build also occurs like steps.

8. The direct-on-line starter is used to start a small dc motor because it limits initial current drawn by armature circuit.
a) True
b) False

Answer: b
Explanation: The direct-on-line starter can not limit the speed by limiting the current.

9. Thyristor controlled starter is preferred over DOL starter due to __________
a) lesser losses
b) controlled direction
c) least resistance offered
d) all of the mentioned

Answer: a
Explanation: A thyristor controlled method is more efficient as it has lesser resistance and losses while operating.

10. For a 7.46 kW, 200 V dc shunt motor with full load efficiency of 85% has armature resistance of 0.25 ohms. Calculate the value of starting resistance in ohms for a current 1.5 times of the full load current.
a) 2.788
b) 3.038
c) 2.688
d) 2.588

Answer: a
Explanation: Full load current = 7460/(200*0.85) = 43.88 A
Starting current = 1.5*43.88 = 65.883 A

R = V/I = 200/65.883
= 3.038 ohms
Starting resistance = 3.038 – 0.25 = 2.788 ohms.

11. The effect of fringing increases as we __________
a) increase air gap
b) decrease air gap
c) increase in flux density
d) introduce more ferric core material

Answer: a
Explanation: Fringing is the effect in which the magnetic flux lines bulge out of the flux. and it is introduced at the air gaps.

12. The post effects of the armature reaction is __________
a) main field distortion
b) shift in MNA
c) reduction in main field
d) none of the mentioned

Answer: d
Explanation: There is no such post effect of armature reaction. The armature reaction phenomena affect the working condition only.

13. If the students give a forward shift of 10° to the dc generator, then it __________
a) reduces flux per pole
b) improves flux per pole
c) increases the flux density in core
d) none of the mentioned

Answer: a
Explanation: A generator given a forward brush shift will get its flux density reduced at the pole as the flux will be in the opposite direction.

14. A dc machine is run at rated speed in forward direction and then in backward direction. It is observed that, speeds of the rotation are different, then it leads to the conclusion of __________
a) incorrect brush placement
b) incorrect pole and core alignment
c) incorrect field supply
d) all of the mentioned

Answer: a
Explanation: Given at the same speed of operation, if the speeds are different then the brushes are placed in not aligned manner.

15. For a dc machine, its commutator has a diameter of 50 c rotating at 1000 rpm. For a brush width of 1 cm, the time commutation taken by the machine will be __________
a) 0.382 ms
b) 0.456 ms
c) 0.573 ms
d) 0.312 ms

Answer: a
Explanation: Time of commutation = brush width/peripheral velocity
= 1*60/(pi*50*1000)
= 0.382 ms.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Speed Control of DC Motors".

1. The PWM control of DC motor varies __________
a) linearly with speed
b) inversely with speed
c) parabolically with speed
d) exponentially with speed

Answer: a
Explanation: In PWM technique duty ratio is a linear function with respect to speed.

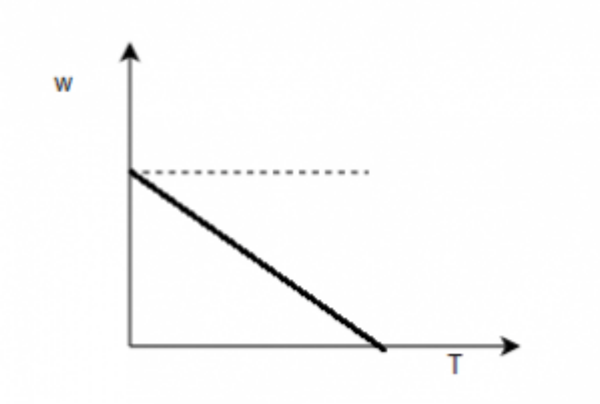
2. Ward-Leonard system of system of speed control is not recommended for __________
a) constant speed operation
b) Wide speed
c) frequent-motor reversed
d) very slow speed

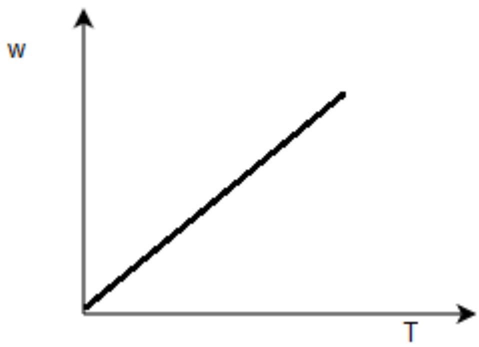
Answer: a
Explanation: Ward-Leonard system of system of speed control is not recommended for constant speed operation.

3. Mark the wrong option. Which of the following cause and effect behaviour in speed control is correct when field resistance is increased.
a) Decrease in flux
b) Increase in armature current
c) Increase in EMF
d) Decrease in speed

Answer: c
Explanation: When field resistance is increased, emf actually decreases, not increases due to fall in flux.

4. The effect of field resistance speed control on a shunt motor speed torque characteristic is?

a) 



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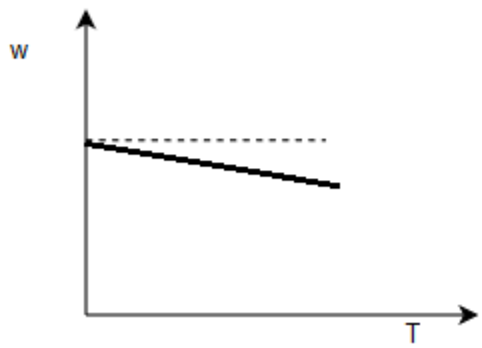


c)

d) none of the mentioned

Answer: a
Explanation: Field resistance speed control will make the speed above the base speed control.

5. At a very low speed, increase in field resistance will __________
a) decrease the speed of motor
b) increase the speed of motor
c) not have signicant effect on speed
d) no effect

Answer: a
Explanation: At low speed increase in armature current caused by decrease in emf, will not be enough to compensate for decrease in flux in induced torque equation.

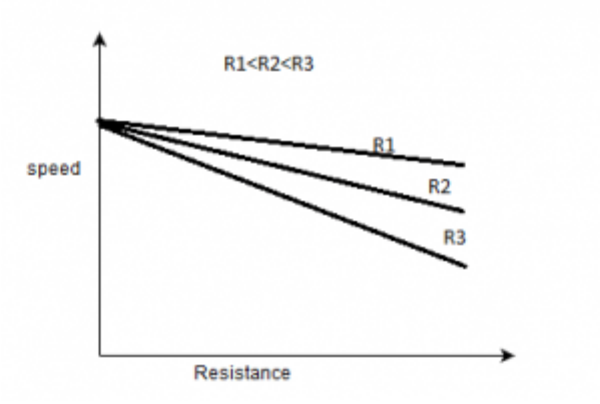
6. Small DC motors have best speed control by __________
a) armature voltage control
b) field resistance control
c) any of the methods
d) none of the mentioned

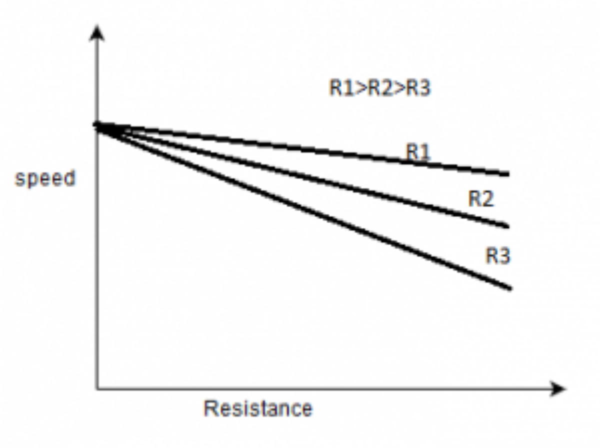
Answer: a
Explanation: For the small dc motors it is difficult to vary the speed using their field control.

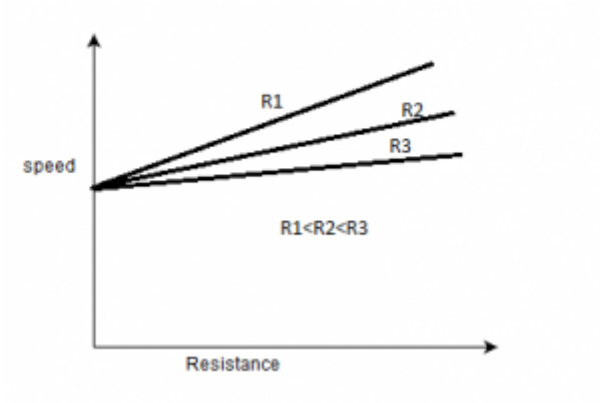
7. To implement armature voltage control, it must be ensured that __________
a) it is used on separately excited machine
b) it is used on shunt machine
c) it is used on series machine
d) any of the mentioned machine

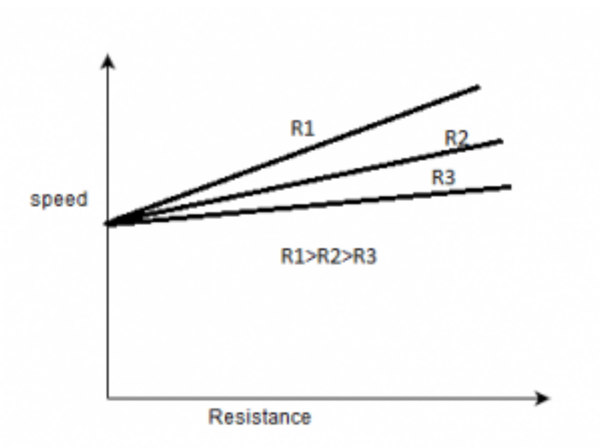
Answer: a
Explanation: It must be separately excited mahcine to implement the armature voltage control.

8. The armature resistance speed control is best illustrated by which of the following?

a) 

b) 

c) 



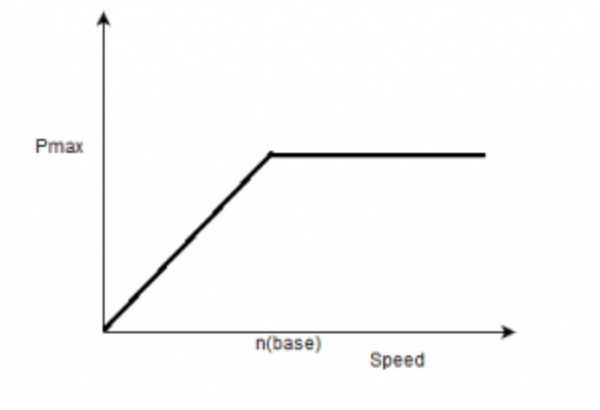
d)

Answer: a
Explanation: As the field resistance increases the speed decreases.

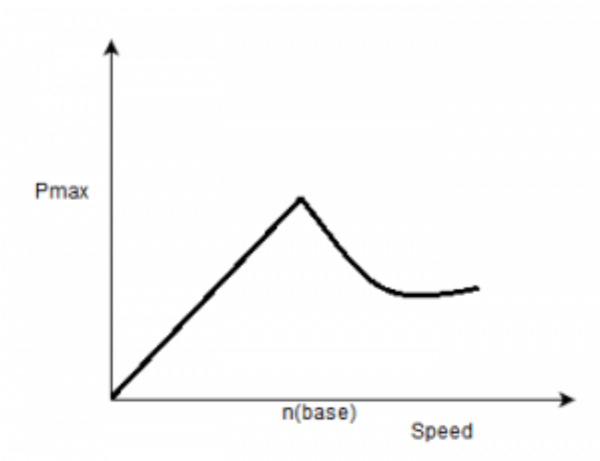
9. Armature voltage control works for speeds ______ base speed and field resistance control works well for speed ______ base speed.
a) below, above
b) above, below
c) above, above
d) below, below

Answer: a
Explanation: For armature voltage control, armature current is increased so as to reduce speed below base speed. In field control flux is reduced so the speed would be above base speed.

10. How does the power varies with the variations in the speed, for a dc shunt motor?



a)

b) 

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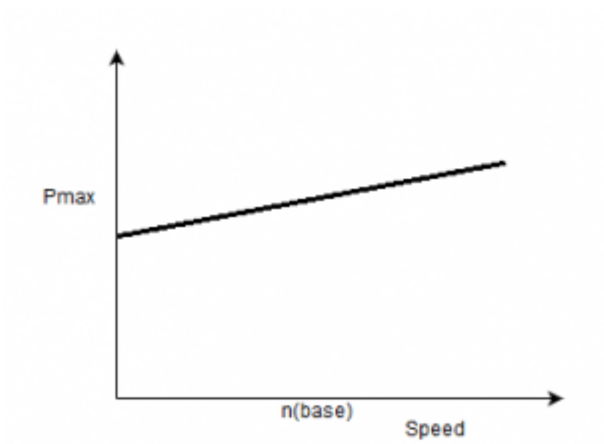
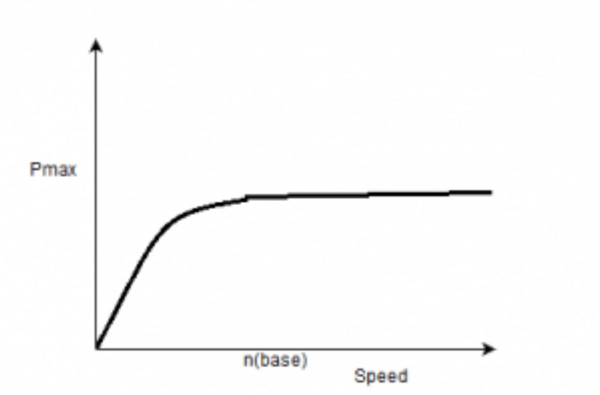
c) 



d)

Answer: a
Explanation: After the base speed is attained, the power consumed becomes constant as the speed remains constant in a shunt machine.

11. The torque limit of speed for a shunt motor __________
a) remains constant till base speed
b) remains constant after base speed
c) varies linearly after base speed
d) varies inversely till base speed

Answer: a
Explanation: The torque limit of the shunt motor remains constant till the base speed.

12. A laboratory group was working with a set of 3-hp shunt DC motor. But there was a mistake that it was fused with a 0.3A fuse instead 3A fuse. Then it was started __________
a) a flash occurred instantly
b) it ran for 3s and fuse was blown
c) it ran normal
d) none of the mentioned

Answer: b
Explanation: Due to the wrong usage of the fuse wire, it could not sustain the current and in few seconds it was blown off.

13. Run-away for large DC machine is avoided by using __________
a) a turn or two of cumulative compounding
b) compensating winding
c) stablizer winding
d) all of the mentioned

Answer: b
Explanation: The runaway in large machine is avoided by using compensating winding.

14. Why does DC motor sometimes run too fast when under-loaded?
a) Due to weak field
b) Due to high line voltage

c) Due to brush-shifted to neutral
d) All of the mentioned

Answer: a
Explanation: All of the reasons cause the dc motor to increase in speed when under loaded.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Permanent Magnet DC (PMDC) Motors”.

1. The qualities aspired to obtain a good permanent magnet is/are _____________
a) high residual flux
b) low coercivity
c) high coercivity
d) high residual flux and high coercivity

Answer: d
Explanation: Its both high residual flux as well as coercivity is desired for a good permanent magnet.

2. Which type of field winding required in PMMDC?
a) series winding
b) shunt winding
c) cumulative winding
d) none of the mentioned

Answer: d
Explanation: There is no field winding used in PMMDC to create the flux.

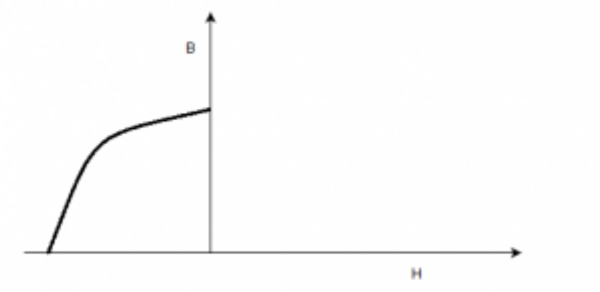
3. PMMDC are smaller in size due to ___________
a) ansence of field winding
b) presence of smaller field winding
c) present of magnets
d) Any of the mentioned

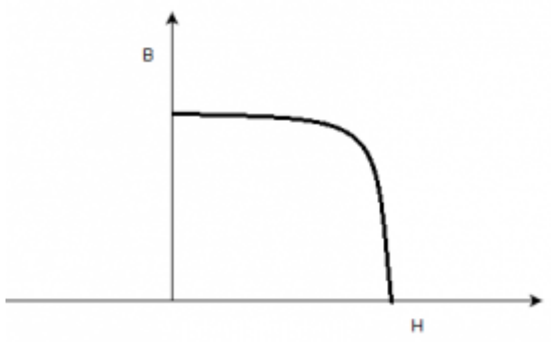
Answer: a
Explanation: There is no field winding used in PMMDC to create the flux. So it is lighter.

4. PMMDC offers _______ characteristics.
a) shunt
b) series
c) armature
d) cumulative

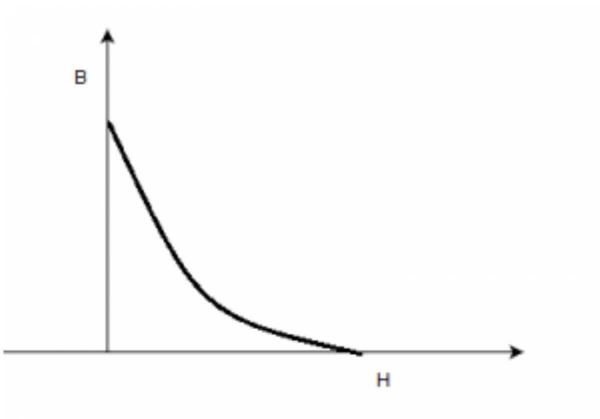
Answer: a
Explanation: As the field remains constant due to the constant field, it has shunt characteristic.

5. Select the possible dc magnetization characteristics of permanent magnetic materials.

a) 



b)



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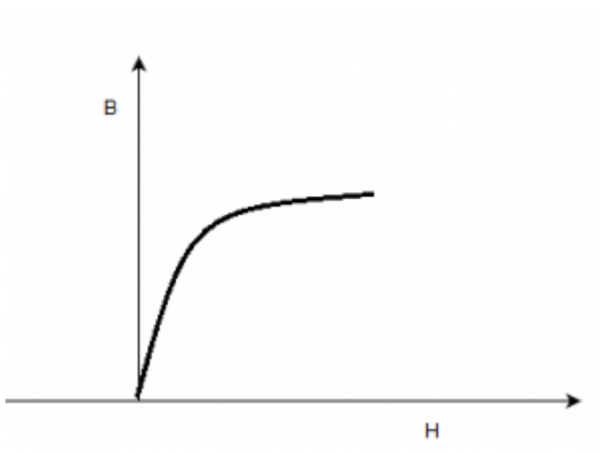
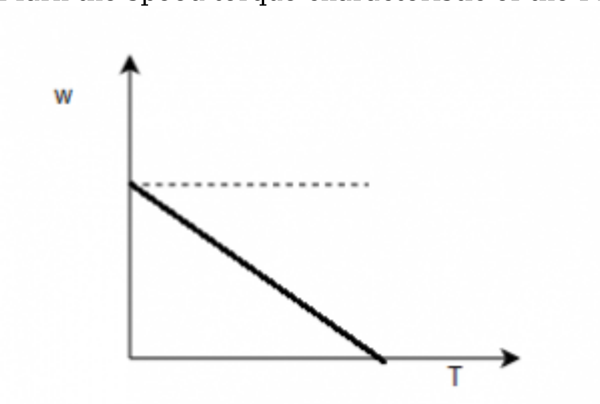
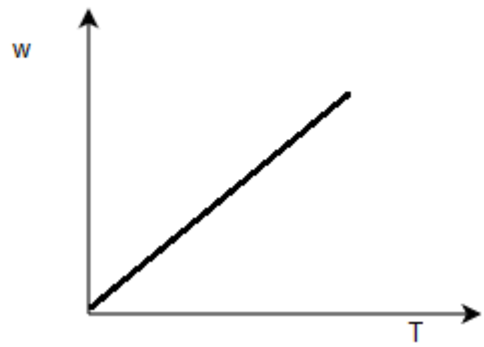


d)

Answer: a
Explanation: The magnetic field has a positive value when the magnetic field intensity, H has negative value due to coercivity property. We use second quadrant of hysteresis loop.

6. Mark the speed torque characteristic of the PMDC.

a) 



b)

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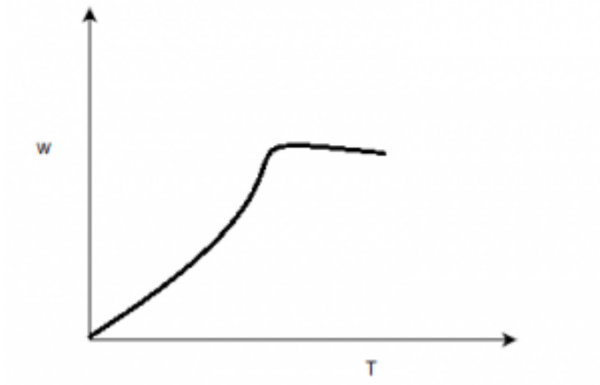
c) 

d) None of the mentioned

Answer: a
Explanation: It is linear in nature and also analogous to shunt machine.

7. PMDC had no _________ excited machine.
a) electrically
b) magnetically
c) none of the mentioned
d) least

Answer: a
Explanation: It has no electrical excitation.

8. How to manage run-away issue for dc shunt motor in industry?
a) By using PMDC motor
b) By using constant field motors
c) This can not be avoided
d) None of the mentioned

Answer: a
Explanation: A PMDC motor can be used to replace the dc shunt motor in industries as they have quite identical characteristics.

9. A PMMDC motor has an armature resistance of 4.2 ohms. When 6 V supply is applied to motor it runs at 1215 rpm drawing 14.5 mA on no-load. The rotational losses is?
a) 86.1 mW
b) 86.1 W
c) 8.6 W
d) 8.6 mW

Answer: a
Explanation: Rotational losses = E*Ia = 5.939* 14.5/1000 = 86.1 mW.

10. PMMDC can only be armature controlled.
a) True
b) False

Answer: a
Explanation: Due to absence of the field winding there is no option of field control.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “EMF Polygon – 1”.

1. The angular slot pitch, γ is given by ___________
a) γ = πP/Total number of slots Elect radians
b) γ = 180P/Total number of slots Elect degrees
c) γ = 180/Slots per pole Elect degrees
d) Any of the mentioned

Answer: d
Explanation: Angle γ is the angle between adjacent slots.

2. Which of these statements are correct regarding the design of distributed armature winding in a 3-phase alternator?

```
(i) it reduces the phase-belt harmonics
(ii) it increases the utilization of the armature iron and copper
(iii) it increases rigidity and mechanical strength of the winding
(iv) it reduces copper in the overhang of the winding
```

a) (i), (iii), (iv)
b) (ii), (iii), (iv)
c) (i), (ii), (iii)
d) (i), (ii), (iii), (iv)

Answer: c
Explanation: Distributed armature winding does not reduce copper in the overhang of the winding, also k_{d_n} =(sinqnγ/2)/(qsinnγ/2), k_{d_n} d_1 , implies it has the effect of reducing n^{th} harmonic EMF, where q=slots per pole per phase.

3. What is the coil span for a 2 pole 18 slot machine?
a) 9
b) 4.5
c) 18
d) 6

Answer: a
Explanation: Coil span = number of slots/number of poles = 18/2 = 9.

4. In a machine with coil span 9, if a coil has its one coil-side in slot 1, then its other coil-side must be in _____________
a) slot 9
b) slot 8
c) slot 10
d) slot 2

Answer: c
Explanation: The other coil-side must be in slot 10=1+coil span=1+9.

5. The belt factor is defined as the ratio of ___________
a) arithmetic sum of coil EMF to the phasor sum of coil EMFs
b) phasor sum of EMF per coil to the arithmetic sum of EMF per coil
c) phasor sum of coil EMFs to the arithmetic sum of coil EMFs
d) phasor sum of coil EMFs to per phase voltage

Answer: c
Explanation: Belt factor or distribution factor or breadth factor = k_d = phasor sum of coil EMFs/arithmetic sum of coil EMFs.

6. The armature winding of a 2-pole, 3-phase alternator for each phase is distributed in a number of slots per phase. The RMS value of the voltage per phase is less than the RMS value

of the voltage per coil multiplied by the number of coils in series because the __________
a) RMS value of the voltage in different coils of the phase is different
b) equal RMS voltages in different coils of the phase has mutual phase difference
c) maximum value of the induced voltage in different coils of the phase are different
d) different coils of the phase pass through different saturated regions of the magnetic circuit

Answer: b
Explanation: The phase displacement will be given by slot angular pitch γ.

7. A 3-phase machine has integral slot winding with fundamental distribution factor k_{d1}, the distribution factor for n^{th} harmonic k_{dn} is _____________
a) less than k_{d1}
b) more than k_{d1}
c) equal to k_{d1}
d) depends upon the number of slots and poles

Answer: a
Explanation: k_{dn} =(sinqnγ/2)/(qsinnγ/2) and examples will show that k_{dn} is less than k_{d1}. This has the effect of reducing the n^{th} harmonic EMF in comparision with fundamental EMF. This is certainly an advantage of distributing the winding in slots.

8. If a stator has 48 slots, 6 poles and 3 phase with narrow spread winding, then the third harmonic belt factor is _____________
a) 0.9556
b) 0.6407
c) 0.1944
d) None of the mentioned

Answer: b
Explanation: q= (s/m)/p=k.S_k/k.P_k =S_k/P_k for fractional slot winding where k is the highest common factor between s/m and P, here q= 48/3*6 =16/6= 8/3 = S_k/P_k
The distribution factor for fractional slot winding's is obtained by replacing q by S_k and k_{dn} = (sinnγ/2)/(S_k sinnγ/2S_k), if n=3, k_{d3} =0.6407.

9. A fraction pitch winding is used to reduce which of the following?

```
(i) amount of copper in the winding
(ii) size of the machine
(iii) harmonics in the generated EMF
(iv) cost of the machine
```

a) (i), (ii), (iii), (iv)
b) (i), (ii), (iii)
c) (ii), (iii), (iv)
d) (i), (iii), (iv)

Answer: d
Explanation: The fractional pitch winding results in reduction of copper in overhang and it results in less cost of the machine. k_{pn} =cos(nε)/2 implies reduces harmonics and thereby rendering the output EMF wave almost a sine wave.

10. The pitch factor, in rotating electrical machinery, is defined as the ratio of resultant EMF of a __________
a) full-pitched coil to that of a chorded coil
b) full-pitched coil to the phase EMF
c) chorded coil to the phase EMF
d) chorded coil to that of a full-pitched coil

Answer: d
Explanation: K_p = Resultant EMF of a chorded coil/Resultant EMF of a full pitched coil = cosε/2.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “EMF Polygon – 2”.

1. The winding’s for a 3-phase alternator are:

```
(i) 36 slots, 4 poles, span 1 to 8
(ii) 72 slots, 6 poles, span 1 to 10
(iii) 96 slots, 4 poles, span 1 to 21
```

The winding’s having pitch factor of more than 0.97 are ___________
a) (i) and (ii) only
b) (ii) and (iii) only
c) (i) and (iii) only
d) (i),(ii) and (iii)

Answer: c
Explanation: K_p =cosε/2
(i) Slots per pole = 36/4=9, for a coil span of 8 slots, the coil is short pitched by 1 slot and the chording angle is ε=γ = 20° ⇒ K_p =cos10°=0.985
(ii) Slots per pole = 72/6=12, for a coil span of 10 slots, the coil is short pitched by 2 slots and the chording angle is ε=2γ and γ=180/12 ⇒ ε = 30° ⇒ K_p =cos15°=0.9659
(iii) Slots per pole = 96/4=24, for a coil span of 21 slots, the coil is short pitched by 3 slots and the chording angle is ε=3γ and γ=180/24 ⇒ ε = 24.5° ⇒ K_p =cos12.25°=0.97723.

2. In 48 slot, 4-pole,3 phase alternator, the coil-span is 10. Its distribution and pitch factors are respectively _____________
a) 0.9717,0.966
b) 0.9822, 0.9814
c) 0.9577, 0.9814
d) 0.9577, 0.966

Answer: d
Explanation: Slots per pole = 48/4=12, for a coil span of 10 slots, the coil is short pitched by 2 slots and the chording angle is ε=2γ and γ=180/12 ⇒ ε = 30° ⇒ K_p =cosε/2=0.9659.
We know, K_d =(sin(qγ/2))/qsin(γ/2), here q=48/4∗3 = 4 ⇒ K_d =0.957662.

3. A 3-phase, 4-pole alternator has 48 stator slots carrying a 3-phase distributed winding. Each coil of the winding is short chorded by one slot pitch. The winding factor is given by _______________
a) (cos7.5)/16
b) (cot7.5)/8
c) 1/(8sin7.5)
d) (cot7.5)/16

Answer: b
Explanation: Slots per pole = 48/4 = 12 ⇒ γ=180/12=15° and q=48/4∗3=4
coil of the winding is short chorded by one slot pitch ⇒ ε=γ=15°, K_w =K_p ∗K_d = cos7.5(sin(4∗15/2))/(4∗sin(15/2)) = (cot7.5)/8.

4. The chording angle for eliminating 5^{th} harmonic should be _____________
a) 30°
b) 34°
c) 36°
d) 35°

Answer: c
Explanation: To eliminate 5 th harmonic k_{p_5} must be zero, k_{p_n} = cosnε/2 ⇒ k_{p_5} = cos5ε/2=0=cos90° ⇒ 5ε/2=90° ⇒ ε = 36°.

5. Which of the following statements are true?

(i) breadth factor for third harmonic k_{d_3} is more than that for fundamental k_{d_1}
(ii) $k_{d_3} < k_{d_1}$
(iii) k_{d_3} may be less or more than k_{d_1} depending upon the number of slots and poles
(iv) coil-span factor for third harmonic $k_{p_3}>k_{p_1}$ (coil span factor for fundamental)
(v) $k_{p_3} < k_{p_1}$
(vi) k_{p_3} may be less or more than k_{p_1} depending upon the number of slots and poles

a) (ii), (v)
b) (i), (iv)
c) (iii), (vi)
d) (i), (iii), (iv), (vi)

Answer: a
Explanation: Examples will show that $k_{d_n} < k_{d_1}$ and has the effect of reducing the n th harmonic EMF in comparison with the fundamental EMF, similarly $k_{p_n} < k_{p_1}$.

6. A 6-pole alternator with 36 slots carries a 2-phase distributed winding. Each coil is short pitched by one slot. The winding factor is given by ______________
a) cot15°/3√2
b) cot15°/4
c) cot15°/2√2
d) cot15°/4

Answer: a
Explanation: Slots per pole = 36/6=6, q=6/2=3 ⇒ γ=180°/6=30°, coil is short pitched by one slot ⇒ ε=γ=30° and K_p =cosε/2=cos15° and K_d =sin(γq/2)/q(sinγ/2)=sin45/(3sin15)
K_w = K_p ∗ K_d =cot15°/3√2.

7. For eliminating n th harmonic from the EMF generated in the phase of a 3-phase alternator, the chording angle should be _______________
a) n∗full pitch
b) (1/n)∗full pitch
c) (2/n)∗full pitch
d) (3/n)∗full pitch

Answer: a
Explanation: k_{p_n} =cosnε/2=0 ⇒ nε/2=90° ⇒ ε=180°/n=full pitch/n.

8. Which among the given harmonics are called belt harmonics?
a) 5, 7, 11, 13
b) 3, 6, 9, 12
c) 5, 6, 11, 12
d) 7, 11, 13, 15

Answer: a
Explanation: The odd harmonics of the order 5, 7, 11, 13 etc are called belt harmonics.

9. Machine A has 60° phase spread and machine B has 120° phase spread. Both the machines have uniformly distributed winding. The ratio of distribution factors of machine A to machine B is _____________
a) 0.866

b) 1.1
c) 1.55
d) 1.155

Answer: c
Explanation: k_{d_A} =(sinσ/2)/σ/2, σ=60° ⇒ k_{d_A} =0.9556
k_{d_B} =(sinσ/2)/σ/2, σ=120° ⇒ k_{d_B} =0.827
thus, k_{d_A}/k_{d_B} =1.155.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Production of Torque in Non-Salient Pole Machines".

1. The electromagnetic torque in non salient pole machines depends on __________
a) number of poles
b) machine dimensions at the air gap
c) peak value of stator and rotor MMF
d) any of the mentioned

Answer: d
Explanation: T_e also depends on the sine of the angle between the axis of the two fields(or MMFs) $T_e = -(P/2)(\mu_o \Pi rl/g)(F_s F_r)\sin\lambda$ Nm.

2. The torque equation for non salient pole machine is $T_e = -(P/2)(\mu_o \Pi rl/g)(F_s F_r)\sin\lambda$ Nm. What does the negative sign in the torque expression indicates?
a) stator and rotor MMF tend to reduce angle λ
b) stator and rotor MMF tend to increase angle λ
c) stator tend to reduce the air gap g
d) rotor tend to reduce the air gap g

Answer: a
Explanation: The torque acts in such a direction as to align the two MMFs F_s and F_r and thereby reduce the angle λ between them.

3. Which of the following statements are correct regarding the torque equation in non salient pole machines, $T_e = -(P/2)(\mu_o \Pi rl/g)(F_s F_r)\sin\lambda$ Nm?
a) stator experiences less torque than rotor and in opposite directions
b) rotor experiences less torque than stator and in same directions
c) stator and rotor experiences equal and opposite torques
d) stator and rotor experiences equal torque and in same directions

Answer: c
Explanation: Both stator and rotor experience equal and opposite torques.

4. In practice, electromagnetic torque acting on the stator __________
a) rotate in opposite direction to rotor
b) is transmitted to ground
c) makes it rotate in same direction as of rotor
d) none of the mentioned

Answer: b
Explanation: As stator is fixed, T_e is transmitted to ground through its foundation.

5. Torque angle λ is the angle between _____________
a) stator MMF F_s and resultant MMF F_R
b) stator MMF F_s and rotor MMF F_r
c) rotor MMF F_r and resultant MMF F_R
d) any of the mentioned

Answer: b
Explanation: The electrical space angle λ between stator and rotor MMFs is called the torque angle.

6. Load angle δ is the angle between _____________
a) stator MMF F_s and resultant MMF F_R
b) stator MMF F_s and rotor MMF F_r
c) rotor MMF F_r and resultant MMF F_R
d) stator MMF F_s and resultant MMF F_R (or) rotor MMF F_r and resultant MMF F_R

Answer: d
Explanation: The electrical space angle δ_s between F_s and F_R ; and δ_r between F_r and F_R are called load angles.

7. In the design of electromagnetic devices, the maximum value of MMF is limited from the considerations of _____________
a) temperature rise
b) limitation on flux density in teeth
c) torque production rise
d) power rating

Answer: a
Explanation: The maximum value of MMF is limited from a consideration of temperature rise.

8. Consider the principle that the torque in a rotating machine is proportional to peak of stator MMF(F_s), rotor MMF(F_r) and the angle between them(δ). Following statements relate to F_s ,F_r and δ in different machine. Which of these statements are correct?

(i) δ is fixed in DC machine
(ii) F_s is fixed in DC shunt machine
(iii) δ is variable in induction machine
(iv) F_r is fixed in synchronous machne
(v) F_r is variable in DC machine
(vi) F_r is fixed in induction motor
(vii) resultant of F_s and F_r is fixed in synchronous motor

a) (i), (ii), (iii), (iv) and (vi)
b) (i), (ii), (iii), (v) and (vii)
c) (ii), (iii), (v), (vi) and (vii)
d) (i), (ii), (iv), (v) and (vii)

Answer: b
Explanation: F_r is not fixed in synchronous and induction machine.

9. In all rotating electrical machine, electrical torque is developed when relative speed between stator field and rotor field is _____________
a) zero
b) equal to rotor speed
c) equal and opposite to rotor speed
d) dependent upon the type of electrical machine

Answer: a
Explanation: If the relative speed between stator field and rotor field is not zero, then the load angle δ_r varies with time.
From equation $T_e = -(\Pi/8)P^2 \Phi F_r \sin\delta_r$ Nm, we can say that average torque over a complete cycle is zero, implies $T_e = 0$.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “MMF Produced by Distributed Windings”.

1. The winding MMF in rotating machines depends on ____________
a) winding arrangement
b) winding current
c) air gap length,slot openings etc
d) both winding arrangement and winding current

Answer: d
Explanation: The winding MMF depends only on the winding arrangement and the winding current.

2. A knowledge of the air gap flux distribution in a machine helps in determining the ____________
a) generated EMF waveform and its magnitude
b) electrical torque
c) winding MMF
d) both generated EMF waveform and electrical torque

Answer: d
Explanation: The winding mmf depends only on the winding arrangement and the winding current.

3. If the current in the coil is DC, then MMF doesn't vary with _____________
a) space
b) time
c) both space and time
d) none of the mentioned

Answer: c
Explanation: If the coil current is DC, the magnitude of MMF wave does not vary with time and space.

4. If the current in a coil is AC, the amplitude of MMF ____________
a) varies with time but not with space
b) varies with space but not with time
c) varies with both space and time
d) doesn't vary with both space and time

Answer: a
Explanation: For AC in the coil, the air-gap MMF wave is time variant but space invariant.

5. Peak value of fundamental component of MMF produced by one N-turn coil carrying a current 'i' is _____________
a) 4/Π(Ni)
b) 2/Π(Ni)
c) 1/Π(Ni)
d) 1/2Π(Ni)

Answer: b
Explanation: The fundamental component of rectangular wave is found to be $F_{\alpha 1}$ =(4/Π)(Ni/2)cosα, for 2-pole machine where α=electrical space angle
The peak value of the sine MMF wave for a 2 pole machine is given by F_{1p} =(4/π)(Ni/2)AT's per pole = 2/π(Ni) AT.

6. The armature MMF wave in a DC machine is _____________
a) sinusoidal and depends on the speed
b) square and independent of speed
c) triangular and depends on speed
d) triangular and independent of speed

Answer: d
Explanation: The armature MMF for a DC machine remains constant in amplitude and does not depend on the armature speed, also the MMF wave produced is seen to be a triangluar MMF wave.

7. Which of the following statements are correct regarding the current sheet?
a) it is a thin strip of conducting material carrying the current in the dot
b) it is wrapped around stator or rotor
c) it develops MMF identical to that produced by the winding it replaces
d) any of the mentioned

Answer: d
Explanation: The MMF produced by uniformly distributed current sheet is identical with the MMF produced by uniformly distributed winding. If the distributed winding in the slots is on the rotor, then the uniformly distributed current sheet would be wrapped around the rotor accordingly.

8. A current sheet with sinusoidal current produces?
a) sinusoidal MMF wave lagging it by 90°
b) sinusoidal MMF wave leading it by 90°
c) trapezoidal MMF wave leading it by 90°
d) trapezoidal MMF wave lagging it by 90°

Answer: b
Explanation: A uniform current sheet produces trapezoidal MMF wave and sinusoidal current sheet produces sinusoidal MMF wave leading by 90°.

9. A uniformly distributed winding on the stator has three full pitched coils, each coil having N turns and each turn carrying a current i. The MMF produced by the winding is?
a) sinusoidal in waveform with an amplitude 3Ni
b) sinusoidal in waveform with an amplitude 3Ni/2
c) trapezoidal in waveform with an amplitude of 3Ni
d) trapezoidal in waveform with an amplitude of 3Ni/2

Answer: d
Explanation: When the machine has more than 3 slots per pole per phase, the steps in the MMF wave are neglected and MMF variation is taken as smooth over these slots and as a consequence, stepped MMf wave changes to trapezoidal MMF wave. The trapezoidal MMF wave amplitude = 3Ni/2.

10. MMF produced by one N-turn coil carrying a current i is _____________
a) rectangular of amplitude Ni/2
b) trapezoidal of amplitude Ni/2
c) rectangular of amplitude Ni
d) trapezoidal of amplitude Ni

Answer: a
Explanation: The MMF variation due to one N-turn coil is seen to be a rectangular wave of amplitude +1/2(Ni) or -1/2(Ni).

11. A winding of 20 full pitched series turns, distributed over a band of 60° under each pole, carries a current of 3A. The winding produces a uniform current sheet of density (in AT's per electrical radiangs) of ____________
a) 180/Π
b) 120/Π
c) 90/Π
d) 60/Π

Answer: a
Explanation: Uniform current density J=(20*3)/(Π/3)=180/Π.

12. A sinusoidal current sheet in a rotating electrical machine has peak value along q-axis. The peak value of sinusoidal MMF would be ____________
a) in phase with current peak
b) 90° lagging the current peak
c) 90° leading the current peak
d) may lag or lead depending upon the type of machine

Answer: c
Explanation: Sinusoidal current sheet produces sinusoidal MMF wave leading by 90°.

13. In a DC machine, z, p, I_a and a are respectively the number of conductors, number of poles, armature current and number of parallel paths. The peak value of fundamental component of armature MMF wave is _____________

a) $8/\Pi[(z/2p)(I_a/a)]$

b) $8/\Pi^2[(z/p)(I_a/a)]$

c) $4/\Pi[(z/2p)(I_a/a)]$

d) $8/\Pi^2[(z/p)(I_a/a)]$

Answer: d

Explanation: The peak value of the fundamental sine component F_a for a DC machine is $F_a = 8/\Pi^2[(z/p)(I_a/a)]$ AT/pole.

14. Which of the following statements are true regarding the armature MMF wave in a DC machine when it is triangular?

```
(i) rotates with respect to stator
(ii) is stationary with respect to stator
(iii) rotates with respect to armature
(iv) is stationary with respect to armature
```

a) (ii) only
b) (iii) only
c) (i) and (iv)
d) (ii) and (iii)

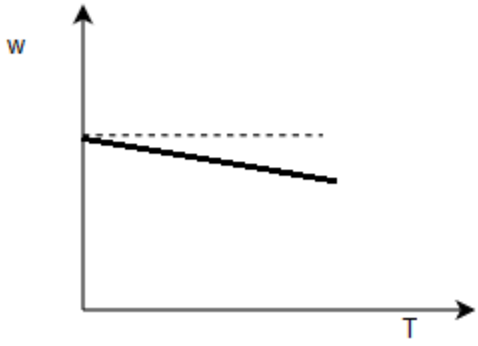
Answer: d

Explanation: In a DC machine, armature current doesn't vary with time. Therefore, the armature MMF wave for a DC machine remains constant in amplitude and doesn't depend on the armature speed. Hence the armature MMF wave is stationary with respect to stator and armature.

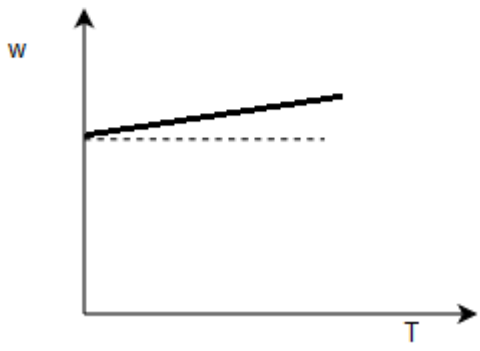
This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Operating Characteristics of DC Motors".

1. The speed torque characteristics of the dc motor is best described by following the equation.

$w=(Vt/k*flux)-Ra*T/((R*flux)^2)$



a)



b)

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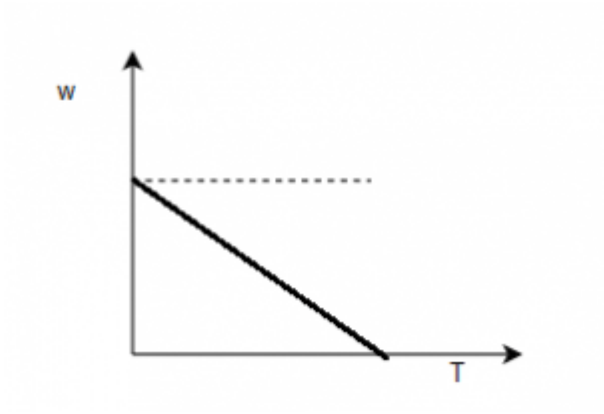
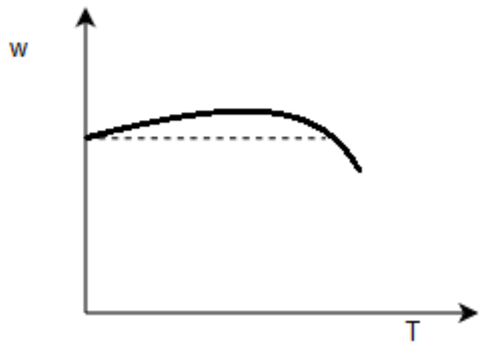


c)

d) 

Answer: a
Explanation: The speed reduced slightly due to armature drops practically.

2. Mark the correct option which affects the terminal voltage of a dc shunt motor.
a) Armature reaction
b) Source voltage variations
c) Compensating winding
d) Any of the mentioned

Answer: c
Explanation: If the dc motor has compensating winding, flux will remain constant regardless of load.

3. For a dc shunt motor of 5 kW, running at 1000 rpm, the induced torque will be ______________
a) 47.76 N
b) 57.76 N
c) 35.76 N
d) 37.76 N

Answer: a
Explanation: Torque = Power/(speed in rev/s)
= 5000/(2*pi*1000/60)
= 47.76 N.

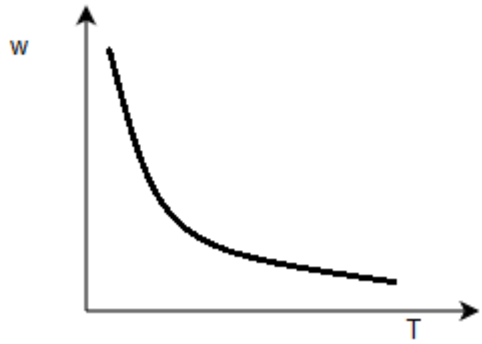
4. The flux and the internally generated voltage of a dc machine is a _________ function of its magneto-motive force.
a) non-linear
b) linear
c) constant
d) inverse

Answer: a
Explanation: The flux and induced emf are non linear function of its mmf.

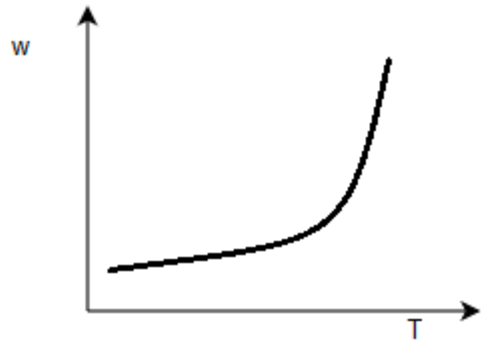
5. It is advised not to run dc series motor with no load. Why?
a) Because zero torque at no load will make speed infinite
b) Because zero torque as no load will not let machine start
c) Because infinite torque will be produced
d) None of the mentioned

Answer: a
Explanation: If the torque is zero in dc series motor then the speed will be infinite causing the damage of the machine permanently.

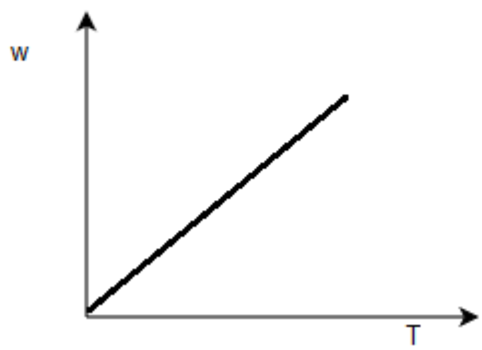
6. Identify the speed torque characteristics of a dc series motor.



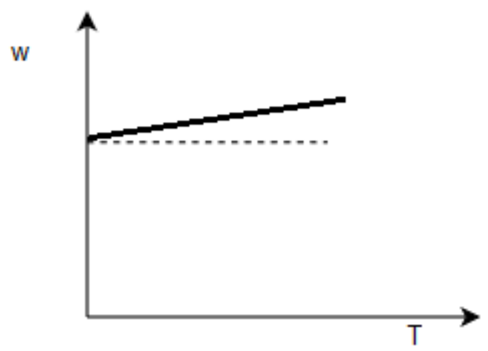
a)



b)



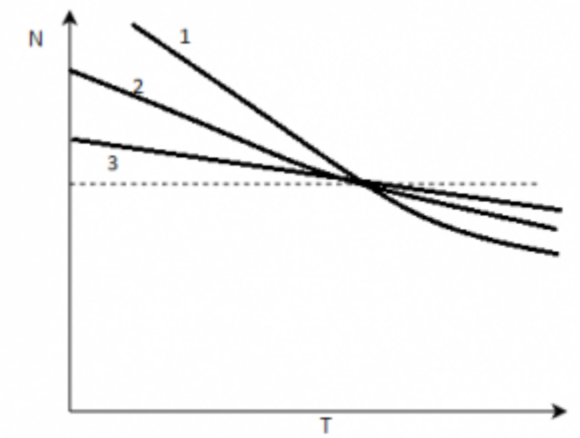
c)



d)

Answer: a
Explanation: It is inverse in nature. At start it is infinite due to zero flux.

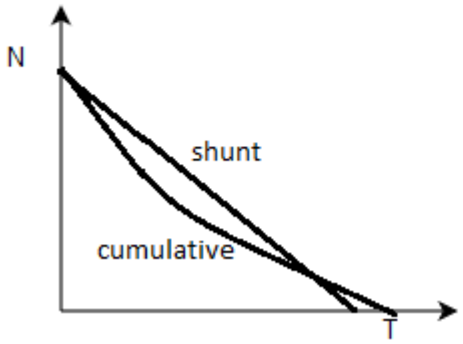
7. Choose the best option which identifies about the below characteristics.



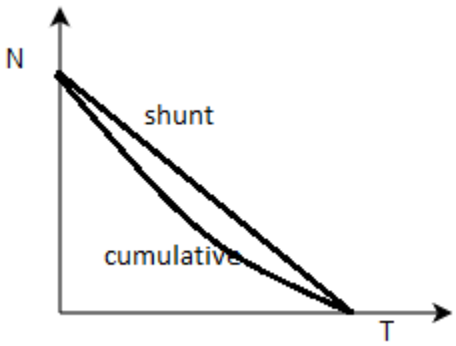
a) (1)series motor (2) Cumulative compound motor (3) Shunt motor
b) (1)Cumulative compound motor (2) series motor (3) Shunt motor
c) (1)Cumulative compound motor (2) Shunt motor (3) series motor
d) (1)Shunt motor (2) series motor (3) Cumulative compound motor

Answer: a
Explanation: Shunt machine has almost constant speed while the series varies as inverse relation with torque.

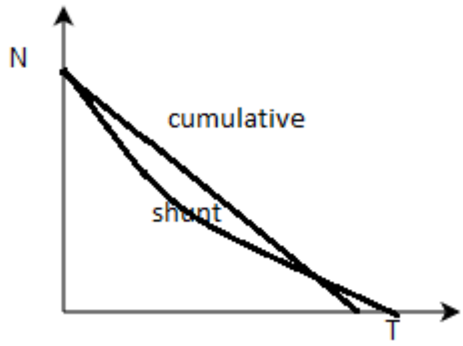
8. How will the speed torque characteristic of a dc shunt motor and cumulatively compound dc motor perform at no load?

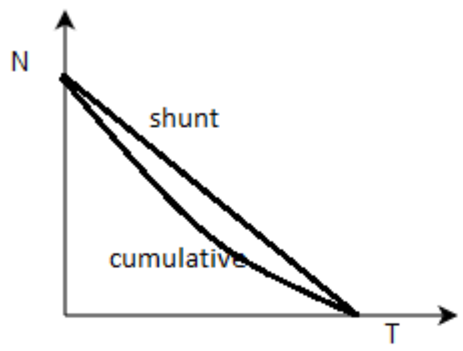


a)



b)

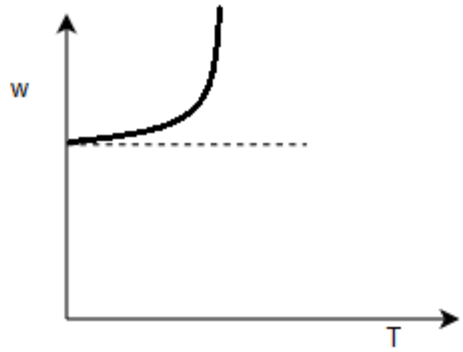
c) 



d)

Answer: a
Explanation: The shunt motor has speed characteristic of linearly falling characteristics as the load increases the speed also falls.

9. The speed torque of the differential compound dc motor is shown below. What conclusions can be made?



a) This is an unstable machine
b) There is regenerative increment in the speed
c) This is impractical to be used
d) All of the mentioned

Answer: d
Explanation: This is basically an unstable scenario which makes the machine unable to be used.

10. It is impossible to start a differential compounded dc motor.
a) True
b) False

Answer: a
Explanation: It is so because of the unstable speed and torque characteristics. At starting, armature current and series field current are high. Since the series flux subtracts from shunt flux, series flux actually reverses the magnetic polarity. This motor will typically be still or turn slowly in wrong direction while burning up because of excessive current.

11. A student is given a differential compound motor and he has been asked to make it start. How will he try?
a) By shorting series field at start
b) To run as shunt motor at start
c) By making rated current at start
d) All of the mentioned

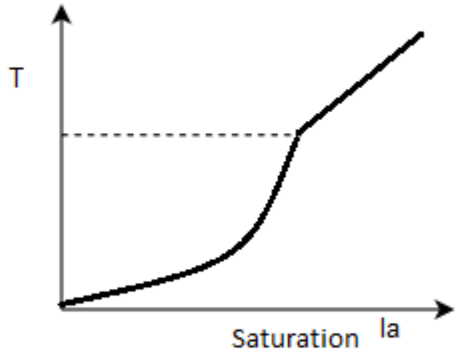
Answer: d
Explanation: At starting, the flux should be rated so that there is no abnormal situation arise.

12. For a 100 hp 250 V, compound dc motor with compensating winding has a field current of 5 A to produce a voltage of 250 V at 1200 rpm. What will be the shunt field current of this machine at no load?
a) 5 A
b) 5.6 A

c) 4 A
d) 0 A

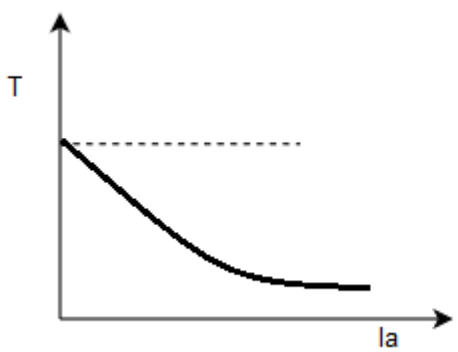
Answer: a
Explanation: At no load, armature current is zero, so the internal generated voltage is 250 V. So 5 A will be the shunt field current at no load.

13. The torque characteristic is best described for a dc series motor with respect to armature current is?



a)

b)

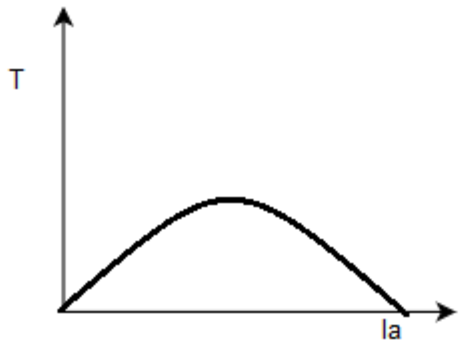


c)

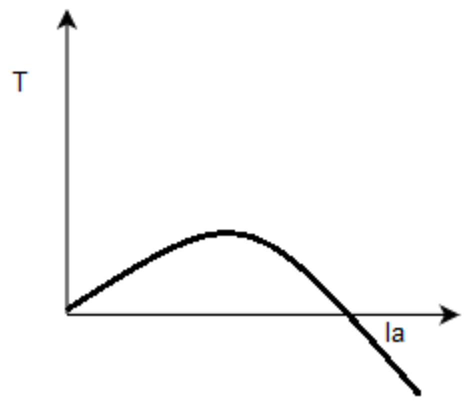
d) None of the mentioned

Answer: a
Explanation: After saturation, flux becomes constant. After that we observe a linear region.

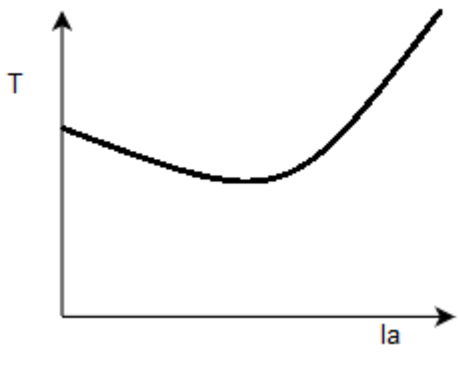
14. The torque vs armature current of a differential compound motor in the strong field is?



a)



b)



c)

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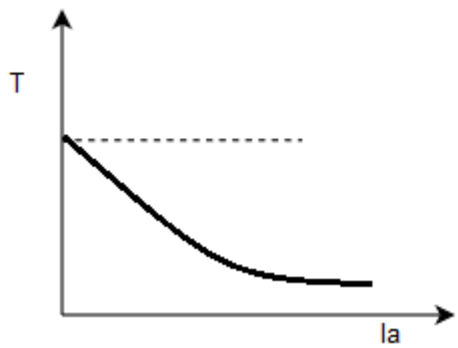


d)

Answer: a
Explanation: Initially it will act as dc shunt motor but as the speed increases it starts behaving like dc series motor.

15. A dc shunt motor is connected to the source through 3-point starter. Suddenly if we starter handle is moved fastly from off to on position, then the __________
a) motor will draw large current
b) motor will not start
c) motor will burn
d) all of the mentioned

Answer: d
Explanation: As the starter is placed very rapidly from off to on the resistance seen by the machine will be very less and it will draw a large starting current.

This set of Electrical Machines online quiz focuses on “Excitation Systems for Synchronous Machines”.

1. A 3 phase synchronous machine is __________ excited machine.
a) doubly
b) single
c) two stage
d) feedback based

Answer: a
Explanation: The 3 phase synchronous machine has two excitations. Ac excitation at armature while dc excitation at field winding.

2. Field winding of a dc machine __________
a) always absorbs power

b) absorbs real power at lagging load
c) delivers power while behaving as generator
d) always delivers power

Answer: a
Explanation: Field is always given supply from dc system so it always absorbs power as it is necessary to produce the flux.

3. In large synchronous machine, field winding is placed on ______ and ac supply on ______
a) rotor, stator
b) stator, rotor
c) armature, slots
d) pole shoes, stator

Answer: a
Explanation: The field winding is placed on the stator as it will carry less current while the ac supply is fed at stator as it will have to carry large amount of current.

4. The pilot exciter in dc exciters is ________
a) dc shunt generator feeding field winding of mains
b) universal motor
c) stepper motor feeding the field winding of mains
d) any of the mentioned

Answer: a
Explanation: Pilot exciter is dc shunt generator which supplies the field of main winding.

5. What are the main problems faced by conventional DC exciters?
a) cooling and maintainance
b) wear and tear
c) additional parasitic losses
d) all of the mentioned

Answer: d
Explanation: The conventional dc exciters have all the above mentioned losses which make them out dated and least efficient.

6. The static excitations mainly comprises of _______
a) brushless excitation system
b) thyrister based excitation system
c) synchronous motor excitation system
d) brushless and thyristor based excitation system

Answer: b
Explanation: SCRs are used in the rectifier configuration as a static system for excitation for dc field winding.

7. The excitation system and speed of alternator has _______
a) linear response
b) exponential response
c) rectangular hyperbola response
d) circular response

Answer: a
Explanation: As the excitation energy is directly taken from alternator terminals, excitation voltage is directly proportional to speed.

8. The brushless excitation and conventional DC excitation systems are comparable but one significant change is _______
a) pilot exciter is brushless permanent magnet motor
b) three phase rectifier feeds directly to main exciter
c) a three phase rectifier is fed by main exciter
d) no direct rectification is provided to the pilot exciter

Answer: a
Explanation: The brushless excitation involves a brushless permanent motor which acts as an auxiliary exciter.

9. The main exciter used in DC excitation is ________
a) field on stator
b) armature on stator
c) field on rotor
d) field on poles

Answer: a
Explanation: The main exciter used in DC excitation is field on stator.

10. If the DC excitation is suddenly dropped to 0, the three phase alternator _________
a) runs as motor
b) stops to zero speed in few seconds
c) continues to run as motor but at lower speed
d) no change in the operating conditions

Answer: a
Explanation: When the dc excitation is disconnected from the supply, it will start acting as synchronous motor as the prime mover will still be mechanically coupled.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Physical Concepts of Synchronous Machine Operation".

1. Floating of synchronous machine on infinite bus means ___________
a) Fa = 0 and machine neither generator nor motor
b) Fa is not zero and machine neither generator nor motor
c) Fa = 0 and machine is not excited
d) frequency is zero

Answer: a
Explanation: Floating means the armature flux is zero and it neither motoring nor generating.

2. If the field poles are ahead of resultant mmf, then the 3-phase synchronous machine is operating as ___________
a) generator
b) motor
c) reluctance motor
d) any of the mentioned

Answer: a
Explanation: Field mmf leads the resultant mmf so it is generator.

3. At steady state operation in a 3-phase synchronous generator. (where Tem is developed electromagnetic torque developed in the machine and Tpm is the prime mover torque.)
a) Tem = Tpm
b) Tem > Tpm
c) Tem < Tpm
d) can not be coupled

Answer: a
Explanation: At steady state the net torque is zero in the machine.

4. Active power in synchronous machine is proportional to __________
a) torque
b) excitation
c) sinϕ
d) all of the mentioned

Answer: a
Explanation: Active power is proportional to the torque of the synchronous machine.

5. The reactive power in synchronous machine is proportional to __________
a) torque

b) excitation
c) sinϕ
d) all of the mentioned

Answer: b
Explanation: Reactive power depends on the excitation of the synchronous machine.

6. If the synchronous machine is loaded from floating conditions, the alternator begins to operate at ___________
a) leading p.f
b) lagging p.f
c) unity p.f
d) zero p.f

Answer: a
Explanation: The resultant flux will be leading in nature, so after loading it from loading it from floating, alternator will operate at leading p.f.

7. If the synchronous machine is loaded from floating conditions, the synchronous motor begins to operate at ___________
a) leading p.f
b) lagging p.f
c) unity p.f
d) zero p.f

Answer: b
Explanation: The resultant flux will be lagging in nature, so after loading it from loading it from floating, alternator will operate at lagging p.f.

8. Reactive power flow in synchronous machine can be controlled by ___________
a) varying field excitation
b) varying field current
c) varying field flux
d) any of the mentioned

Answer: d
Explanation: All the alternatives are same, varying the field flux matters at the end to change the reactive power in a synchronous machine.

9. If the 3-phase alternator has 4 poles and has synchronous speed of 120 rad/s. Then the mechanical speed in rad/sec is?
a) 60
b) 240
c) 120
d) 30

Answer: a
Explanation: Mechanical speed = electrical speed*2/Number of Poles.

10. The power load angle characteristic as maximum for a load angle of ___________
a) 90°
b) 45°
c) more than 90°
d) 180°

Answer: a
Explanation: As per the parabolic graph, the maxima is obtained at 90°.

11. For running a 750 kW compressor, a synchronous motor is preferred because of ___________

```
(i) lower noise
(ii) faster build up of pressure
(iii) better power factor
(iv) low starting torque
```

a) (ii), (iii)
b) (i), (ii), (iv)
c) (i), (ii), (iii), (iv)
d) (iii), (iv)

Answer: a
Explanation: It is preferred due to better power factor and low starting torque.

12. A poly phase synchronous motor will be used for the load of ______ over poly phase induction motor.
a) 600 kW 500 rpm
b) 600 kW 1500 rpm
c) 600 kW 3500 rpm
d) 600 kW 1200 rpm

Answer: a
Explanation: A synchronous motor is used at low speed.

13. During the starting of the 3-phase synchronous motor by damper bars, the field winding is usually short circuited so that starting torque is equal to ___________
a) induction motor torque plus an additional torque produced by short circuited field winding
b) induction motor torque
c) electromagnetic torque
d) reluctance torque due to rotor saliency

Answer: a
Explanation: Using dampers to start the synchronous motor, it will produce induction motor torque initially along with the torque due to shorted field winding.

14. To start the synchronous motor, its field winding should be ___________
a) short circuited
b) kept open
c) connected to dc excitation source
d) any of the mentioned

Answer: a
Explanation: To start the synchronous motor, it is first run as field excitation as zero, so we short circuit them.

15. Squirrel cage bars placed in the rotor pole faces of a 3-phase alternator help in reducing hunting.

```
I. above synchronous speed
II. below synchronous speed
III. at synchronous speed
```

a) I, II
b) III
c) I, II, III
d) none of the mentioned

Answer: a
Explanation: This method is based on the operation of the induction motor, hence it will not operate at synchronous speed.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Power Factor Control of Synchronous Machines”.

1. The magnetization current drawn from an AC supply a synchronous motor is used to __________
a) set up flux in magnetic circuit of device
b) compensate core losses
c) set up magnetizing armature reaction
d) all of the mentioned

Answer: a
Explanation: Magnetizing current sets up the flux needed in the machine.

2. A 3 phase synchronous motor is working at normal excitation, then the flux deficient in circuit is _________
a) given by armature winding mmf
b) given by field winding mmf
c) supplied to armature winding mmf
d) supplied to field winding mmf

Answer: a
Explanation: it is given by armature winding mmf.

3. The excess flux in synchronous motor is neutralized by ___________
a) armature winding by drawing demagnetizing component of the current from ac supply
b) armature winding by drawing magnetizing component of the current from ac supply
c) field winding by drawing demagnetizing component of the current from dc supply
d) field winding by drawing magnetizing component of the current from dc supply

Answer: a
Explanation: Excess flux is neutralized y the demagnetizing component.

4. The V-curves of synchronous motor is plotted between _________
a) Ia Vs If with constant shaft load
b) If Vs Ia with constant shaft load
c) power factor vs If
d) power factor vs Ia

Answer: a
Explanation: The V-curves of synchronous motor is plotted between Ia Vs If with constant shaft load.

5. When a constant power output is desired to maintain ___________
a) Ef*sinδ and Ia*cosθ are to be maintained constant
b) Ef*sinδ is be maintained constant
c) Ia*cosθ is to be maintained constant
d) Ef*sinδ and Ia*sinθ are to be maintained constant

Answer: a
Explanation: For constant real power output the component of the excitation voltage lagging to Vt should remain constant as per the phasor diagram.

6. When the excitation voltage is increased from 1 to 1.3 pu of a 3-phase synchronous motor. Then load angle for the constant power operation ___________
a) must be decreased
b) can also be increased
c) increased
d) decreased

Answer: a
Explanation: Efsinδ is to be maintained constant. so if excitation voltage increases then the load angle must decrease.

7. The armature current is _________ at UPF when compared to leading power factor for a motor.
a) minimum
b) maximum
c) equal
d) none of the mentioned

Answer: a
Explanation: At leading pf armature current will be high as the emf will be high.

8. The armature current is ________ at UPF than motor at lagging power factor.
a) minimum
b) maximum

c) zero
d) none of the mentioned

Answer: a
Explanation: At leading pf armature current will be high as the emf will be high for a synchronous motor.

9. The inverted V plots is plotted between ___________
a) power factor vs field current for constant shaft load
b) field current vs power factor for variable shaft load
c) armature current vs field current
d) terminal voltage vs power factor

Answer: a
Explanation: inverted v-curves are plotted between power factor and field current for constant shaft load.

10. For a power system having induction motor loads, an overexcited synchronous motor is also attached. Then the over all power factor ___________
a) improves
b) degrades
c) becomes upf
d) remains same

Answer: a
Explanation: An over excited synchronous motor acts as a source of lagging reactive power and so the overall power factor improves.

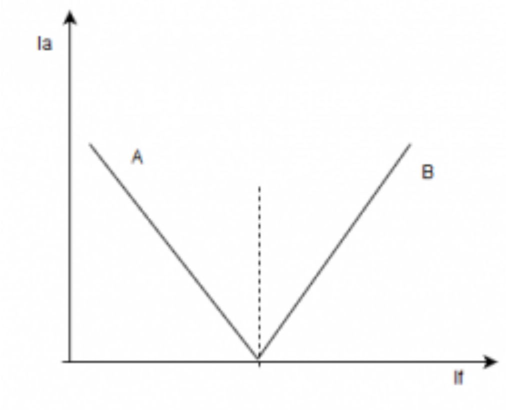
11. For a power system having induction motor loads, an overexcited synchronous motor is also attached. The induction motor will now operate at ___________
a) lagging
b) leading
c) reduced power factor
d) increased power factor

Answer: a
Explanation: Adding synchronous motor will improve the pf of the system but then the induction motor will still work at lagging pf only.

12. Synchronous compensators are ___________
a) overexcited synchronous motor with no mechanical load
b) overexcited synchronous motor with mechanical load
c) underexcited synchronous motor with no mechanical load
d) normal excited synchronous motor with no mechanical load

Answer: a
Explanation: Synchronous compensators are overexcited synchronous motor with no mechanical load.

13. For a synchronous motor, mark the appropriate.



a) A-Inductor, B-Capacitor
b) A-Capacitor, B-Resistor
c) A-Inductor, B-Inductor
d) A-Capacitor, B-Inductor

Answer: a
Explanation: A will act as the inductor curve consuming the reactive power while the B curve is like capacitor.

14. (I) Speed of an isolated alternator can be altered.
(II) Speed of an alternator connected to IBB can be also altered.
a) I is true, II is false
b) Both the statements are true
c) I is false while II is true
d) Both are false

Answer: a
Explanation: Speed of the alternator connected to the infinite bus bas can not be changes as it has to be of fixed frequency.

15. (I) For constant power of an isolated alternator, V-curves can be obtained.
(II) For constant power of an alternator connected to IBB, V-curves can be obtained
a) I is true, II is false
b) Both the statements are true
c) I is false while II is true
d) Both are false

Answer: c
Explanation: For an isolated alternator working at constant power, we can not alter the armature current to have a v-curve while the is possible for the machine connected to infinite bus bar.

16. The operating frequency and voltage of an isolated alternator _________ if the prime mover input to motor is increased.

a) increases
b) decreases
c) remains constant
d) no relation exists between the power and frequency

Answer: a
Explanation: By varying the prime mover torque, the load angle as well as the operating frequency also get affected.

17. The active power delivered by an alternator will ________ when the prime mover input is increased for the alternator connected to infinite bus bar.
a) increases
b) decreases
c) remains constant
d) no relation exists between the power and prime mover droop characteristic

Answer: a
Explanation: The load angle will increase and so the real power will increase in case the prime mover input is increased.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Two Reaction Theory of Salient Pole Machines”.

1. In salient-pole machines, the armature mmf cannot be accounted for by introducing one equivalent reactance due to ___________
a) non-uniform airgap
b) variable resistance
c) non-uniform air gap
d) any of the mentioned

Answer: a
Explanation: Due to saliency of the of the rotor poles, the air gap varies and the so one reactance is not sufficient to express the armature mmf.

2. If the internal power factor angle of synchronous motor is 30 degree. Then the direct-axis component of the armature current will be ___________
a) 0.5 pu
b) 0.866 pu
c) 1.73 pu
d) 0

Answer: a
Explanation: Id = Ia*sinψ = 1*sin30
= 0.5 pu.

3. If the internal pf angle of a synchronous motor is 30 degree. Then the quadrature axis component of the armature is?
a) 0.866 pu
b) 0.5 pu
c) 1.73 pu
d) 0

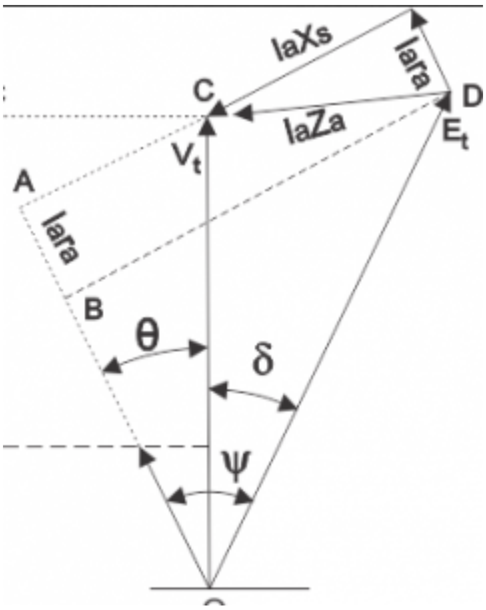
Answer: a
Explanation: Id = Ia*cosψ = 1*cos(3*0).

4. A salient pole synchronous generator has following per-unit parameter Xd = 1.2 pu, Xq = 0.8pu, ra = 0.25 ohms. Then the armature current at 0.8 lagging is?
a) 1,-36.9°
b) 1, 36.9°
c) 1, 73°
d) 1, 27°

Answer: a
Explanation: In per unit, armature current will be lagging by 36.9°.

5. The internal power factor angle is given for a lagging load of a 3- phase alternator.
a) $\psi = \delta - \theta$
b) $\psi = \delta + \theta$
c) $\psi = -\delta - \theta$
d) $\psi = \delta - \theta$

Answer: b



Explanation:

6. Mark the correct expression for alternator working at a lagging power factor.
a) $\tan\psi = (I_aX_q - V_t\sin\theta)/(V_t\cos\theta - I_a*r_a)$
b) $\tan\psi = (I_aX_q + V_t\sin\theta)/(V_t\cos\theta - I_a*r_a)$
c) $\tan\psi = (I_aX_q + V_t\sin\theta)/(V_t\cos\theta + I_a*r_a)$
d) $\tan\psi = (I_aX_q - V_t\sec\theta)/(V_t\mathrm{cosec}\theta - I_a*r_a)$

Answer: a
Explanation: The internal power factor angle is given as $\tan\psi = (I_aX_q - V_t\sin\theta)/(V_t\cos\theta - I_ar_a)$ for an alternator.

7. For a 400 V, 3 phase alternator gives an open circuit voltage of 380V and armature current of 38A at a field current of 20A. Then the synchronous reactance of the machine is?
a) 10 ohm
b) 38/√3
c) 19 ohm
d) 1.9 ohm

Answer: a
Explanation: Z = Vt/Ia at the same field current = 380/38 = 38 ohms.

8. While finding the parameters for an alternator, its voltage regulation is found to be negative. Then the load connected to it must be ___________
a) capacitive nature
b) inductive nature
c) resistive nature
d) can not be judged based on voltage regulation

Answer: a
Explanation: The given voltage regulation is mentioned as negative. So it must have a load which is a source of reactive power and hence it must be a capacitor.

9. for a synchronous motor, its power factor ___________
a) improves with increase in excitation and may even become leading at higher excitations
b) is independent of its excitation
c) decreases with increase in excitation
d) increases with loading for a given excitation

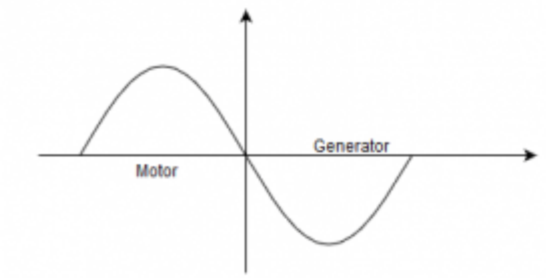
Answer: a
Explanation: A per the inverted V-curves it can be easily concluded that as the excitation increases synchronous motor becomes leading.

10. For obtaining maximum current when we conduct the ‘Slip Test’ on a synchronous machine, its armature field will align along ___________
a) d-axis
b) q-axis
c) 45° to d-axis
d) 45° to q-axis

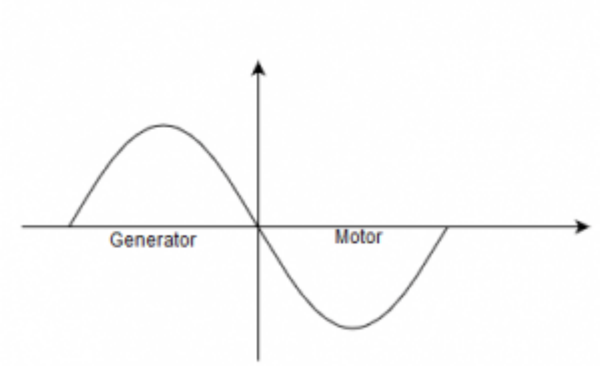
Answer: b
Explanation: The maximum current is observed at low reluctance which is along q-axis.

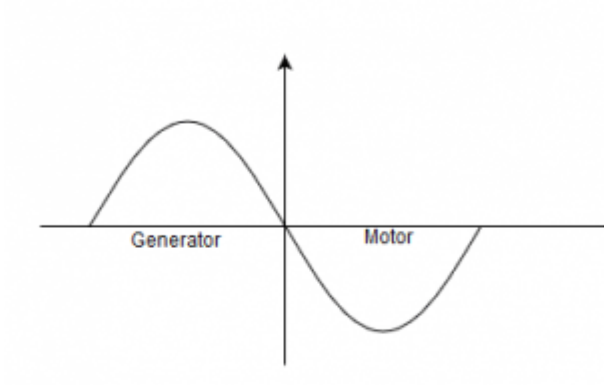
This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Power Angle Characteristics of Synchronous Machines”.

1. Choose the correct power angle characteristics for the synchronous motor and generator.



a)

b) 

c) 

d) None of the mentioned

Answer: a
Explanation: In the generator mode, the power is positive and it is taken out of the terminals.

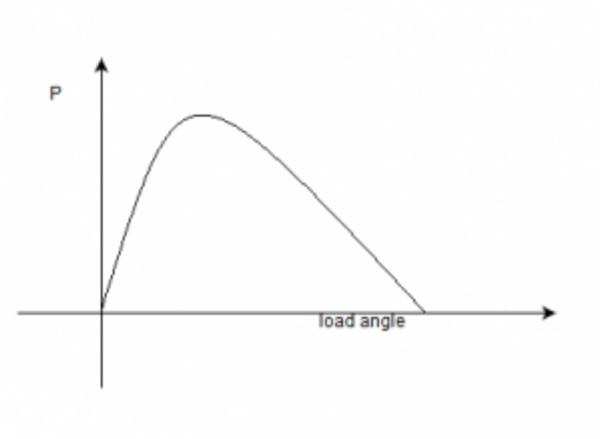
2. For a 3 phase 400V alternator having 0.5pu of synchronous reactance and its excitation voltage of 1.2pu and Vt of 1pu. Then the power delivered to the infinite bus is?
a) 2.4pu
b) 4.8pu
c) 1.44pu
d) 1pu

Answer: a
Explanation: P = EV/X = 1.2*1/0.5 = 2.4 pu.

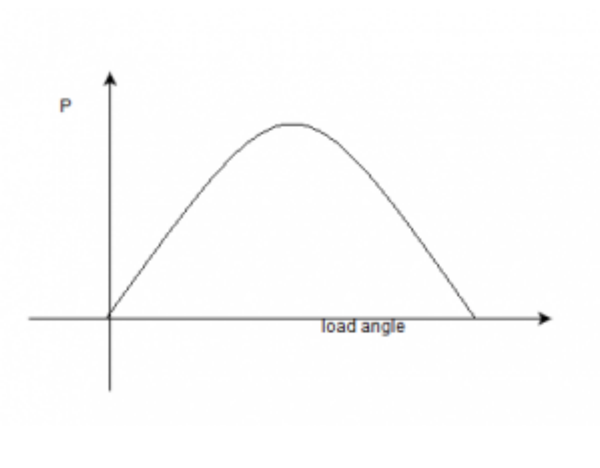
3. For a 3 phase 400V alternator supplying a load of 0.8 pf lagging at an armature current of 1.1pu. The power delivered to load is?
a) 0.88pu
b) 0.8pu
c) 0.66pu
d) 1.375pu

Answer: c
Explanation: P = EVsinδ/X = 1.1*1*sin36.67 = 6.6 pu.

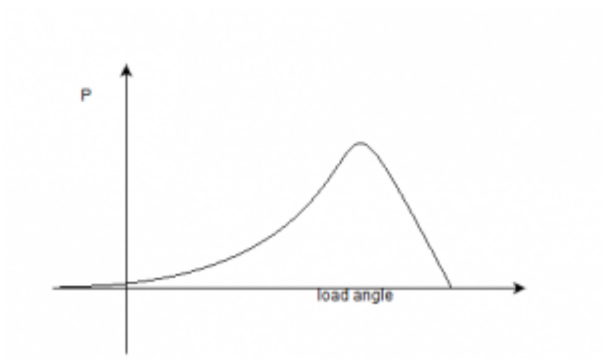
4. The power-angle characteristic for a three phase salient pole alternator is most correctly shown by?



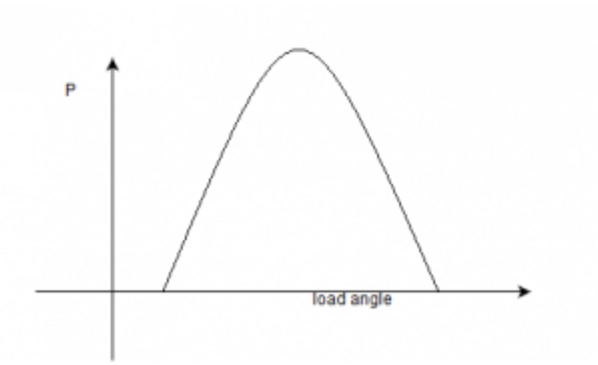
a)



b)



c)

d) 

Answer: a
Explanation: The power angle curve is not completely sinusoidal due to the salient nature of the poles.

5. A 3 phase 400V salient pole alternator is running at no-load. Suddenly the excitation is removed then the net power in the machine is proportional to ______________
a) sin 2d
b) sin d
c) cos 2d
d) 0

Answer: a
Explanation: The reluctance power generated will be proportional to sin(2δ).

6. A 3 phase 400V cylindrical rotor is running at 1500rpm. Suddenly the field excitation zero. Then the net reluctance power is?
a) 0
b) sin 2d
c) cos d
d) cos 2d

Answer: a
Explanation: The net reluctance power for a cylindrical rotor type alternator will be zero if the field excitation is made zero.

7. A cylindrical rotor alternator can also run as reluctance motor.
a) True
b) False

Answer: b
Explanation: The net reluctance power for a cylindrical rotor type alternator will be zero if the field excitation is made zero. There will not be any torque generated.

8. If the synchronous machine is connected to an infinite bus of constant voltage Vt, through a transformed, a transmission line of reactance 'X'. Then power for a cylindrical machine is?
a) P = (Ef*Vt sinδ)/(Xs + X)
b) P = (Ef*Ef sin2δ)/(Xs + X)
c) P = (Ef*Vt sinδ)/(Xs – X)
d) P = (Vt*Vt sinδ)/(Xs + X)

Answer: a
Explanation: The total reactance will be the reactance offered to the synchronous motor in the machine.

9. Maximum power in cylinder rotor alternator occurs at load angle of ___________
a) 90 degree
b) 45 degree
c) less than 90 degree
d) 180 degree

Answer: a
Explanation: The maximum power will occur at exact 90° for a cylindrical rotor alternator.

10. A synchronous generator is operating with a Ef=1.40pu. This machine having Xs of 1.2pu, is delivering a synchronous power of 0.5pu to the bus. If the prime-mover torque is increased by 1%, by how much will the synchronous power P change?
a) 1%
b) 10%
c) -1%
d) 4%

Answer:a
Explanation: dP/dδ = EVcosδ/X
So the change in P will also be 1%.

11. A synchronous generator is running over excited with a Ef=1.40pu. This machine, with a synchronous reactance of 1.2pu, is delivering a synchronous power of 0.5pu to the bus. If the prime-mover torque is increased by 1%, by how much will the reactive power, Q change?
a) -0.475 %
b) 0.475%
c) 4.75%
d) -4.75%

Answer: a
Explanation: $dQ/d\delta = -EV\sin\delta/X$
$dP/d\delta = EV\cos\delta/X$
$dQ/dP = -\tan\delta = -\tan 25.4 = -0.475$
$dQ = -0.475\%$.

12. A synchronous machine which is synchronized with an infinite bus. If it is desired to obtain a condition when the machine delivers the real power to the IBB without changing the field excitation, then ___________
a) reactive power will be consumed by the machine
b) reactive power will be delivered by the machine
c) no reactive power flow will take place
d) none of the mentioned

Answer: a
Explanation: Due to the condition here that it is providing the real power to the infinite bus bar here, the machine will need more flux to produce the real power in the machine.

13. The phasor addition of stator and rotor mmfs in a cylindrical rotor synchronous machine, is possible because ___________
a) mmfs are rotating in opposite direction
b) mmfs are rotating in same direction at different speeds
c) mmfs are stationary with respect to each other
d) one mmf is stationary and the other mmf is rotating

Answer: c
Explanation: The phasor addition is possible due to the fact that the two mmfs are stationary with respect to each other.

14. For the effective electromechanical energy conversion in the device, the developed torque depends upon ___________
a) stator field and torque angle
b) stator field and rotor field
c) stator field and rotor field and the torque angle
d) stator field only

Answer: c
Explanation: $T \propto E*V*\sin\delta$.

15. In a synchronous machine, hunting is predominantly damped by ___________
a) mechanical losses in the rotor
b) iron losses in rotor
c) copper losses of stator
d) copper losses of rotor

Answer: d
Explanation: The hunting is damped by the copper losses in the rotor.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Measurement of Xd and Xq”.

1. The d-axis reactance is determined by _______________
a) OCC & SCC
b) OCC
c) Slip test
d) SCC

Answer: a
Explanation: Both the OCC as well as short circuit test are used to calculate the d-axis reactance.

2. The slip test is used to determine ____________
a) Xq
b) Xd
c) Xd and Xq
d) None of the mentioned

Answer: a
Explanation: Slip test is used to determine the q-axis reactance.

3. During slip test it would be observed that ____________

```
i) Swing of ammeter is wide
ii) Swing of voltmeter is  wide
```

a) i is true, ii is false
b) i is false, ii is true
c) both true
d) both false

Answer: a
Explanation: The impedance during slip test is low so the voltage drop will be less and the current will be more.

4. Slip test must be conducted at low armature terminal voltage. This is due to ____________
a) avoiding error due to large slip
b) avoiding error due to small slip
c) avoiding heating
d) all of the mentioned

Answer: a
Explanation: Slip test is conducted at low terminal voltage to avoid large slip in the synchronous machines.

5. A 3 Phase 400, 100 MVA alternator is connected to infinite bus bar. If the mechanical power input is more than the maximum reluctance power, the reluctance generator will lose synchronizm if ____________
a) field is open circuited
b) field is short-circuited
c) load is removed
d) damper is removed

Answer: a
Explanation: If the excitation itself is made zero, then machine will stop.

6. If a cylindrical rotor synchronous generator, is connected to the IBB, if the field is made zero, then it behaves as ____________
a) induction generator for a short time
b) induction motor
c) synchronous motor
d) synchronous generator

Answer: b
Explanation: It will act as induction motor as there will be difference in the speed.

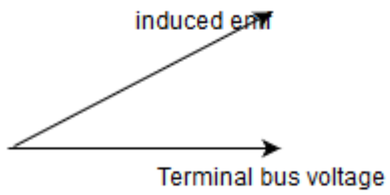
7. When a 3–phase alternator is suddenly short–circuited at its terminals, the initial value of the short–circuit current is limited by which one of the following?
a) x”d
b) x’d
c) xs
d) Sum of x”d, x’d and xs

Answer: a
Explanation: When suddenly the terminals of the synchronous machine will be short circuited, at that immediate instant it will be subtransient reactance.

8. An alternator with higher value of SCR has _____________
a) better voltage regulation and higher stability limit
b) poor voltage regulation and lower stability limit
c) poor voltage regulation and higher stability limit
d) better voltage regulation and lower stability limit

Answer: a
Explanation: SCR is directly proportional to voltage regulation. Even stability limit is directly proportional to SCR.
SCR = 1/X.

9. The phasor diagram of a synchronous machine connected to an infinite bus is shown in the figure.



The machine is acting as
a) generator and operating at leading pf
b) generator and operating at lagging pf
c) motor and operating at leading pf
d) motor and operating at lagging pf

Answer: a
Explanation: The induced voltage leads the bus voltage, which means that it is at leading pf and then excitation magnitude is also more than terminal bus voltage.

10. If the excitation of a 3-phase alternator operating on infinite bus bars is changed, which one of the following will get affected?
a) Active real power of machine
b) Reactive power of machine

c) Terminal voltage of machine
d) Frequency of machine

Answer: b
Explanation: Excitation is coupled with the reactive power of the machine majorly.

11. In which one of the following is reluctance power developed?
a) Salient pole alternator
b) Non-salient pole alternator
c) Squirrel cage rotor type induction motor
d) All of the mentioned

Answer: a
Explanation: Because there is variable air gap due to saliency of the poles.

12. While conducting measurement for Xd and Xq, the information obtained is below.

```
Id max = 10 A; Id min = 5 A
Vd max = 30 V; Vd min = 25 V
```

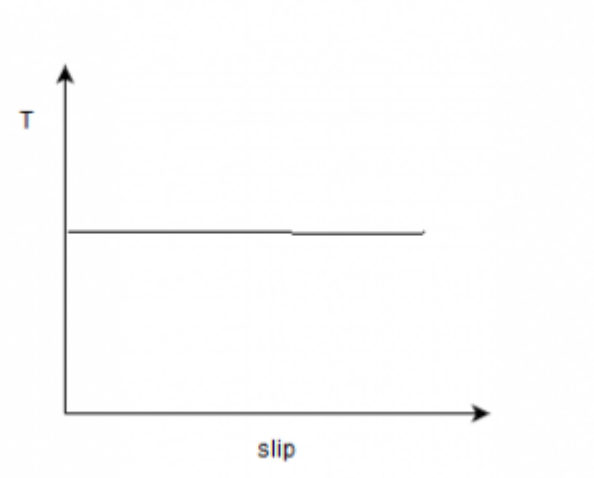
Which one of the following is correct?
a) Xd = 3, Xq = 2.5
b) Xd = 6, Xq = 3.86
c) Xd = 3, Xq = 3.86
d) Xd = 6, Xq = 2.5

Answer: d
Explanation: Xd=V(max)/I(min) = 30/5 = 6 ohms;
Xq=V(min)/I(max) = 25/10 = 2.5 ohms.

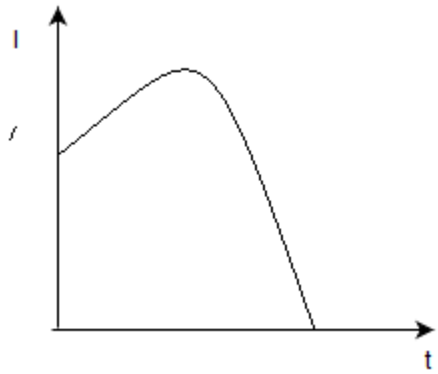
13. A synchronous motor is operated at a bus voltage of 1.5 pu and drawing 1.0 pu at zpf leading current. Its synchronous reactance is 0.4 pu. What is the excitation emf of the motor?
a) 2.0 pu
b) 1.5 pu
c) 1.0 pu
d) 1.1 pu

Answer: d
Explanation: E = V-I*X = 1-0.5=0.5 pu.

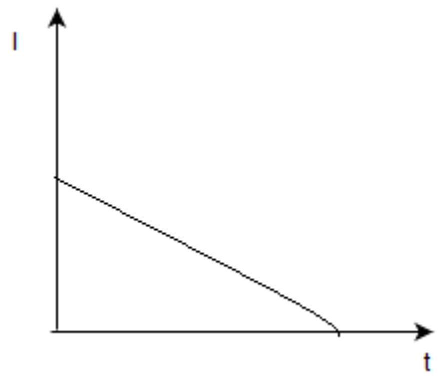
14. Consider a 3-phase alternator with negligible armature resistance and high rotational inertia delivering power to an isolated load when the armature terminals got short circuited. After sometime, the mechanical
power input to the shaft of the machine is terminated at time t0. The short-circuit current circulating in the armature will change till the machine comes to halt at ‘ts’. Which one of the curves depicts this phenomena?



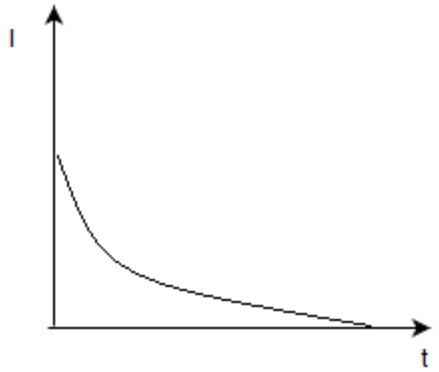
a)



b)



c)



d)

Answer: a
Explanation: The short circuit current will be a constant value till it flows.

15. A stationary alternator is connected to the infinite bus. It should not be connected because _____________
a) it will get short circuited
b) it will operate as induction motor
c) it will reduce bus bar voltage
d) all of the mentioned

Answer: a
Explanation: When a stationary synchronous machine is connected to the infinite bus, due to lack of synchronism there will be short circuit in the machine as the impedance reached very negligible.

16. Which of the options given will have no effect on the working of the synchronous motor if ignored?
a) It has comparable reactance
b) It requires dc excitation
c) It can not be started under no load
d) It has tendency to hunt

Answer: a
Explanation: The medium reactance is not any disadvantage to the synchronous machine.

17. When synchronous motor is running at synchronous speed, the damper winding produces?
a) no torque
b) eddy current torque
c) damping torque
d) torque aiding the developed torque

Answer: a
Explanation: As the relative speed will be zero in the damper winding and the torque too.

18. Slip test is performed to obtain _____________
a) direct axis reactance and quadrature axis reactance
b) slip
c) positive and negative sequence reactance
d) sub transient reactance

Answer: a
Explanation: Slip test is used to determine the direct axis and quadrature axis reactance.

This set of Electrical Machines Quiz focuses on “Phasor Diagram of a Cylindrical Rotor Alternator”.

1. The flux addition is due to ______________

```
(i) sinusoidal distribution of mmfs
(ii) zero relative velocity between two mmfs
(iii) spatial distribution of three phases by 120°
```

a) (i), (ii)
b) (i), (ii), (iii)
c) (iii)
d) (ii), (iii)

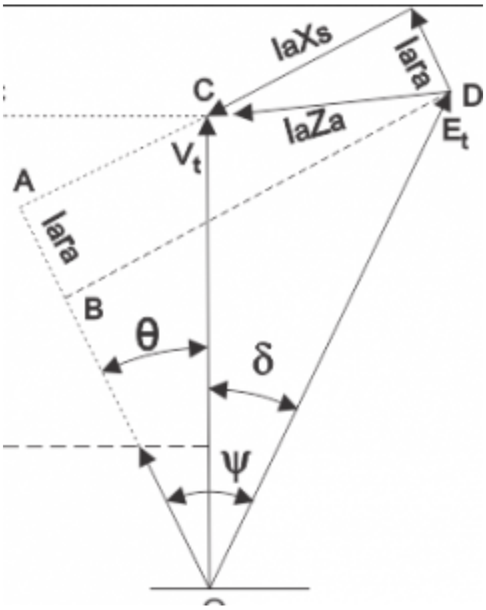
Answer: a
Explanation: Flux addition in ac machines is due to sinusoidal flux distribution and they must be stationary with respect to each other.

2. If the resultant flux will not be in phase with the resultant mmf Fr. This is due to __________
a) hysteresis effect
b) armature reaction
c) hysteresis effect and armature reaction
d) eddy currents

Answer: a
Explanation: Hysteresis effect causes the flux to be lagging in nature.

3. The internal power factor angle Ψ is between __________
a) Ef and Ia
b) Ia and field flux
c) Ef and Vt
d) Vt and Ia

Answer: a

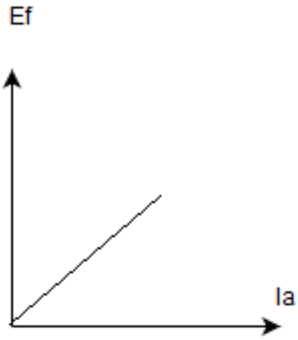


Explanation:

4. The load angle δ is between ___________
a) Ef and Ia
b) Ia and field flux
c) Ef and Vt
d) Vt and Ia

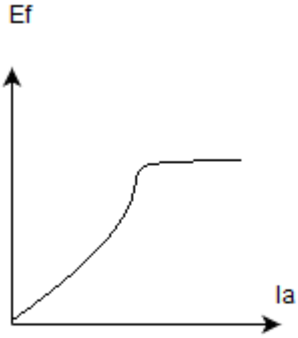
Answer: c
Explanation: It is the angle between excitation voltage and the terminal voltage.

5. If it is assumed that the iron part of magnetic circuit requires zero mmf, relation between Ef and If will be ___________

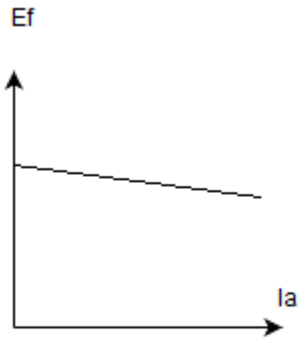


a)

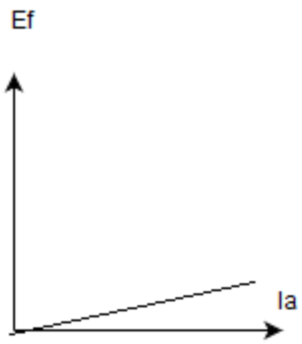
-



b)



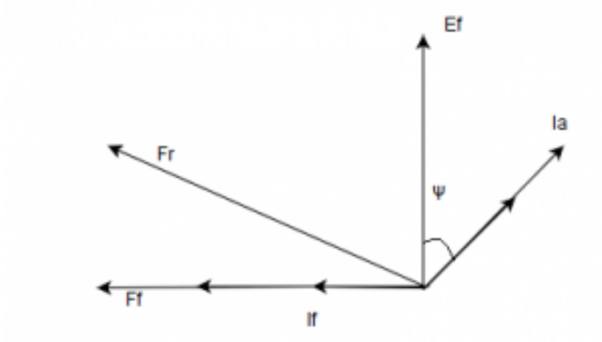
c)



d)

Answer: a
Explanation: There will be linear relation in Ef and Ia as mmf required is zero.

6. Phasor diagram below is best describing the ___________



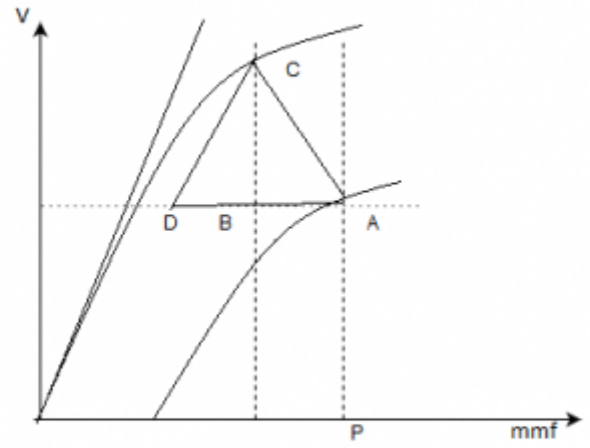
a) Open circuit characteristic of alternator
b) Short circuit characteristic of alternator
c) External circuit characteristic of alternator
d) Internal circuit characteristic of alternator

Answer: a
Explanation: Graph of Ef vs Ff is the open circuit characteristic of the machine.

7. The short circuit characteristic of alternator is a straight line due to ___________
a) no saturation
b) no armature reaction
c) no eddy current
d) all of the mentioned

Answer: a
Explanation: At the short circuit of the alternator is having the linear relation as the armature does not enter the saturation mode due to demagnetizing nature of armature reaction.

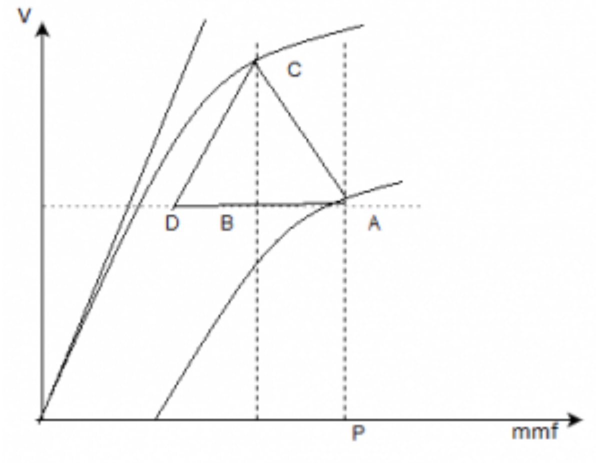
8. From the OCC and SCC curves, what does the intercept AB represent?



a) Armature reaction
b) Leakage reactance
c) Armature copper losses
d) Sum of armature reaction and leakage reactance

Answer: a
Explanation: It is armature reaction which is calculated based on Potier triangle.

9. From the OCC and SCC curves, what does the intercept BC represent?



a) Armature reaction
b) Leakage reactance
c) Armature copper losses
d) Sum of armature reaction and leakage reactance

Answer: b
Explanation: It is leakage reactance which is calculated based on potier triangle.

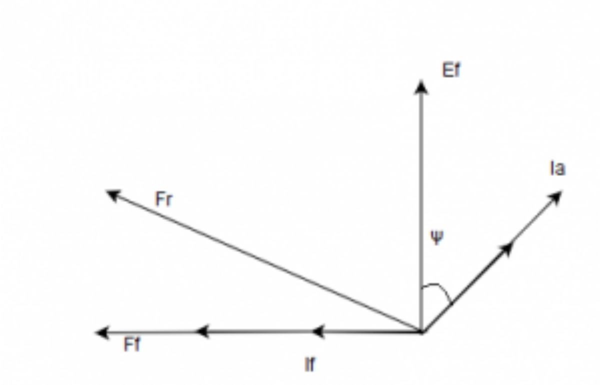
10. The leakage reactance can be determined with lesser accuracy by using Potier triangle.
a) True
b) False

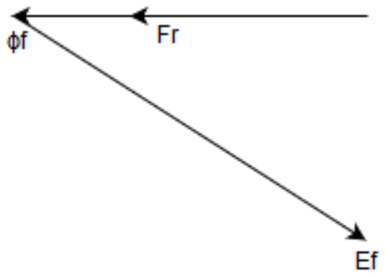
Answer: b
Explanation: The leakage reactance can be determined with better accuracy by using Potier triangle.

11. Potier method is very accurate due to ___________
a) emfs are handled as voltage and mmf as AT
b) emf and mmf are handled as AT
c) emf and mmf are handled as voltage
d) none of the mentioned

Answer: a
Explanation: The potier’s method is very accurate because emfs are handled as voltage and mmf as AT.

12. Choose the correct representation for the time phasor below.

a) 



b)

c)

d) all of the mentioned

Answer: d
Explanation: It is the angle between excitation voltage and the armature current.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Synchronous Machine Applications".

1. One of the most prominent component of base loads is ____________
a) synchronous generator
b) induction generator
c) dc series generator
d) all of the mentioned

Answer: a
Explanation: Synchronous machines are the main generating section of the power plants.

2. ______ alternator is used in thermal stations and ______ alternator is used in hydel plants.
a) Cylindrical-rotor, salient pole
b) Salinet pole, cylindrical-rotor
c) Salient pole, Reluctance
d) Cylindrical-rotor, cylindrical-rotor

Answer: a
Explanation: Due to salient poles, the machine will not run at very large speed and it becomes less rugged.

3. Synchronous compensators are mainly employed for ____________
a) compensating reactive power
b) compensating real power
c) improving power factor
d) compensating field flux

Answer: a
Explanation: Synchronous compensator is a source for the reactive power.

4. We prefer induction motor over synchronous motor due to ____________
a) no requirement of dc supply
b) starting problems
c) sensitive to environment
d) all of the mentioned

Answer: a
Explanation: All the listed factors are disadvantages for using a synchronous motor.

5. The condition which allows the torques to be taken care for choosing a synchronous motor is/are?
a) starting torque
b) pull-in torque
c) pull-out torque
d) all of the mentioned

Answer: d
Explanation: All the performance torques are needed to know before using any synchronous motor.

6. A synchronous machine with its field winding on stator and polyphase armature winding on rotor. At steady state, its air gap field is?
a) stationary w.r.t. stator
b) rotating at double the speed Ns w.r.t. rotor
c) rotating in direction opposite to rotor
d) all of the mentioned

Answer: d
Explanation: All are correct.

7. A synchronous machine with its field winding on rotor and polyphase armature winding on stator. At steady state running condition, its air gap field is?
a) stationary w.r.t. stator
b) rotating at double the Ns w.r.t. rotor
c) rotating at -Ns w.r.t. rotor
d) stationary w.r.t. rotor.

Answer: d
Explanation: As the field is on rotor itself, the sir gap will be stationary w.r.t. rotor.

8. Choose the appropriate synchronous generators used in the thermal power stations.

```
(i) cylindrical rotor
(ii)slip rings and brushes
(iii)laminated rotor
(iv)stator slots in the multiple of 6
(v)salient rotor
```

a) (i), (ii), (iv)
b) (ii), (iii), (v)
c) (i), (iii)
d) (ii), (iii), (iv), (v)

Answer: a
Explanation: Thermal plants use cylindrical rotor synchronous machines.

9. The practical speed ranges for the thermal, nuclear and hydel power plants is (in rpm)?
a) 3000, 3000, 300
b) 3000, 300, 300
c) 1500, 1500, 3000
d) 1000, 500, 3000

Answer: a
Explanation: Thermal and nuclear power plants have high speed requirements and hydel power plants have salient pole generators so the speed is also less.

10. Synchronous motor has been preferred for driving the loads requiring high power at low speeds.
a) True
b) False

Answer: a
Explanation: Synchronous motor acts a capacitor when operated at leading p.f. with no load.

11. The zero power characteristics used in the Potier plot can be obtained by loading the alternator using ____________
a) synchronous motor
b) lamp load
c) dc motor
d) induction motor

Answer: a
Explanation: To obtain mmf and emf drops the loading is done as a synchronous motor.

12. Below are the statements about cylindrical rotor alternator.

```
A. E.m.f. generated by armature reaction lags armature current by 90°.
B. Air gap voltage leads the field flux by 90°.
```

a) Only A is true
b) Only B is true
c) A is true, B is false
d) A and B both are true

Answer: d
Explanation: Both the statements are right.

13. Out of the given statements about the cylindrical rotor alternator, mark the correct.

```
A. Air gap voltage lags the field flux by 90°
B. Armature reaction mmf lags the field flux by (90°+ internal p.f. angle).
```

a) A is false, B is true
b) Only A is true
c) Only B is true
d) Both A and B are true

Answer: a
Explanation: Air gap voltage will lead the field flux by 90° in a cylindrical-rotor alternator.

14. The power factor of an alternator under short circuit condition will be almost near _____________
a) zero lagging
b) zero leading
c) unity
d) depends on the type of the alternator

Answer: a
Explanation: During short circuit condition, the magnetizing current flows to provide the core losses compensation. So the pf is slightly zpf lagging.

15. In a 3-phase cylindrical rotor alternator the __________
a) field mmf leads air gap flux, air gap flux leads armature flux
b) field mmf leads air gap flux, air gap flux lags armature flux
c) armature mmf leads air gap flux and air gap flux leads field flux
d) armature mmf leads air gap flux and air gap flux lags field flux

Answer: a
Explanation: Check the phasor diagram.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Voltage Regulation of an Alternator".

1. When the load on an alternator is varied, its terminal voltage also changes due to ______________
a) armature resistance
b) leakage reactance
c) armature reaction
d) all of the mentioned

Answer: a
Explanation: Armature reactance, leakage reactance and armature reaction cause the terminal voltage to differ from the excitation voltage.

2. Voltage regulation for the alternator operating at leading power factor is negative.
a) True
b) False

Answer: a
Explanation: Voltage regulation for an alternator operating at leading power factor is negative due to magnetizing nature of armature reaction.

3. Voltage regulation for an alternator operating at leading power factor is negative due to ____________
a) magnetizing nature of armature reaction
b) demagnetizing nature of armature reaction
c) cross-magnetizing nature of armature reaction
d) all of the mentioned

Answer: a
Explanation: Field flux gets aided by the armature reaction leading to higher Vt.

4. Alternator on infinite bus bar has constant ____________
a) terminal voltage and frequency
b) frequency
c) power factor
d) power factor and terminal voltage

Answer: a
Explanation: Infinite bus bar has constant voltage and frequency.

5. The emf method of the voltage regulation is applicable only to cylindrical rotor alternator due to ____________
a) resultant air gap flux is not affected by angular position of rotor
b) uniform angular position of rotor
c) non uniform angular position of rotor
d) saliency of the poles is a trouble while estimating the emf

Answer: a
Explanation: It is so because resultant air gap is unaffected by rotor position.

6. Emf method is also known as ____________
a) pessimistic method
b) optimistic method
c) zero power factor method
d) none of the mentioned

Answer: a
Explanation: Unsaturated impedance is greater than saturated impedance, so the drop accounted will be less than the actual making the voltage regulation more than actual.

7. In mmf method ____________
a) all the emf is scaled to mmf
b) only the mmf values are considered neglecting impedance drop
c) all the emf are taken zero
d) emf is converted to saturated impedance drops

Answer: a
Explanation: In mmf method all the emf is scaled to mmf

8. Mmf method of voltage regulation is called ________ while the emf method is ___________
a) optimistic, pessimistic
b) pessimistic, pessimistic
c) optimistic, optimistic
d) pessimistic, optimistic

Answer: a
Explanation: In the mmf method the calculated value is lesser than the actual value so it is less misleading than emf method which predicts a greater value.

9. The preferred order of calculating the voltage regulation is ____________
a) ZPF > ASA > MMF > EMF
b) ZPF > MMF > ASA > EMF
c) ASA > MMF > ASA > EMF
d) EMF > ASA > ZPF > MMF

Answer: a
Explanation: Emf method is least preferred over the other methods and zpf method gives the accurate results as it does not alter the values.

10. In a calculation, the actual voltage regulation is 33.1% while the calculated value of the voltage regulation is 56.8%. This infers that the chosen method has been ____________
a) emf
b) mmf
c) asa
d) zpf

Answer: a
Explanation: As the given value is more than actual, so it must be emf method.

11. In a calculation, the actual voltage regulation is 33.1% while the calculated value of the voltage regulation is 25%. This infers that the chosen method has been ____________
a) emf
b) mmf
c) asa
d) zpf

Answer: b
Explanation: As the given value is less than actual, so it must be mmf method.

12. In a calculation, the actual voltage regulation is 33.1% while the calculated value of the voltage regulation is 32.9%. This infers that the chosen method has been ____________
a) zpf or asa
b) emf
c) mmf
d) mmf or zpf

Answer: a
Explanation: As the given value is very close to actual, so it must be zpf or asa method of regulation.

13. If the emf from the air gap line is the 3-phase alternator is 440V per phase and armature current is 110 A. The synchronous reactance is?
a) 4 ohms
b) 2 ohms
c) 6.92 ohms
d) 2.32 ohms

Answer: a
Explanation: Z = V/I = 440/110 = 4 ohms.

14. If the machine size increases, the three phase alternator resistance ________ and synchronous reactance ________
a) increases, decreases
b) decreases, increases
c) remains constant, decreases
d) decreases, decreases

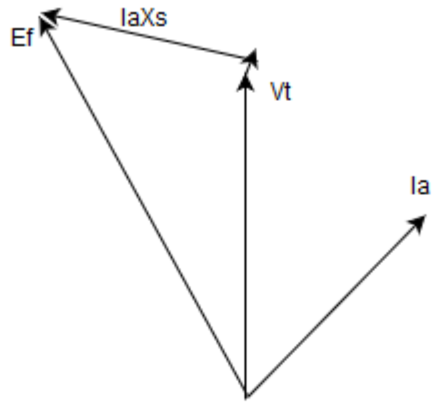
Answer: a
Explanation: If the machine size increases, the copper amount will increase but the air gap will also increase having more reluctance so the reactance will reduce.

15. Ideally the voltage regulation of an alternator should be ____________
a) zero
b) infinite
c) 50%
d) 100%

Answer: a
Explanation: Ideally the terminal voltage and the excitation voltage should be same.
So V.R. = E-V/V = 0%.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Synchronous Motor Phasor Diagram”.

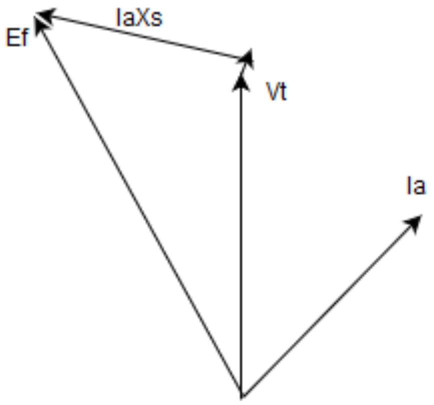
1. Below is the phasor diagram of synchronous generator.



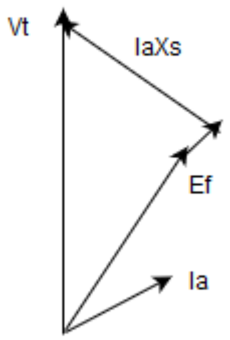
If the machine is made to run as synchronous motor, what will be the phasor diagram changes then?
a) Reverse Ia
b) Reverse Ef
c) Reverse Vt and Ia
d) Reverse Vt

Answer: a
Explanation: Only the direction of the armature current changes in the motor as it absorbs the electrical energy.

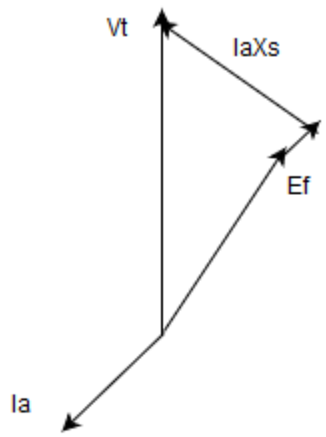
2. Below is the phasor diagram of synchronous generator.



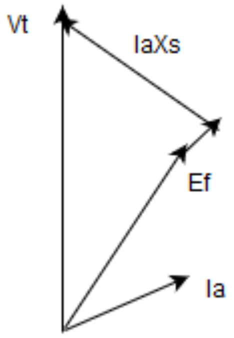
If the machine is made to run as synchronous motor, what will be the new phasor diagram?



a)

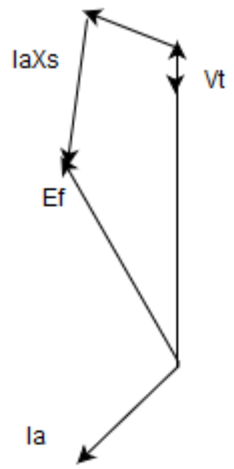


b)



c)

d)



Answer: a
Explanation: Only the direction of the armature current changes in the motor as it absorbs the electrical energy. It has a component in phase opposite to Ef.

3. The voltage equation of synchronous motor is?
a) Ef = Vt + Ia*(ra+jXa)
b) Ef = Vt – Ia*(ra+jXa)

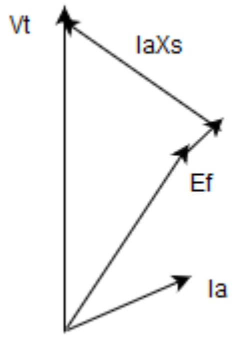
c) Ef = Vt + Ia*(ra-jXa)
d) Ef = Vt – Ia*(ra-jXa)

Answer: a
Explanation: The voltage equation of synchronous motor is Ef = Vt + Ia*(ra+jXa).

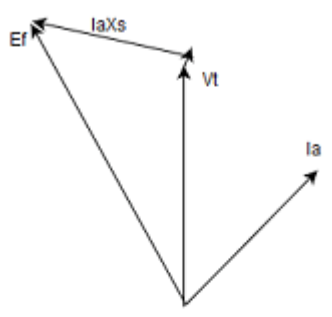
4. Synchronous motor delivers lagging power at ___________
a) leading pf
b) lagging pf
c) zero pf
d) unity pf

Answer: a
Explanation: As Q < 0 for synchronous motor at leading pf.

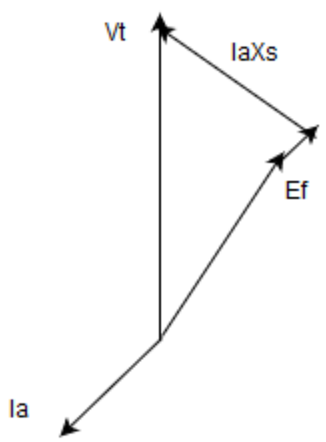
5. A 420 V synchronous motor is working at 30° lagging load. What can be the expected phasor?



a)



b)

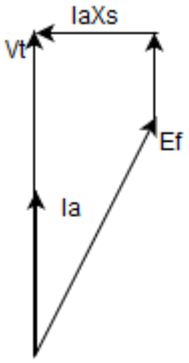


c)

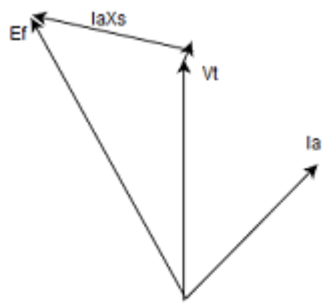
d) None of the mentioned

Answer: a
Explanation: The Ia should lag Ef by 30°.

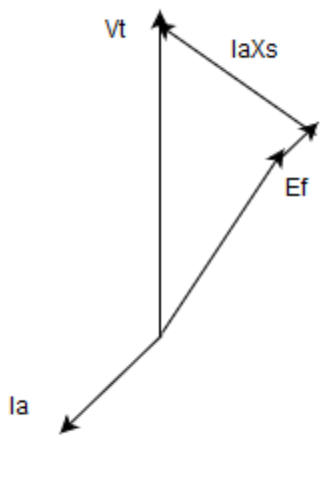
6. The synchronous motor is operating at upf load. The most suitable phasor will be?



a)

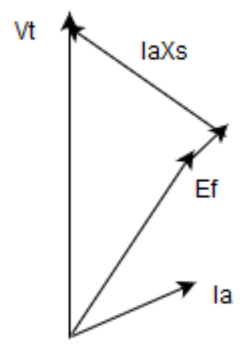


b)



c)

d)

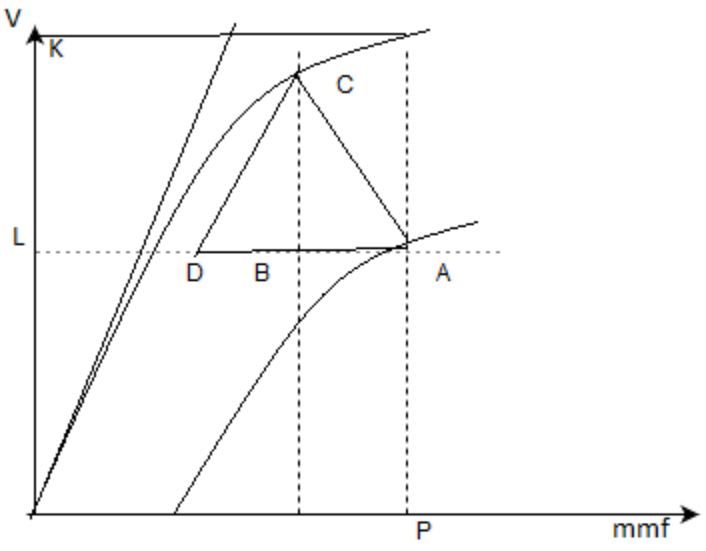


Answer: a
Explanation: Ia must be in phase with the Ef.

7. The zero power factor of an alternator can be obtained by __________ at rated Ia.
a) over exciting
b) conducting short circuit of secondary terminals
c) under excitation
d) running as reluctance motor

Answer: a
Explanation: By over exciting an alternator gives the additional flux required to make it operate at zero power factor.

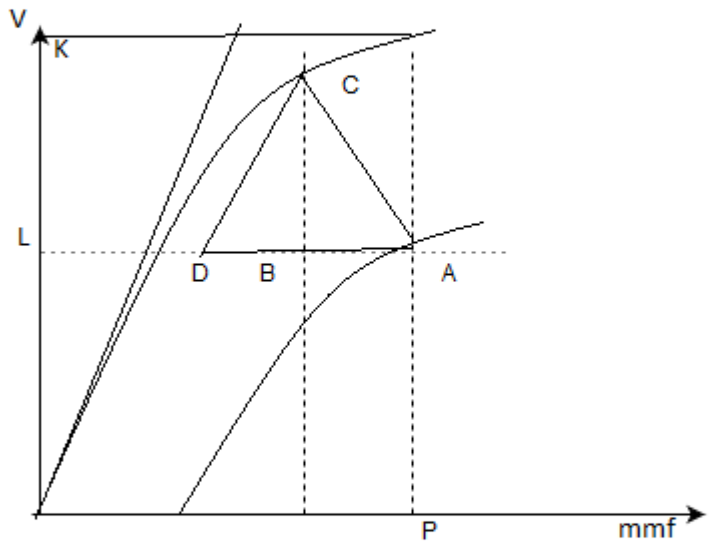
8. From the figure shown below for the OCC and SCC of a three phase alternator, the point ‘L’ corresponds to ________ and the point ‘A’ can be obtained by ______ the alternator.



a) terminal voltage, over exciting
b) excitation voltage, over exciting
c) terminal voltage, under exciting
d) excitation voltage, under exciting

Answer: a
Explanation: The point 'L' corresponds to Vt and the point 'A' can be obtained by over exciting the alternator.

9. In the figure below, the point ‘F’ corresponds to _______ which can be obtained by ________



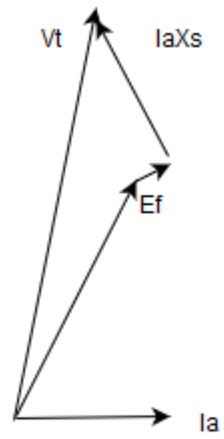
a) field current required to circulate short circuit current, SCC
b) field current required to circulate full load current, SCC
c) mmf required to cancel the hysteresis losses, SCC
d) mmf required to compensate the leakage reactances, SCC

Answer: a
Explanation: Point ‘F’ corresponds to the short circuit current and it is obtained by SCC plot.

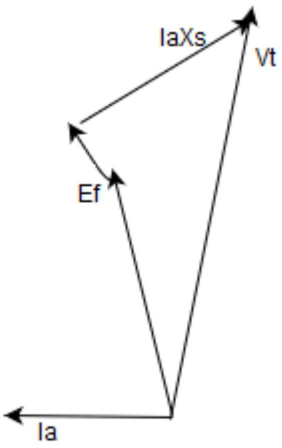
10. The operating point for an over excited alternator working near zpf lagging power factor gives 'A' as the operating point. Then if the same machine is working as an over excited synchronous motor will give same operating point at ___________
a) zpf leading
b) zpf lagging
c) upf
d) there will never be the same operating point for the machine as motor as well as generator

Answer: a
Explanation: Yes, by making it from lag to leading power factor, a synchronous machine can have same operating point for the alternator as well as synchronous motor.

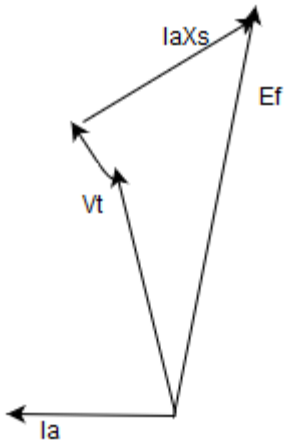
11. Identify the over excited alternator operating at zpf.



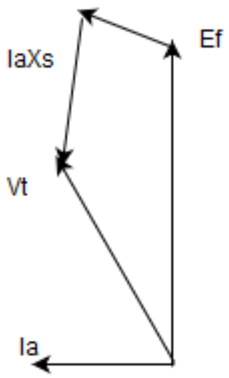
a)



b)



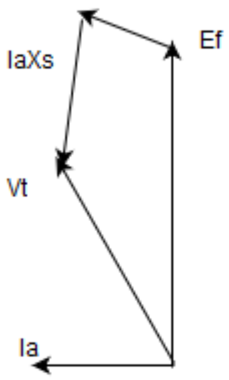
c)



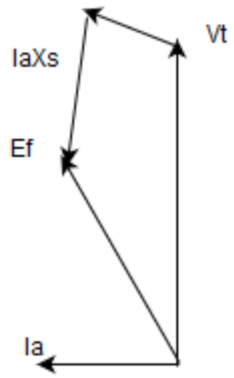
d)

Answer: a
Explanation: Ef>Vt, makes it work as over excited.

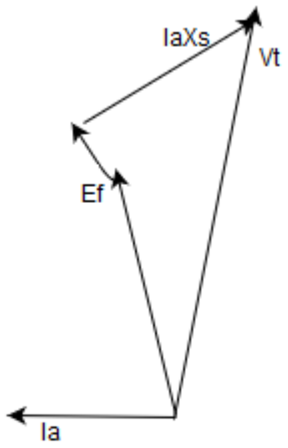
12. Identify the over excited synchronous motor operating at zpf.



a)



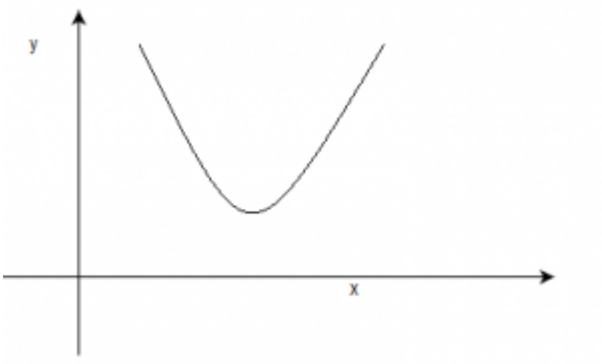
b)

c) 

d)None of the mentioned

Answer: a
Explanation: Ef>Vt, and the Ia is in opposite to that of alternator.

13. For the below graph depicting the performance of a synchronous motor, coordinates ‘x’ and ‘y’ are respectively?
In the ‘V’ curve shown in the above figure for a synchronous motor, the parameter of x and y coordinates are, respectively.



a) Armature current and field current
b) Power factor and field current
c) Armature current and torque
d) Torque and field current

Answer: a
Explanation: V curve is between the armature current and the field current.

14. We can increase the torque of a reluctance synchronous motor if we ___________
a) Increase reluctance of the magnetic circuit along the direct axis
b) Decrease the reluctance of the magnetic circuit along the quadrature axis
c) Increase the ratio of the quadrature axis reluctance to direct axis reluctance
d) Decrease the ratio of quadrature axis reluctance to direct axis reluctance

Answer: c
Explanation: Te = -1/2(φ^2)(Rlq-Rld) sin2δ.

15. Switched reluctance motors are basically ___________
a) salient pole synchronous motor but without excitation winding

b) stepper motor with salient poles
c) synchronous motor with salient poles on stator and rotor
d) stepper motor with closed loop control and with rotor position sensor

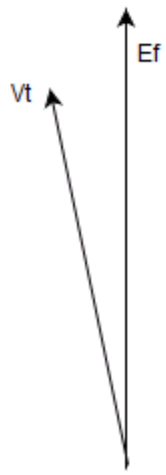
Answer: d
Explanation: A switched reluctance motor has stepper motor.

This set of Electrical Machines Question Bank focuses on “Operating Characteristics of Alternators and their Ratings”.

1. A 315V, 3-phase 400 MVA alternator is running at no load at constant excitations. The most appropriate representation in space domain is?

a) 

b)

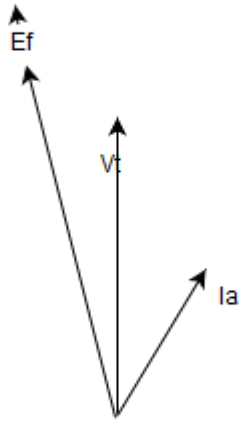


c)

d)

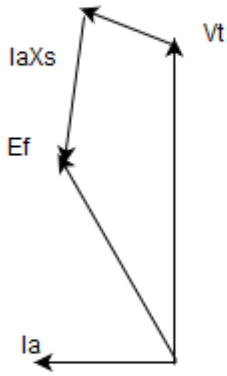
Answer: a
Explanation: At no load Ia = 0. So Ef = Vt.

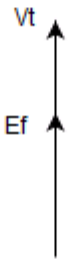
2. A 315V, 3-phase 400 MVA alternator is running at lagging power factor at constant excitations. The most appropriate representation in space domain is?



a)

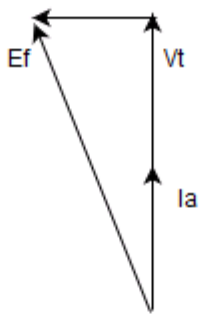
b)





c)

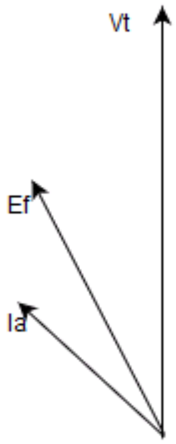
d)



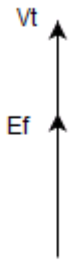
Answer: a
Explanation: Ia should lag Ef.

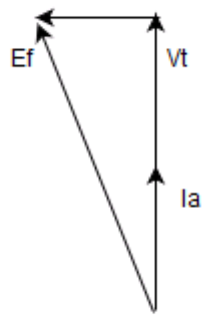
3. A 315V, 3-phase 400 MVA alternator is running at leading power factor load at constant excitations. The most appropriate representation in space domain is?

a)

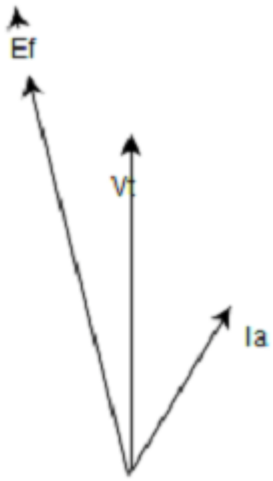


b)



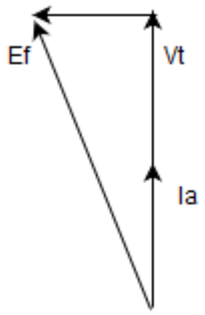


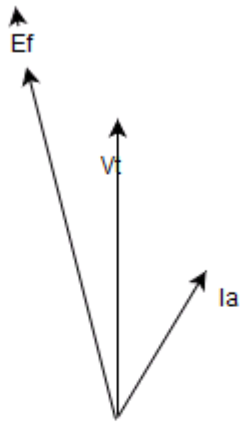
c)

d) 

Answer: a
Explanation: Ia will lead the excitation.

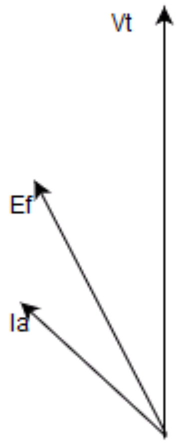
4. A 315V, 3-phase 400 MVA alternator is running at unity power factor at constant excitations. The most appropriate representation in space domain is?

a) 

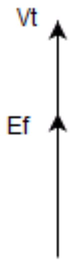


b)

c)

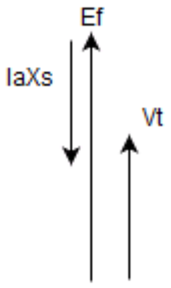


d)

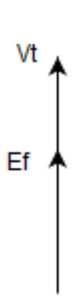


Answer: a
Explanation: Ia in phase with excitation voltage.

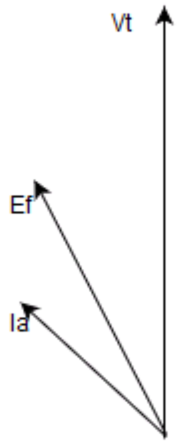
5. A 315V, 3-phase 400 MVA alternator is running at zero power factor lagging at constant excitations. The most appropriate representation in space domain is?

a) 

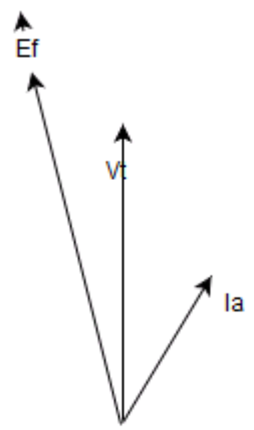
b)



c)

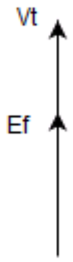


d)

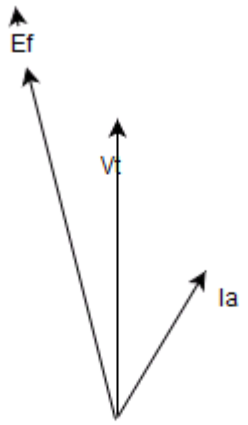


Answer: a
Explanation: I_a has to be lagging by 90°.

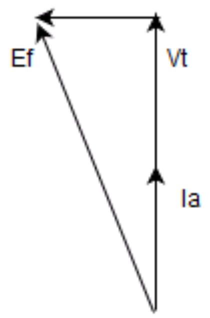
6. A 315V, 3-phase 400 MVA alternator is running at zero power factor leading at constant excitations. The most appropriate representaion in space domian is?



a)

b) 

c)

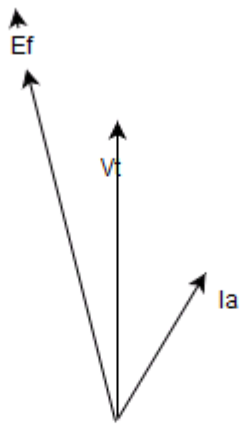


d) none of the mentioned

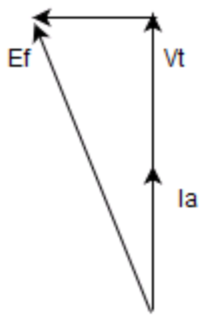
Answer: a
Explanation: Ia has to be leading by 90°.

7. With the alternator running at rated terminal voltage Vt, at rated current Ia = 1 per unit. What happens if load current is reduced to zero, if it was operating at lagging power factor?

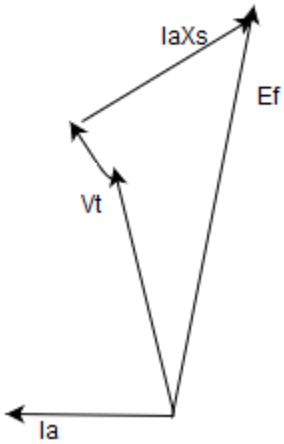
a)

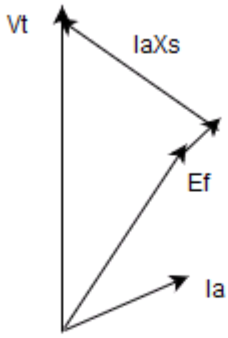


b)



c)

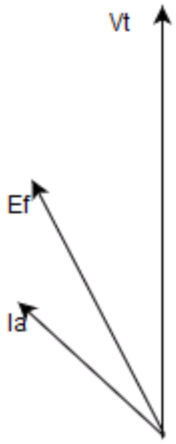


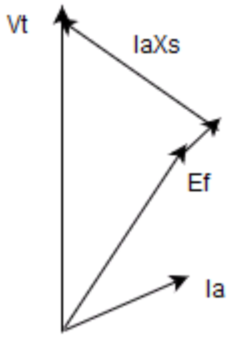
d) 

Answer: a
Explanation: Check for the Ia lagging Ef and Ef > Vt.

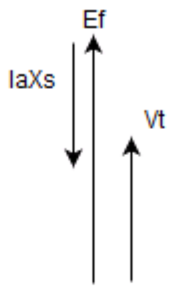
8. With the alternator running at rated terminal voltage Vt, at rated current Ia = 1 per unit. What happens if load current is reduced to zero, if it was operating at leading power factor?

a)

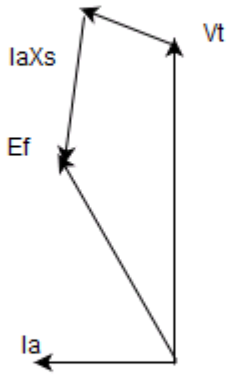


b) 

c)



d)

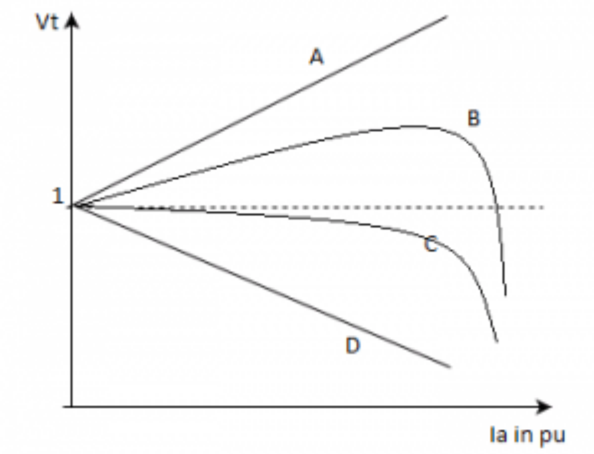


Answer: a
Explanation: Check for the Ia leading Ef and Ef < Vt.

9. If the machine was operating at upf, then the new excitation voltage will be __________
a) greater than 1 pu
b) less than 1 pu
c) 1 pu
d) zero

Answer: a
Explanation: The new excitation will be more than 1 pu to compensate for the flux required.

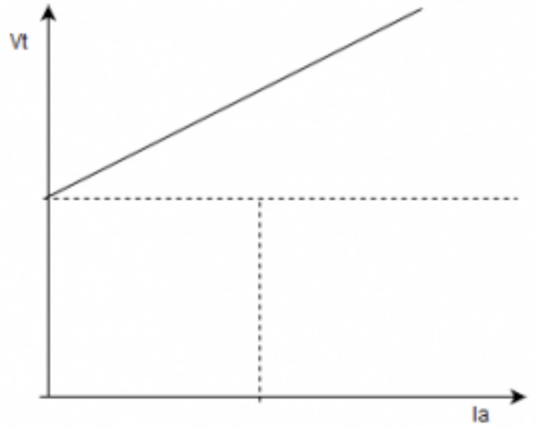
10. The variation of Vt vs Ia is for the alternator is given below.

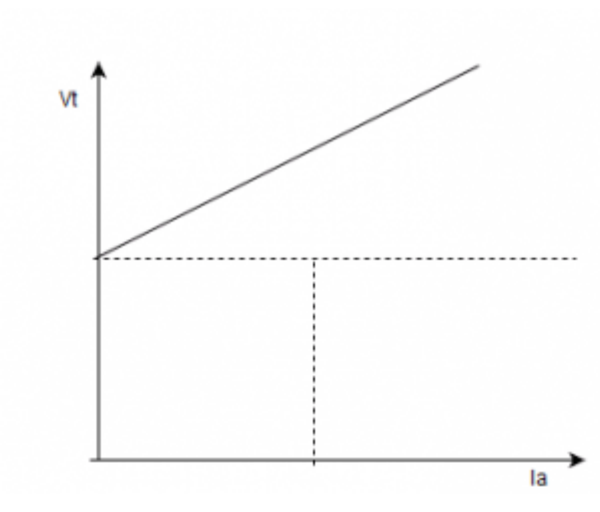


Choose the appropriate
a) A-zpf lead; B-0.8 lead; C-0.8 lag; D-zpf lag
b) A-zpf lag; B-0.8 lead; C-0.8 lag; D-zpf lead
c) A-zpf lead; B-0.8 lag; C-0.8 lead; D-zpf lag
d) A-zpf lead; B-0.8 lag; C-0.8 lead; D-zpf lag

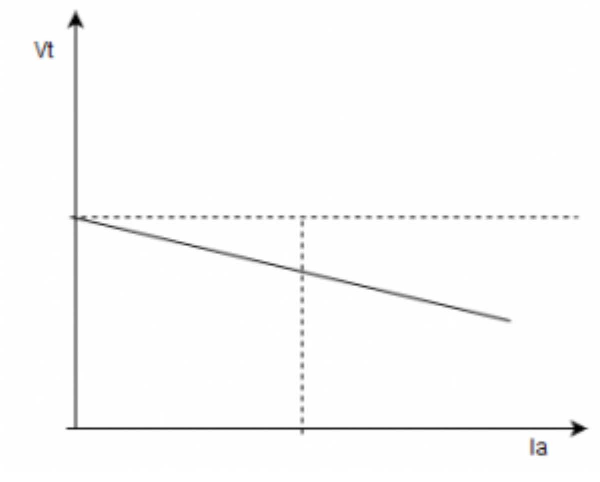
Answer: a
Explanation: A is zpf lead for the alternator and D will be zpf lag.

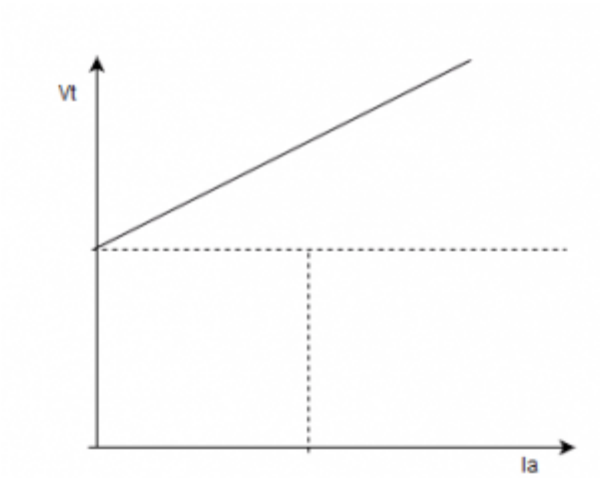
11. Mark the plot for terminal voltage vs armature current for the alternator.

a) 

b) 

c)



d) 

Answer: a
Explanation: After the maximum excitation the alternator will have a fall out if the excitation is increased beyond synchronous speed.

12. Alternator compounding characteristic is obtained by __________
a) keeping Vt constant
b) keeping Ef constant
c) keeping Ia constant
d) varying Vt

Answer: a
Explanation: Alternator compounding characteristic is obtained by keeping Vt constant.

13. At zpf lag, the excitation should be increased in order to maintain the armature terminal voltage constant.
a) True
b) False

Answer: a
Explanation: Due to demagnetizing armature reaction at zpf lag in an alternator.

14. The rating of the alternator is decided by __________
a) losses
b) voltage
c) armature current
d) temperature

Answer: a
Explanation: The losses determine the rating to be used for alternator.

15. The core losses in synchronous machine is ________ dependent.
a) voltage
b) current
c) temperature
d) insulation

Answer: a
Explanation: Core losses depend on the voltage applied to the machine.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Power Factor Correction by Synchronous Motors".

1. The magnetization current drawn from an AC supply a synchronous motor is used to __________
a) set up flux in magnetic circuit of device
b) compensate core losses
c) set up magnetizing armature reaction
d) all of the mentioned

Answer: a
Explanation: Magnetizing current sets up the flux needed in the machine.

2. A 3 phase synchronous motor is working at normal excitation, then the flux deficient in circuit is _________
a) given by armature winding mmf
b) given by field winding mmf
c) supplied to armature winding mmf
d) supplied to field winding mmf

Answer: a
Explanation: it is given by armature winding mmf.

3. The excess flux in synchronous motor is neutralized by _________
a) armature winding by drawing demagnetizing component of the current from ac supply
b) armature winding by drawing magnetizing component of the current from ac supply
c) field winding by drawing demagnetizing component of the current from dc supply
d) field winding by drawing magnetizing component of the current from dc supply

Answer: a
Explanation: Excess flux is neutralized y the demagnetizing component.

4. The V-curves of synchronous motor is plotted between _________
a) Ia Vs If with constant shaft load
b) If Vs Ia with constant shaft load
c) power factor vs If
d) power factor vs Ia

Answer: a
Explanation: The V-curves of synchronous motor is plotted between Ia Vs If with constant shaft load.

5. When a constant power output is desired to maintain _________
a) Ef*sinδ and Ia*cosθ are to be maintained constant
b) Ef*sinδ is be maintained constant
c) Ia*cosθ is to be maintained constant
d) Ef*sinδ and Ia*sinθ are to be maintained constant

Answer: a
Explanation: For constant real power output the component of the excitation voltage lagging to Vt should remain constant as per the phasor diagram.

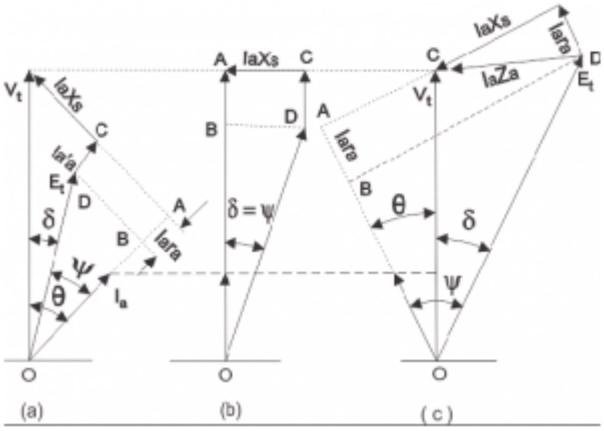
6. When the excitation voltage is increased from 1 to 1.3 pu of a 3-phase synchronous motor. Then load angle for the constant power operation _________
a) must be decreased
b) can also be increased
c) increased

d) decreased

Answer: a
Explanation: ‘Ef*sinδ’ is to be maintained constant. so if excitation voltage increases then the load angle must decrease.

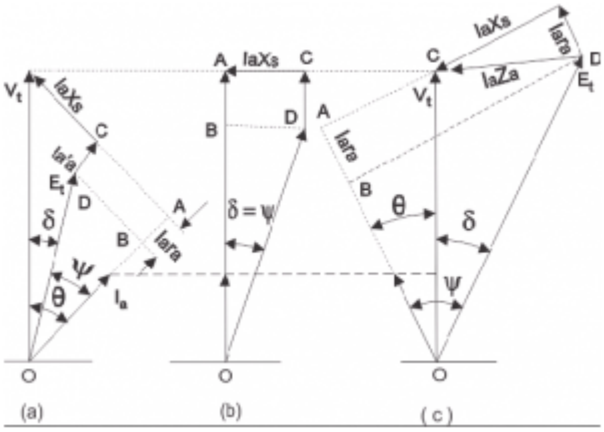
7. The armature current is _________ at UPF when compared to leading power factor.
a) minimum
b) maximum
c) equal
d) none of the mentioned

Answer: a

Explanation: 

8. The armature current is ________ at UPF than motor at lagging power factor.
a) minimum
b) maximum
c) zero
d) none of the mentioned

Answer: a

Explanation: 

9. The inverted V plots is plotted between ________
a) power factor vs field current for constant shaft load
b) field current vs power factor for variable shaft load
c) armature current vs field current
d) terminal voltage vs power factor

Answer: a
Explanation: Inverted v-curves are plotted between power factor and field current for constant shaft load.

10. For a power system having induction motor loads, an overexcited synchronous motor is also attached. Then the over all power factor?
a) improves
b) degrades
c) becomes upf
d) remains same

Answer: a
Explanation: An over excited synchronous motor acts as a source of lagging reactive power and so the overall power factor improves.

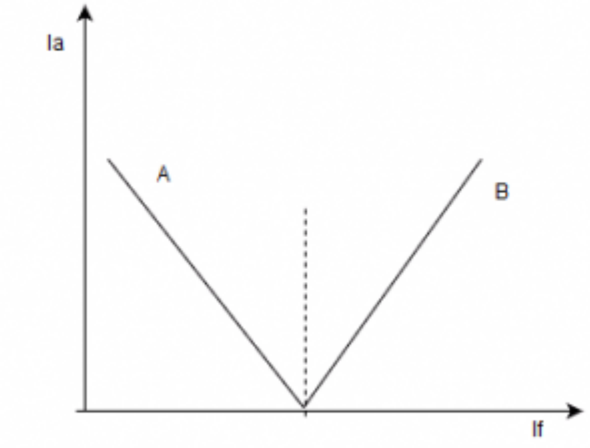
11. For a power system having induction motor loads, an overexcited synchronous motor is also attached. The induction motor will now operate at _________
a) lagging
b) leading
c) reduced power factor
d) increased power factor

Answer: a
Explanation: Adding synchronous motor will improve the pf of the system but then the induction motor will still work at lagging pf only.

12. Synchronous compensators are _________
a) over excited synchronous motor with no mechanical load
b) over excited synchronous motor with mechanical load
c) under excited synchronous motor with no mechanical load
d) normally excited synchronous motor with no mechanical load

Answer: a
Explanation: Synchronous compensators are synchronous motor with no mechanical load which are overexcited.

13. For a synchronous motor, mark the appropriate.



a) A-Inductor, B-Capacitor
b) A-Capacitor, B-Resistor
c) A-Inductor, B-Inductor
d) A-Capacitor, b-Inductor

Answer: a
Explanation: A will act as the inductor curve consuming the reactive power while the B curve is like capacitor.

14. (I) Speed of an isolated alternator can be altered.
(II) Speed of an alternator connected to IBB can be also altered.
a) I is true, II is false
b) Both the statements are true
c) I is false while II is true
d) Both are false

Answer: a
Explanation: Speed of the alternator connected to the infinite bus bas can not be changes as it has to be of fixed frequency.

15. (I)For constant power of an isolated alternator, V-curves can be obtained.
(II)For constant power of an alternator connected to IBB, V-curves can be obtained.
a) I is true, II is false
b) Both the statements are true
c) I is false while II is true
d) Both are false

Answer: c
Explanation: For an isolated alternator working at constant power, we can not alter the armature current to have a v-curve while the is possible for the machine connected to infinite bus bar.

16. The operating frequency and voltage of an isolated alternator _________ if the prime mover input to motor is increased.
a) increases
b) decreases
c) remains constant
d) no relation exists between the power and frequency

Answer: a
Explanation: By varying the prime mover torque, the load angle as well as the operating frequency also get affected.

17. The active power delivered by an alternator will ________ when the prime mover input is increased for the alternator connected to infinite bus bar.
a) increases
b) decreases
c) remains constant
d) no relation exists between the power and prime mover droop characteristic

Answer: a
Explanation: The load angle will increase and so the real power will increase in case the prime mover input is increased.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Starting of Synchronous Motors".

1. Synchronous motors are ____________
a) not self starting
b) self starting
c) single excited
d) none of the mentioned

Answer: a
Explanation: The average torque developed in the synchronous motor is zero.

2. Which method is/are used to perform magnetic locking?

```
I. Auxiliary motor
II. Dc motor
III. induction motor
```

a) I, II, III
b) II, III
c) II, I
d) II

Answer: a
Explanation: A sub motor is needed to make the synchronous machine run till the speed of synchronous speed and to achieve that we need additional motor.

3. Auxiliary method of starting is not possib1e due to the fact that _____________
a) it can not be started under load
b) it can be only started under load
c) it is less efficient
d) all of the mentioned

Answer: a
Explanation: Auxiliary motors usually reduces the performance indices of the synchronous machine when started under load.

4. Rating of the dc motor to be used in the starting of SM, should be higher than the synchronous motor.
a) True
b) False

Answer: b
Explanation: No, the dc motor used as pony motor is of lower rating than the synchronous motor it starts.

5. A synchronous machine with its field winding on stator and polyphase armature winding on rotor. At steady state, which of the following is not true for its air gap field?
a) stationary w.r.t. stator
b) rotating at double the speed Ns w.r.t. rotor
c) rotating in direction opposite to rotor
d) rotating at Ns w.r.t. rotor

Answer: d
Explanation: The air gap will not be at synchronous speed w.r.t. rotor.

6. A synchronous machine with its field winding on rotor and polyphase armature winding on stator. At steady state running condition, its air gap field is?

```
I. stationary w.r.t. stator
II. rotating at double the Ns w.r.t. rotor
III. rotating at -Ns w.r.t. rotor
IV. stationary w.r.t. rotor.
```

a) IV
b) I, II, IV
c) II, IV
d) I

Answer: a
Explanation: The excitation is given on rotor so the air gap field will be stationary w.r.t. rotor.

7. Consider a 3-phase cylindrical-rotor alternator.

```
A. E.m.f. generated by armature reaction lags armature current by 90°.
B. Air gap voltage leads the field flux by 90°
C. Air gap voltage lags the field flux by 90°
D. Armature reaction due to intermediate lagging p.f is partly cross magnetizing & partly
```

a) A, B
b) A, C, D
c) B, D
d) A, B, D

Answer: a
Explanation: Having cross magnetizing armature reaction in the machine means partial magnetization and demagnetization, adding another clause is useless.

8. These days alternators are designed to have larger air gaps for ___________
a) stable parallel operation
b) higher stability limit
c) sinusoidal mmf distribution
d) all of the mentioned

Answer: a
Explanation: Large air gap ensures more SCR value and better preformances.

9. Consider the following statements and mark appropriately.

```
 I. In a cylindrical-rotor synchronous machine, armature flux is in phase with armature c
 II. In salient pole machine, armature flux lags the armature current.
```

a) I is true
b) II is true
c) I and II are true
d) None of them are true

Answer: c
Explanation: In CRSM, there is no saliency and the armature flux follows armature current in phase.

10. In a 3-phase cylindrical-rotor alternator, synchronous reactance is sum of mutual and leakage reactance.
a) True
b) False

Answer: b
Explanation: Xs = magnetizing reactance + leakage reactance.

11. A 3-phase, 400V, synchronous motor is providing load at 0.8 p.f. lagging. If the field current of the motor is continuously increased, then the _______________
a) power factor increases and then decreases
b) power factor is not affected
c) power factor decreases upto a certain value of field current and then increases
d) power facor increases simply

Answer: a
Explanation: The magnetization current is increased as we increase the excitation, so the power factor will increase upto the saturation and then again it will decrease.

12. A synchronous machine is operating at constant load and at unity power factor. If its excitation is increased and then it operates as ____________
a) motor at leading p.f
b) motor at lagging p.f
c) absorber of reactive power
d) generator at leading p.f

Answer: a
Explanation: It will operate at leading p.f. if it was in motoring mode.

13. A synchronous machine is operating at constant load and at unity power factor. If its excitation is increased, then it operates as ____________
a) generator at lagging p.f
b) motor at lagging p.f
c) absorber of reactive power
d) generator at leading p.f

Answer: a
Explanation: It will operate at lagging p.f. if it was working as generator.

14. The reactive power output of a synchronous generator is limited by ____________
a) armature current and field current
b) field current and load angle
c) load angle and prime mover input
d) armature current and prime mover input

Answer: a
Explanation: Q=f(Ia,If).

15. Power factor of a synchronous motor varies when the ____________
a) applied voltage is varied
b) load is changed
c) supply frequency and field excitation is changed
d) all of the mentioned

Answer: a
Explanation: p.f. = f(V,E,f,Field current).

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Power Flow Through an Inductive Impedance – I”.

1. Which is the correct relation below?
a) Pim = -Pog

b) Pim = (Pog)*
c) Pim = Pog
d) Pim = -(Pog)*

Answer: a
Explanation: Electrical input to the motor is equal output power of the generator but in opposite direction.

2. The condition for maximum power output for an alternator having its load impedance as (2+j) ohms is?
a) 26.56°
b) 63.43°
c) 90°
d) 116.56°

Answer: a
Explanation: Maximum power output is arctan(1/2)= 26.56°.

3. For an alternator, the specified load angle should be __________ for an impedance angle of 'θ'.

a) δ=θ
b) δ=90-θ
c) δ=90+θ
d) δ=-θ

Answer: a
Explanation: dP/dδ = EVcos(δ+α) = 0
δ = 90-α=θ.

4. For a 3 phase synchronous motor, the load angle should be equal to impedance angle.
a) True
b) False

Answer: a
Explanation: dP/dδ = EVcos(δ+α)/Z = 0
δ = 90-α=θ.

5. With constant E,V,Z, the maximum input power can be obtained at load angle of value ________

a) 180-θ
b) 90+θ
c) θ
d) 180

Answer: a
Explanation: dPi/dδ = EVcos(δ-α) = 0
δ = 90+α = 2α+θ=180-θ.

6. for a 3 phase 315V alternator having impedance angle of 60 degree, the required load angle for the maximum power input to the generator is ________
a) 120°
b) 60°
c) 150°
d) 30°

Answer: a
Explanation: δ = 90+α = 2α+θ=180-θ
So δ = 180-60=120°.

7. For a 3 phase synchronous generator of terminal voltage as 1 pu and field excitation of 1.2 pu. If the resistive drop is 0.2 pv, then what can be concluded for power factor?
a) upf
b) zpf
c) lagging pf
d) leading pf

Answer: a
Explanation: The Value for Ef-Ia*ra = Vt; Here it is Vt = 0. So it is upf.

8. For a 3 phase synchronous generator of terminal voltage as 1 pu and field excitation of 1 pu. If the resistive drop is 0.2 pv, then what can be concluded for power factor?
a) Leading
b) Lagging
c) Upf
d) Zpf

Answer: a
Explanation: Here Vt > Ef-Ia*ra.

9. For a 3 phase synchronous generator of terminal voltage as 1 pu and field excitation of 1.5 pu. If the resistive drop is 0.2 pv, then what can be concluded for power factor?
a) Leading
b) Lagging
c) Upf
d) Zpf

Answer: b
Explanation: Here Vt < Ef-Ia*ra.

10. For a three phase synchronous motor, if the following condition is satisfied, it can be said that it is operating at _____________

```
Vt < Ef-Ia*ra
```

a) Leading
b) Lagging
c) Upf
d) Zpf

Answer: a
Explanation: The reactive power will be positive for this condition.

11.For a three phase synchronous motor, if the following condition is satisfied, it can be said that it is operating at _____________

```
Vt = Ef-Ia*ra
```

a) Leading
b) Lagging
c) Upf
d) Zpf

Answer: c
Explanation: The net reactive power flow will be zero.

12. For a three phase synchronous motor, if the following condition is satisfied, it can be said that it is operating at _____________

```
Vt > Ef-Ia*ra
```

a) Leading
b) Lagging
c) Upf
d) Zpf

Answer: b
Explanation: The motor will absorb the reactive power which will be lagging in nature.

13. Reactive power is a matter of interest at _____________
a) output terminals of generator
b) input terminal of motor
c) output terminals of generator and input terminal of motor

d) none of the mentioned

Answer: a
Explanation: Reactive power is a matter of interest at output terminals of generator and input terminal of motor.

14. The reactive power flow is outward from an alternator, then it is _____________
a) over excited
b) under excited
c) critically excited
d) none of the mentioned

Answer: a
Explanation: Because Q > 0; For an alternator, Q = V(Ecosδ -V)/Z.

15. The reactive power flow is outward from an alternator, then the alternator works at _____________
a) lagging power factor
b) leading power factor
c) zero power factor
d) normal power factor

Answer: a
Explanation: As the reactive power is positive the power factor based on the standard convention should be lagging.

This set of Electrical Machines Interview Questions and Answers for Experienced people focuses on “Power Flow Through an Inductive Impedance – II”.

1. When excitation given to a 3-phase alternator is equal to terminal voltage then _____________
a) the absorbed reactive power is zero
b) the absorbed real power is zero
c) the delivered real power is zero
d) any of the mentioned

Answer: a
Explanation: When excitation is equal to the terminal voltage there will not be any net flow of energy across the system.

2. The generator(3 phase alternator) absorbs reactive power from the infinite bus at leading power factor.
a) True
b) False

Answer: a
Explanation: Infinite bus bar provides the flux needed to set up the reactive power to produce the real power in the generator.

3. When terminal voltage exceeds the excitation, then operating power factor is?
a) leading
b) lagging
c) uPF
d) zpf

Answer: a
Explanation: As the reactive power is negative the power factor based on the standard convention should be lagging.

4. Under the conditions of maximum reactive power output, the reactive power flowing out of an alternator is ___________
a) positive
b) negative
c) zero
d) equal to power

Answer: b
Explanation: The alternator will always absorb the reactive power to meet its flux requirements to generate the real power.

5. Under the condition of maximum power delivered, reactive power is ___________
a) negative
b) positive
c) zero
d) same as previous condition

Answer: a
Explanation: The alternator will always absorb the reactive power to meet its flux requirements to generate the real power.

6. Under the condition for 3 phase alternator, maximum active power output, the delivered reactive power output is _________ while under maximum reactive power output, the delivered reactive power is _________
a) negative, negative
b) positive, negative
c) negative, positive
d) positive, positive

Answer: a
Explanation: Under both the situation, there is need of reactive power which will set up the flux in the machine to make it run.

7. For an overexcited 3 phase synchronous motor, connected to infinite bus is ___________
a) motor is delivering reactive power to IBB
b) motor is absorbing reactive power to IBB
c) motor is delivering zero reactive power to IBB
d) none of the mentioned

Answer: a
Explanation: An over excited synchronous motor will act as a source of the reactive power.

8. If the synchronous motor connected to the infinite bus bar delivers positive reactive power to it, then it must be operating at ___________
a) leading pf
b) lagging pf
c) zero pf
d) unity pf

Answer: a
Explanation: An over excited synchronous motor will act as a source of the reactive power and it will operate at leading pf.

9. For an underexcited 3 phase synchronous motor, connected to IBB is ___________
a) absorbing reactive power from IBB
b) delivering reactive power to IBB
c) absorbing zero reactive power from IBB
d) delivering zero reactive power to IBB

Answer: a
Explanation: An under excited synchronous motor will act as a source of the reactive power.

10. If the synchronous motor connected to the infinite bus bar absorbs reactive power to it, then it must be operating at ___________
a) leading pf
b) lagging pf
c) zero pf
d) unity pf

Answer: b
Explanation: An under excited synchronous motor will act as a sink of the reactive power and it will operate at leading pf.

11. What is Synchronous motor?
a) absorbs reactive power for maximum input real power
b) absorbs reactive power for maximum input reactive power
c) delivers reactive power for maximum input real power
d) delivers reactive power for maximum input reactive power

Answer: a
Explanation: Synchronous motor always absorbs reactive power for maximum real as well as reactive power.

12. Under the conditions of maximum values of active or reactive power, a synchronous machine always absorbs reactive power.
a) True
b) False

Answer: a
Explanation: Synchronous motor always absorbs reactive power for maximum real as well as reactive power.

13. An _________ synchronous machine delivers reactive power whereas an _________ one absorbs reactive power.
a) over excited, under excited
b) under excited, over excited
c) over excited, over excited
d) under excited, normal excited

Answer: a
Explanation: An over excited synchronous machine delivers reactive power whereas an under excited one absorbs reactive power.

14. An alternator, with synchronous reactance of 0.8 pv is connected to an IBB at rated voltage. With its excitation emf adjusted to 1.3 pv, the alternator delivers an output of 0.5 pv. The load angle is ___________
a) 17.92
b) 72.08
c) 34.92
d) 90

Answer: a
Explanation: δ = atan(0.5*0.8/1.3) = 17.92°.

15. An 3 phase alternator star connected 400 V synchronous motor takes a power input of 5472 watts at rated voltage. Its synchronous reactance is 10** per phase and negligible resistance. If its excitation voltage is adjusted equal to the rated voltage of 400 V, its power factor is ________
a) cos(10°)
b) cos(20°)
c) cos(40°)
d) cos(30°)

Answer: a
Explanation: Vt = Ef = 400/1.73 = 231 V
V*Esinδ/X = P
δ = 20°
θ = δ/2.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Losses and efficiency".

1. For the given traction application using a dc series motor for a starting time 't' is applied. If this method is replaced by a series-parallel control, giving 50% time for each series and parallel. The saving in the starting energy of __________
a) 25%
b) zero
c) 50%

d) 75%

Answer: a
Explanation: Initially let the energy utilized was 100% for time t.Then for 50% duration for series, energy used is 50%. For parallel operation for the same circuit, the resistance gets halved assuming the same machine. So, for 50% of the parallel operation, 25% of energy is only utilized. Hence total saving is 25%.

2. If two series motors are identically coupled. One is running as motor while other as generator. For this combination, the iron losses and frictional losses are found identical for __________
a) identical speed and excitation
b) identical speed
c) identical rating and construction
d) none of the mentioned

Answer: a
Explanation: For same iron and frictional losses, same frequency should be there. For that same speed must be run.

3. Hysteresis loss in a dc machine is _____ of rate of flow of air and _____ on frequency of _____

a) independent, dependent, magnetic reversal
b) independent, dependent, operation
c) dependent, independent, magnetic reversal
d) none of the mentioned

Answer: a
Explanation: Hysteresis loss in a dc machine is independent of rate of flow of air and depends on frequency of magnetic reversal.

4. In dc machine iron losses cause __________
a) heating in core
b) loss in efficiency
c) rise in temperature of ventilating air
d) all of the mentioned

Answer: a
Explanation: The iron losses cause heating of the core which causes reduction inefficiency and cooling air gets heated up.

5. For squirrel cage and slip ring induction motor, cooling methods is efficient in __________
a) squirrel cage induction motor
b) slip ring induction motor
c) both of the motors
d) none of the mentioned

Answer: a
Explanation: As the squirrel cage induction motor has more ventilation and more space as compares to slip ring induction motor, there will be more efficient ways to cool down the squirrel cage motor.

6. If one of the phases of the supply breaks down, then the connected three phase induction motor __________
a) continues to run as a single phase induction motor, provided load does does not increase beyond 57.7%
b) stops operating after few seconds
c) continues to run as single phase induction motor
d) continues to run as two phase induction motor

Answer: a
Explanation: When one of the phases breaks down then the other two phases will supply the rated current but the load should be reduced to 57.7%.

7. If one of the phases of RYB supply gets broken, then the temperature rise of the induction motor __________
a) remains same as before
b) reduces as compared to the normal operating temperature
c) reduces to temperature rise of corresponding single phase induction motor
d) increases

Answer: a
Explanation: The current flowing in the armature will remain same so to maintain the flux requirements of the machine. Hence the temperature rise will also remain same as the current remains same.

8. A three phase induction motor is connected to the infinite bus operating at the normal conditions. There occurs an unbalancing in the supply, leading to __________
a) unequal heating losses
b) stopping of motor
c) increase in lower
d) none of the mentioned

Answer: a
Explanation: The unbalancing in the supply phase will create an unbalanced distribution of the current in the phases, thereby unequal heating.

9. A peaky voltage supply is given to the 3 phase power transformer of the connection power system. These results in __________
a) reduction in iron losses
b) reduction in copper losses
c) increase in iron losses
d) reduction in noise

Answer: a
Explanation: The flux wave will be sinusoidal in nature as the emf is peaky in nature. Sine wave has least losses when compared to other wave forms.

10. The iron losses in a saturated three phase alternator is lesser than the non-saturated three phase alternator.
a) True
b) False

Answer: a
Explanation: The non-saturated reactance is greater than saturated reactance. So the reactive losses or iron losses will reduce due lesser contribution of the same.

11. The hydroelectric plants in the industry are best suited with __________
a) closed circuit air cooling
b) hydrogen gas
c) direct water
d) all of the mentioned

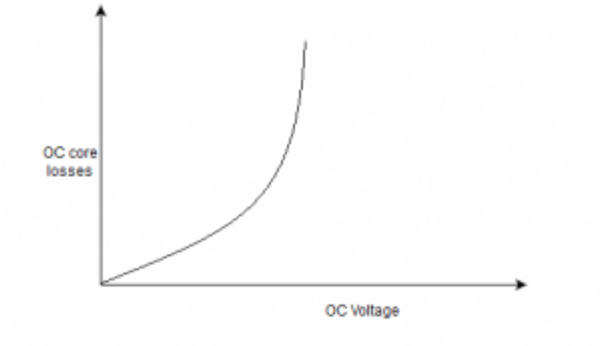
Answer: a
Explanation: The closed circuit is so used to reuse the air in the system so that to save water again in the cooling system.

This set of Electrical Machines Questions and Answers for Entrance exams focuses on “Efficiency of Synchronous Machines”.

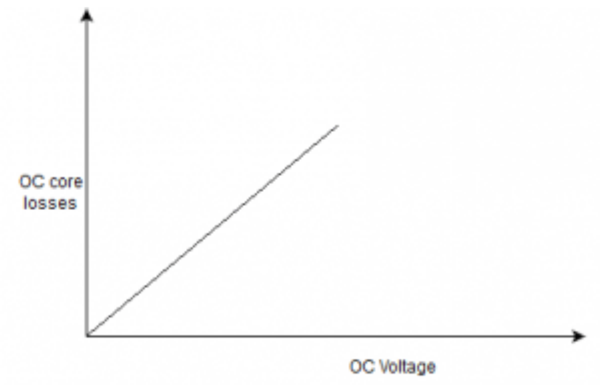
1. The short circuit load losses is/are _______________
a) direct load loss and stray load losses
b) direct load loss
c) stray load losses
d) field current loss

Answer: a
Explanation: Short circuit losses comprise of direct load loss and stray losses too.

2. The open circuit voltage and open circuit core loss variation is?



a)



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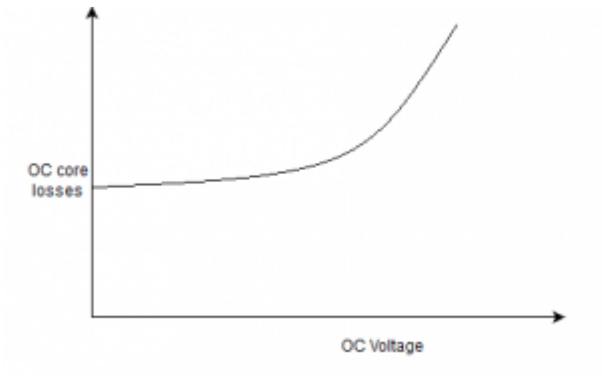
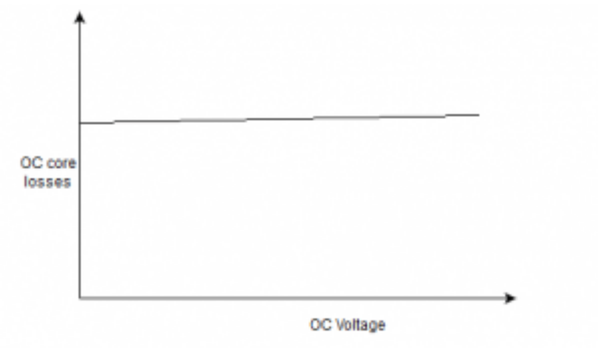
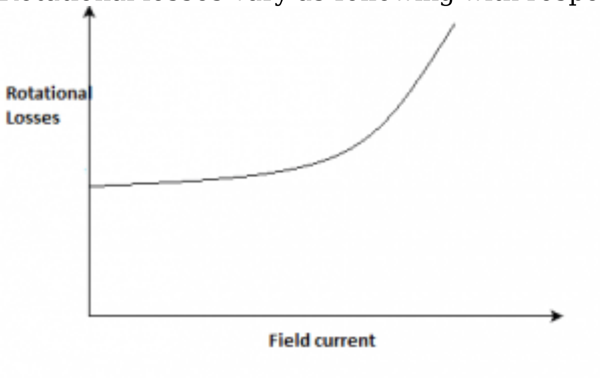
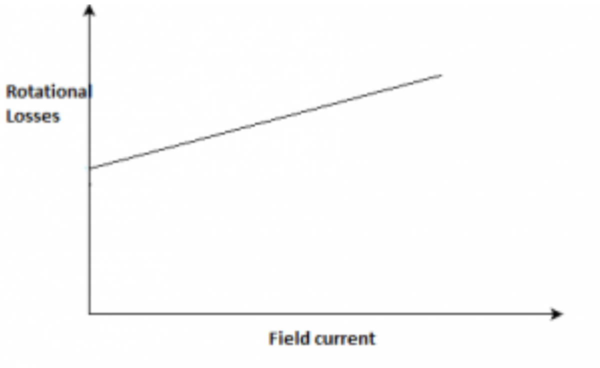
c) 

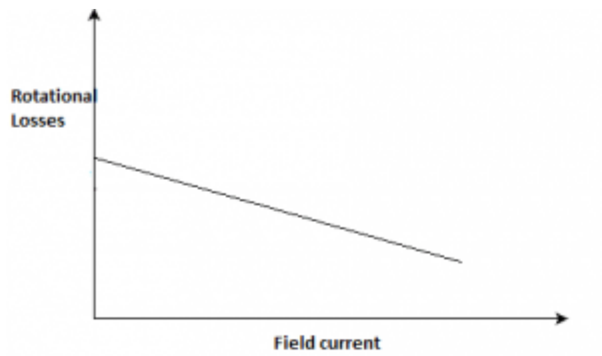
d) 

Answer: a
Explanation: Core losses vary as a square of the voltage.

3. Rotational losses vary as following with respect to field current.

a) 

b) 



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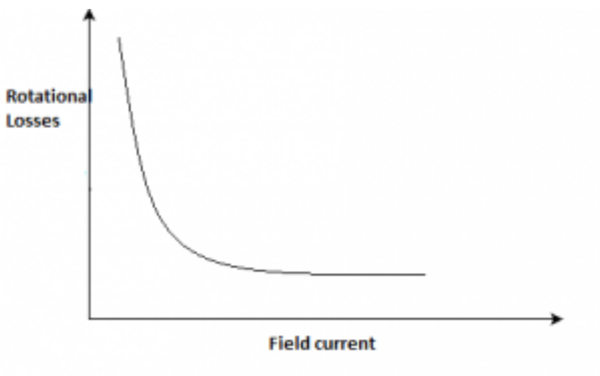
d) 

Answer: a
Explanation: The y-intercept depicts the friction and windage losses.

4. A 100 KVA, 400V, 3-phase, star connected alternator due to the following data:

```
Friction and windage losses = 340W
Open circuit core loss = 480W
Rf = 180ohms, ra = 0.02ohms.
```

The voltage applied to the field winding is 220V. The short circuit load loss at half full load is?
a) 258W
b) 268W
c) 480w
d) 340W

Answer: a
Explanation: SC losses at half load = $3*((Ia/2)^2)*ra$
$= 3*((131.22/2)^2)*0.02$
= 258.3 A.

5. A 100 KVA, 400V, 3-phase, star connected alternator due to following data:

```
Friction and windage losses = 340W
Open circuit core loss = 480W
Rf = 180ohms, ra = 0.02ohms.
```

The voltage applied to the field winding is 220V. The field current loss will be?
a) 270W
b) 258W
c) 480W
d) 250W

Answer: a
Explanation: Field circuit loss = 220^2/180 = 169W

6. A 100 KVA, 400V, 3-phase, star connected alternator due to following data:

```
Friction and windage losses = 340W
Open circuit core loss = 480W
Rf = 180ohms, ra = 0.02ohms.
```

The voltage applied to the field winding is 220V. The efficiency of the machine at half load is?
a) 96.7%
b) 95%
c) 94.2%
d) 97

Answer: a
Explanation: Total losses at half load = 340+480+258+268.9 = 1347W
Efficiency = 1-(1347/40000+1347)
= 96.47%.

7. A 100 KVA, 400V, 3-phase, star connected alternator due to following data:

```
Friction and windage losses = 340W
Open circuit core loss = 480W
Rf = 180ohms, ra = 0.02ohms.
```

The voltage applied to the field winding is 220V. The load losses at full load is?
a) 1033W
b) 500W
c) 540W
d) 940W

Answer: a
Explanation: Short circuit losses at full load = $3*(131.22)^2*0.02$ = 1033W.

8. A 100 KVA, 400V, 3-phase, star connected alternator due to following data

```
Friction and windage losses = 340W
Open circuit core loss = 480W
Rf = 180ohms, ra = 0.02ohms.
```

The voltage applied to the field winding is 220V. Efficiency at full load is?
a) 97%
b) 96.5%
c) 92%
d) 95%

Answer: a
Explanation: Total losses at full load = 340+480+1033+268.9 = 2122W
Efficiency = 1 – (2122/2122+80000) = 97.4%.

9. The given variable losses are 5kW fr a 500 KVA, 11 kV, 3-phase star connected alternator having armature resistance of 4 ohms. Calculate the current at which maximum efficiency occurs?
a) 20.4A
b) 10.2A
c) 40A
d) 26A

Answer: a
Explanation: I^2 =5000/3*4
I = 20.4 A.

10. The given variable losses are 5kW fr a 500 KVA, 11 kV, 3-phase star connected alternator having armature resistance of 4 ohms. Calculate the full load armature current per phase.
a) 26.24 A
b) 20.41 A
c) 79 A
d) 40 A

Answer: a
Explanation: I = P/1.73*V = 5000/1.73*11000 = 26.24 A.

11. A synchronous machine with its field winding on stator and polyphase armature winding on rotor. At steady state, its air gap field is?

```
I. stationary w.r.t. stator
II. rotating at double the speed Ns w.r.t. rotor
III. rotating in direction opposite to rotor
```

a) I, II, III
b) I
c) II, III
d) II, I

Answer: a
Explanation: All the statements are correct.

12. A synchronous machine with its field winding on rotor and polyphase armature winding on stator. At steady state running condition, its air gap field is?
a) rotating at synchronous speed w.r.t. stator
b) stationary w.r.t. rotor
c) rotating in the direction of the rotor rotor rotation
d) all of the mentioned

Answer: a
Explanation: As the field is on the rotor, the field will be set up w.r.t. rotor.

13. Consider a 3-phase cylindrical-rotor alternator.

```
A. E.m.f. generated by armature reaction lags armature current by 90°.
B. Air gap voltage leads the field flux by 90°
C. Air gap voltage lags the field flux by 90°
D. Armature reaction mmf lags the field flux by (90°+ internal p.f. angle)
```

a) A, B, D
b) A, C, D
C) B, D
D) C, D

Answer: a
Explanation: Air gap voltage will lag the field flux by 90° to generate the emf.

14. In a 3-phase cylindrical-rotor alternator, synchronous reactance is sum of ______________
a) mutual and leakage reactance
b) magnetizing and leakage reactance
c) magnetizing and mutual reactance
d) mutual, magnetizing and leakage reactance

Answer: a
Explanation: Xs = magnetizing reactance + leakage reactance.

15. The reactive power output of a synchronous generator is limited by __________
a) armature current and field current
b) field current and load angle
c) load angle and excitation
d) armature current only

Answer: a
Explanation: Q=f(Ia,If).

This set of Electrical Machines Multiple Choice Questions & Answers focuses on "Synchronizing Power and Synchronizing Torque".

1. The coupling angle or load angle of a synchronous motor is defined as the space angle between ___________

a) rotor and stator poles of opposite polarity
b) rotor and stator poles of same polarity
c) rotor and stator teeth
d) rotor and resultant magnetic field

Answer: a
Explanation: It is measured between stator and rotor poles of opposite polarity.

2. What is Synchronizing power?

```
(i) Stiffness coefficient of electromagnetic coupling between stator and rotor
(ii) Stability measure of synchronous machine
(iii) Power consumption factor
```

a) i,ii
b) ii, iii
c) iii, i
d) i, ii, iii

Answer: a
Explanation: Synchronizing power is stiffness coefficient representation as well the a measure of stability.

3. Large stiffness coefficient represents _____________
a) motor speed remains practically constant
b) large fluctuations due to mechanical load
c) motor speed is variable to changes
d) no such significance with speed

Answer: a
Explanation: Large stiffness represents the tight coupling in the machine and more stability.

4. An over excited synchronous machine is more stable than under excited.
a) True
b) False

Answer: a
Explanation: Synchronizing power is directly proportional to the excitation.

5. Consider the below remarks for an alternator.

```
(i) An over excited machine is more stiff
(ii) Machine with longer air-gap is less stable than one with smaller air-gap
```

a) (i) is True, (ii) is False
b) (i) is False, (ii) is True
c) (i) is True, (ii) is True
d) (i) is False, (ii) is False

Answer: a
Explanation: Larger the air gap smaller than the reactance.

6. As load angle is increased, degree of stability __________
a) reduces
b) increases
c) remains same
d) no change in stability

Answer: a
Explanation: Synchronizing power = $EV*\cos\delta/X$.

7. Synchronizing power is ___________
a) transient in nature
b) steady state in nature
c) pulsating at small frequencies
d) constant for a machine

Answer: a
Explanation: It is transient in nature and determines stability while disturbances.

8. Which of the following makes synchronizing power to come to play in the machine?
a) Disturbance in power mover
b) Disturbance in field current
c) Disturbance in load
d) All of the mentioned

Answer: a
Explanation: Any disturbance will lead to transients to arise and so the synchronizing power.

9. Which of the following is/are used in synchronous machines to maintain mechanical stability?

a) Damper winding
b) Interpole winding
c) Compensating winding
d) Equalizer rings

Answer: a
Explanation: Damper windings are the dummy windings which help to stablize the machine during transient instability.

10. For a 4-pole 3 phase, 400V alternator has synchronizing power of 300 units. Then the synchronizing power per mechanical degree is?
a) 300
b) 1200
c) 900
d) 600

Answer: a
Explanation: P(sy, mech) = Poles* P(sy,ele)/2
P(sy,ele) = 300 units.

11. Electromagnetic torque is present in rotating machines when ______________
a) both stator and rotor windings carry current
b) rotor windings carry current
c) stator windings carry current
d) any of the mentioned

Answer: a
Explanation: Synchronous machine is a doubly excited machine.

12. The operation of a synchronous motor operating on constant excitation across infinite bus will not be stable if power angle δ?
a) exceeds internal angle θ
b) is less than θ
c) is more than θ/2
d) is less than θ/2

Answer: a
Explanation: Power angle should not exceed θ, to operate under normal conditions.

13. In a synchronous motor the back emf peak set up in the stator depends on ____________
a) rotor excitation
b) supply voltage
c) rotor speed
d) load on the motor

Answer: a
Explanation: It will depend on the excitation.

14. Variation in the dc excitation of a synchronous motor causes variation in ____________
a) armature current and power factor
b) power factor
c) armature current

d) speed

Answer: a
Explanation: Armature current and power factor both will vary by varying the dc excitation.

15. Which motor can conveniently operate at lagging as well as leading power factor?
a) Synchronous motor
b) Slip ring induction motor
c) Squirrel cage induction motor
d) Stepper motor

Answer: a
Explanation: Its the synchronous motor which can favourably operate both at leading and lagging power factor.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Synchronous Machine Stability”.

1. Steady state stability limit is defined as maximum power flow possible through a particular point without loss of stability when the ___________
a) power is increased gradually
b) power is increased suddenly
c) power is reduced gradually
d) power is reduces suddenly

Answer: a
Explanation: Steady state analysis involves study of stability at gradual changes in the machine.

2. If the load angle is increased till 135°, the consequence will be ___________
a) loss of synchronism
b) no alternation of synchronism
c) increase in stability limit
d) reduction in stability limit

Answer: a
Explanation: Because load angle is more than 90°.

3. The steady state limit can be improved by ___________

```
i. Increasing excitation
ii. reducing reactance
iii. using series capacitors
```

a) i, ii, iii
b) i, ii
c) iii only
d) ii, iii

Answer: a
Explanation: Steady state limit = EV/X.

4. Series capacitors will improve the ___________
a) SSSL
b) Transient stability
c) Hunting
d) Stiffness

Answer: a
Explanation: Steady state limit = EV/X.

5. Transient stability limit is less important than SSSL.
a) True
b) False

Answer: b
Explanation: Transient stability is more of concern due to the reason that the machine may loose synchronism due to sudden disturbances.

6. (i) Transient stability is lower than SSSL.
(ii) Transient disturbances are more common.
a) i and ii both are true
b) i false, ii true
c) i true, ii false
d) Both are false

Answer: a
Explanation: Both are correct statements.

7. The supply voltage to an induction motor is decreased by 10%. By what percentage, approximately, will the maximum torque decrease?
a) 5%
b) 10%
c) 20%
d) 40%

Answer: c
Explanation: Torque is proportional to V^2.
Torque will change by twice percentage of the change in voltage i.e. 20%.

8. In a salient pole synchronous machine the air gap is least under the middle of the pole shoe and increases outwards.
a) True
b) False

Answer: a
Explanation: Air gap for a salient pole structure is minimum at mid of a given pole.

9. If it is planned to bring an incoming alternator to the operating alternator in parallel, then which of the criteria can be ignored?
a) Prime mover speed
b) Voltage magnitude
c) Frequency
d) Phase sequence of the alternator

Answer: a
Explanation: To operate under synchronising conditions, there must be same voltage, frequency and phase sequence for the machines in the parallel.

10. Which one of the following is the base reason to place field on rotor in the alternator?
a) Small power in field circuit
b) Insulation of high voltage is made easy on stator than on rotor
c) Huge power in stator
d) Large current in the stator

Answer: b
Explanation: Providing insulation becomes easier as the stator will be stationary.

This set of Electrical Machines Interview Questions and Answers for freshers focuses on “Hunting and Damper Windings”.

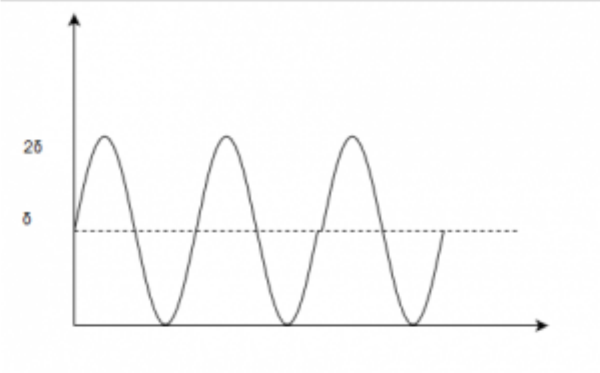
1. The relative speed between rotor and stator field is zero. This means ____________
a) mechanical speed of rotor is equal to stator field speed
b) mechanical speed is zero
c) stator field is stationary
d) none of the mentioned

Answer: a
Explanation: The relative speed is between the rotor and the stator field.

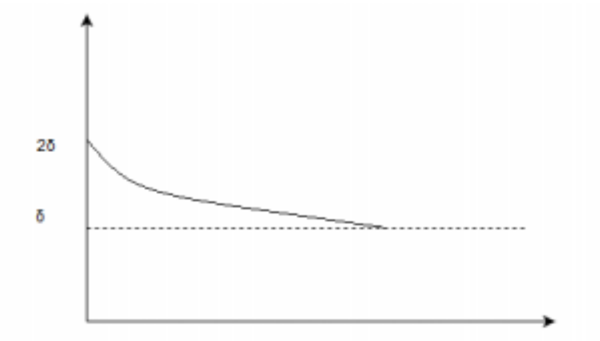
2. The satisfactory operation of the synchronous machine means ____________
a) mechanical speed of rotor is equal to stator field speed
b) mechanical speed is zero
c) stator field is stationary
d) none of the mentioned

Answer: a
Explanation: The relative speed should be zero between the rotor and the stator field.

3. Variation of load angle delta, after sudden loading of an unloaded synchronous motor with no damping is?



a)



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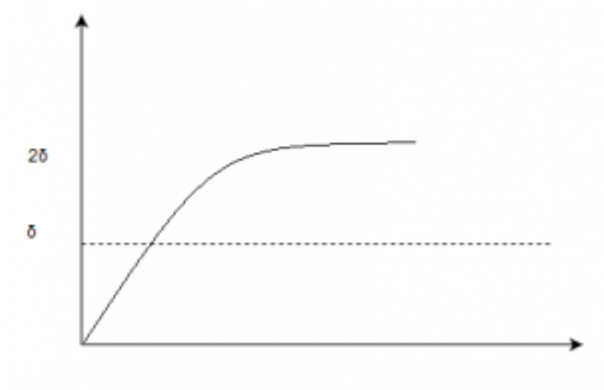

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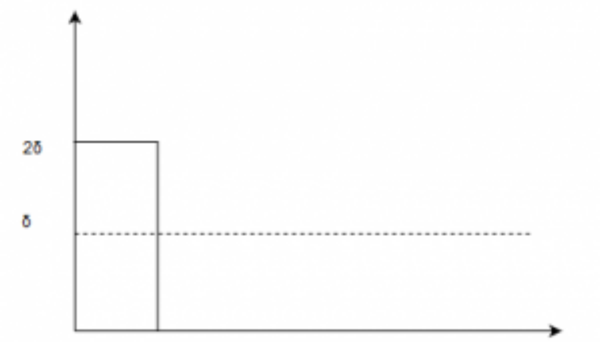
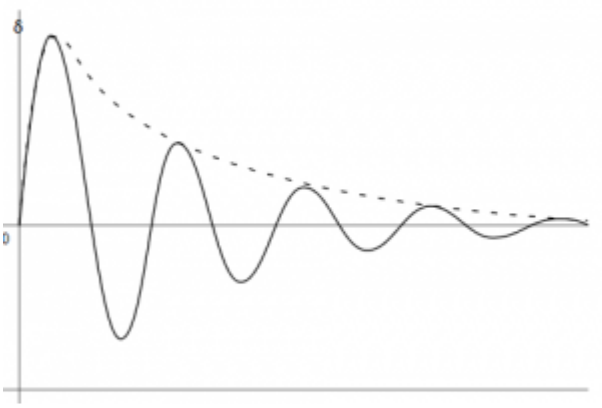
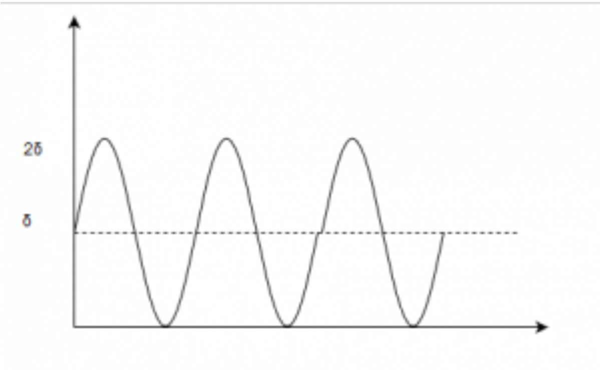
d) 

Answer: a
Explanation: With no damping there will be oscillations in the rotor angle.

4. Variation of load angle delta, with loading of an unloaded synchronous motor with damping is?



a)



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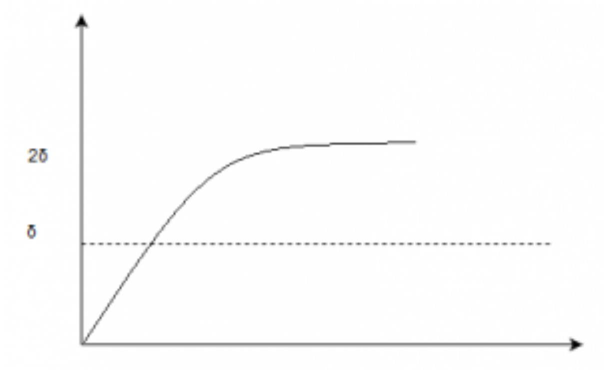

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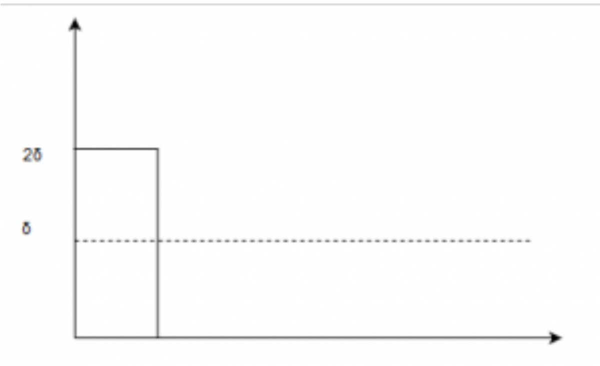
d) 

Answer: a
Explanation: With damping the load angle damps out to nominal value.

5. Effects of hunting are/is ____________
a) mechanical stress
b) surge in current
c) rise in temperature
d) all of the mentioned

Answer: d
Explanation: Hunting causes all the mentioned effects on the synchronous machine.

6. What are the probable causes of hunting?
a) sudden change in load
b) fault in supply
c) sudden change in field current
d) all of the mentioned

Answer: d
Explanation: Changing the load suddenly, excitation or the faults will cause transients in the machine.

7. Using a ______ can be used to limit hunting.
a) Flywheel
b) DC Exciter
c) Large load
d) Any of the mentioned

Answer: d
Explanation: Any method mentioned will diminish the transients in the machine.

8. Employment of damper winding will reduce hunting.
a) True
b) False

Answer: a
Explanation: Damper winding are mechanical windings which also reduce the hunting.

9. Damper windings are made of ____________
a) copper
b) iron
c) silicon
d) cast iron

Answer: a
Explanation: They are made of copper as the current also flows through them.

10. The damper winding are placed in ____________
a) pole shoes
b) series with armature
c) series with field
d) rotor slots

Answer: a
Explanation: The damper winding are placed in pole shoes.

11. Turbo generators do not use damper winding due to ____________
a) solid steel rotor core
b) laminated armature
c) soft iron core
d) small current flow in pole shoes

Answer: a
Explanation: Because eddy current in the q-axis produce the same effect as the damper in salient pole machine.

12. Damper winding should have ____________
a) high resistance
b) low starting torque
c) low resistance
d) low reactance

Answer: c
Explanation: For desired hunting, the damper winding should have low resistance.

13. At synchronous speed, relative speed between rotating air-gap flux and damper is?
a) zero
b) Ns
c) lesser than Ns
d) more than zero

Answer: a
Explanation: It is zero.

14. When the rotor speed becomes greater than synchronous speed, which type of torque is produced in damper winding?
a) Induction generator
b) Synchronous generator
c) Reluctance motor
d) Induction motor

Answer: a
Explanation: The slip will become negative and it will operate in generating mode.

15. When an alternator is loaded suddenly the torque produced in damper is?
a) Induction motor
b) Induction generator
c) Synchronous motor
d) Synchronous generator

Answer: a
Explanation: Sudden loading will reduce the speed of the machine and so there will be small slip induced in the machine, making it operate as induction motor.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Induction Motor as a Transformer”.

1. An induction motor can be said analogous to __________
a) transformer
b) synchronous motor
c) universal motor
d) stepper motor

Answer: a
Explanation: An induction motor has similar operation as a transformer.

2. A 3-phase induction motor with its rotor blocked behaves similar to a __________
a) transformer under short circuit of secondary terminals
b) transformer under open circuit of secondary
c) synchronous motor under slip test
d) synchronous motor under open circuit

Answer: a
Explanation: It is analogous to transformer under the shorted terminals of the secondary.

3. No load current in induction motor is 10-20% of full load current and the no load current of transformer is 2-6%.
a) True
b) False

Answer: a
Explanation: The air gap in induction motor is more prominent than transformer and so the flux requirement will also be more.

4. The rated current in induction motor for a three phase system is 100A. What can be the no load estimated current for the machine?
a) 12 A
b) 20 A
c) 30 A
d) 5 A

Answer: a
Explanation: No load current in induction motor is 10-20% of full load current.

5. The no load current of the transformer is very less due to __________
a) mutual flux having low reluctance iron core
b) mutual flux having high reluctance iron core
c) leakage flux having low reluctance iron core
d) leakage flux having high reluctance iron core

Answer: a
Explanation: It is due to the low reluctance path, the flux requirement is low in the transformer.

6. The no load current of the induction motor is high due to __________
a) long and high reluctance path between stator and rotor
b) mutual flux having moderate reluctance path between stator and rotor
c) leakage flux having low reluctance iron core
d) leakage flux having high reluctance iron core

Answer: a
Explanation: It is due to the higher reluctance path, the flux requirement is low in the induction motor.

7. At no load induction motor has possible power factor as __________
a) 0.2
b) 0.5
c) 0.65
d) 0

Answer: a
Explanation: At no load the lower power factor is low and lagging in nature.

8. Mechanically air gaps in induction motor are kept very low to avoid __________
a) lower power factor
b) lagging nature
c) magnetizing current
d) all of the mentioned

Answer: d
Explanation: Air gap is kept lower to avoid the low value power factor, lagging behaviour and to reduce the magnetizing current.

9. The low no load power factor __________
a) reduces full load operating pf
b) increases full load operating pf
c) reduces full load excitation voltage
d) increases full load excitation voltage

Answer: a
Explanation: The low no-load power factor reduces full load operating pf.

10. An induction motor when started on load, it does not accelerate up to full speed but runs at 1/7th of the rated speed. The motor is said to be __________
a) Locking
b) Plumming
c) Crawling
d) Cogging

Answer: c
Explanation: Running stably at low speed around 1/7th of normal motor speed is known as crawling.

11. The great advantage of the double squirrel-cage induction motor over single cage rotor is that its __________
a) efficiency is higher
b) power factor is higher
c) slip is larger
d) starting current is lower

Answer: d
Explanation: The outer cage has higher resistance and low reactance while vice versa for the inner cage. So at starting the current is confined to outer cage with the reduction in starting current improving the torque.

12. The rotor of 3-phase slip ring induction motor is fed from a 3-phase supply with its stator winding short circuited having rotor rotating clockwise at a speed of Nr, then the __________
a) speed of air gap field w.r.t. stator is Ns-Nr anticlockwise
b) speed of air gap field w.r.t. stator is Ns-Nr clockwise
c) speed of airgap field w.r.t rotor is Ns clockwise
d) speed of airgap field w.r.t. stator is Ns-Nr clockwise

Answer: a
Explanation: The air gap field of stator = -(Ns-Nr).

13. (I) Even at no load a large 3-phase squirrel- cage induction motor is started at reduced voltage than rated.
(II) If a large 3–phase squirrel-cage induction motor with no load is started at full voltage, it will be damaged.
a) I is true, II is false
b) I is true and II is also true
c) I is false, II is true
d) I and II are false

Answer: a
Explanation: Large current of short duration are not harmful to induction motor but it may cause voltage drop in the power supply.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Rotor Frequency".

1. Slip is defined as __________ (Ns as the synchronous speed and Nr is the rotor speed)
a) Ns-Nr/Ns
b) Ns-Nr/Nr
c) Nr-Ns/Ns
d) Ns-Nr

Answer: a
Explanation: Slip is the ratio of the relative speed of between the stator mmf and the rotor speed to the synchronous speed of the machine.

2. For a 4 pole three phase induction motor having synchronous speed of 1500 rpm is operating at 1450rpm. The frequency of the induced emf in rotor is?
a) 100 Hz
b) 50 Hz
c) 150 Hz
d) 0 Hz

Answer: a
Explanation: The induced frequency will be f = P(Ns-Nr)/2.
f = 4(1500-1450)/2 = 100 Hz.

3. A three phase, 50 Hz induction motor has a full load speed of 1440 rpm. The number of poles of this motor is?
a) 4
b) 6
c) 5
d) 2

Answer: a
Explanation: P = 120f/N = 120*50/1440 = 4(1/6). The number of the poles should be whole number and must be even. So number of poles must be 4.

4. A three phase, 50 Hz induction motor has a full load speed of 1440 rpm. The full load slip will be?
a) 4%
b) 5%
c) 2.4%
d) 3%

Answer: a
Explanation: s = 1500-1440/1500 = 4%.

5. A three phase, 50 Hz induction motor has a full load speed of 1440 rpm. Rotor frequency is?
a) 2 Hz
b) 50 Hz
c) 52 Hz
d) 58 Hz

Answer: a
Explanation: s = 0.04, rotor frequency = s*f = 0.04*50 = 2 Hz.

6. A three phase, 50 Hz induction motor has a full load speed of 1440 rpm. Speed of the stator filed with respect to stator structure is?
a) 157 rad/s
b) 150 rad/s
c) 6.28 rad/s
d) 145 rad/s

Answer: a
Explanation: Speed of the stator filed with respect to stator structure = Ns = 1500 rpm = 157 rad/s.

7. A three phase, 50 Hz induction motor has a full load speed of 1440 rpm. Speed of the stator field revolving rotor structure is?
a) 157 rad/s
b) 150 rad/s
c) 6.28 rad/s
d) 145 rad/s

Answer: c
Explanation: Speed of the stator field revolving rotor structure = 1550-1440 = 60 rpm = 6.28 rad/s.

8. A three phase, 50 Hz induction motor has a full load speed of 1440 rpm. Speed of the rotor field w.r.t. rotor structure is?
a) 157 rad/s
b) 150 rad/s
c) 6.28 rad/s
d) 145 rad/s

Answer: c
Explanation: Speed of the rotor field w.r.t. rotor structure = 120*rotor frequency/Poles = 120*2/4 = 60 rpm = 6.28 rad/s.

9. A three phase, 50 Hz induction motor has a full load speed of 1440 rpm. Speed of the rotor field w.r.t. stator field is?
a) zero
b) 150 rad/s
c) 6.28 rad/s
d) 145 rad/s

Answer: a
Explanation: As both the rotor field and stator file rotate at synchronous speed, the relative speed between them is zero.

10. A properly shunted center zero galvanometer is connected in the rotor circuit of a 6-pole, 50 hz wound rotor induction motor. If the makes 90 complete oscillations in one minute, the rotor speed is?
a) 1000 rpm
b) 970 rpm
c) 950 rpm
d) 930 rpm

Answer: b
Explanation: Rotor frequency = s*f1 = 90/60 = 1.5 Hz.
s = 1.5/50 = 0.03
rotor speed = 1000(1-0.03) = 970 rpm.

11. A 4-pole, 3-phase slip ring induction motor is used as a frequency changer. Its stator is excited from 3-phase, 50 Hz supply. A load requiring 3-phase, 20 Hz supply is connected to the star-connected rotor through three slip-rings of SRIM. At what two speeds the prime mover should drive the rotor of this SRIM?
a) 900 rpm
b) 600 rpm
c) 1500 rpm
d) 0

Answer: a
Explanation: Ns = 1500 rpm. Speed of the rotor field with respect to rotor structure = 120 * f2/ P = 120*20/4 = 600 rpm
Nr = 1500-600
= 900 rpm.

12. For a 4-pole, 3-phase induction motor the rotor speed found is 2100 rpm at 50 Hz. Then the phase sequence of the emf generated will be?
a) acb
b) abc
c) no emf will be induced
d) cba

Answer: a
Explanation: Stator field will be running at the speed of 600 rpm anticlockwise wrt to rotor. So the phase sequence generated at the slip rings is reversed.

13. Stator flux induces emf in the rotor conductors __________
a) magnitude depending on the load
b) rotating at synchronous speed around stator
c) constant in magnitude
d) none of the mentioned

Answer: a
Explanation: The emf will be induced based on the slip which depends on the load connected to the rotor.

14. The 3-phase induction motor with rotor circuit open will __________
a) not run
b) run normally
c) get over heated
d) make noise

Answer: a
Explanation: It will not run because there will not be any closed path for the flux in rotor circuit of the machine to generate emf.

15. The rotor of th 3-phase induction motor rotates in the same direction as that of stator field. This can be explained by __________
a) Newton’s laws of motion
b) Farady’s laws of electromagnetic induction
c) Lenz’s law
d) Fleming’s right hand rule

Answer: a
Explanation: Newtons’s law explains the over all behaviour of the inertia involved in the machine and a unidirectional torque generated.

16. In a three phase slip ring induction motor, brushes are connected to __________
a) external star connected resistors
b) dc supply
c) 3-phase ac supply
d) any of the mentioned

Answer: a
Explanation: The rotor external resistances must e connected in star and at the external end of the rotor.

17. The rotor winding for 3-phase slip ring induction motor having delta connected stator must be connected in __________
a) star
b) delta
c) tertiary
d) any of the mentioned

Answer: a
Explanation: We should use star connected resistors as the initial requirement is low resistance for high starting torque.

18. The squirrel cage induction motor of 6-pole can be used as ________ induction motor.
a) any number of poles

b) 6 pole
c) 6 or 12 pole
d) integral number of 4 poles

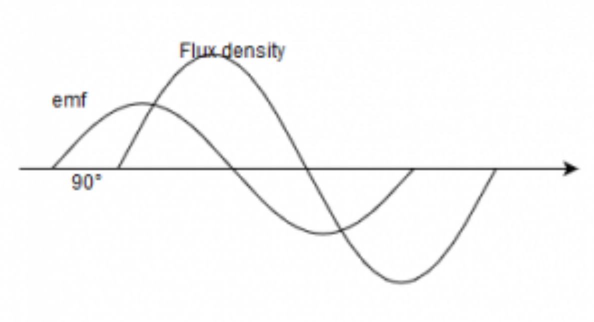
Answer: a
Explanation: The poles in a squirrel cage induction motor can be adjusted.

This set of Electrical Machines Questions and Answers for Campus interviews focuses on “Flux and MMF Phasors and Waves in Induction Motors”.

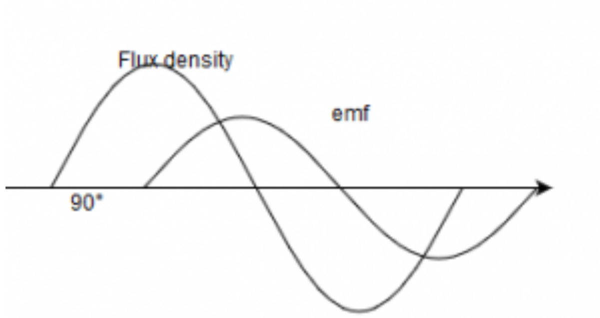
1. A three phase induction motor is not self starting.
a) True
b) False

Answer: b
Explanation: A three phase induction motor is self starting. Because air gap flux and rotor mmf produce electromagnetic torque in the direction of rotating magnetic field.

2. Mark the correct waveform for the emf produced in an induction motor and the resultant flux density wave for a resistive load.



a)



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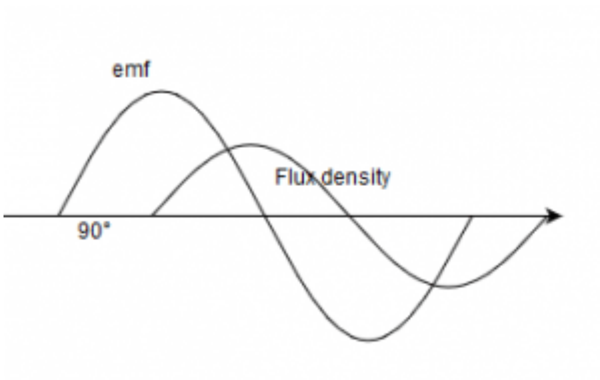

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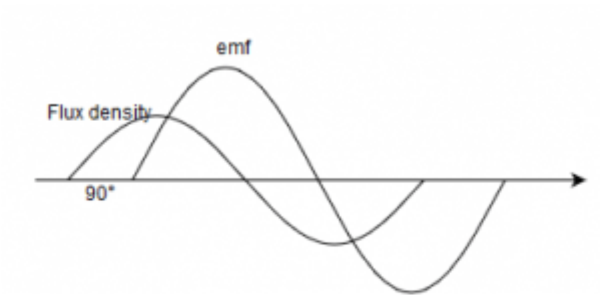
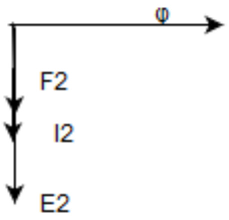


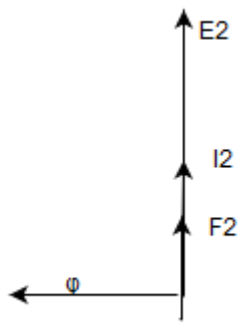
d)

Answer: a
Explanation: The flux will lead the induced current and emf by 90°.

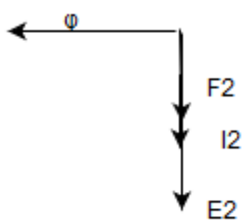
3. Mark the most appropriate phasor for the induction machine operation as motor.



a)



b)



c)

d) none of the mentioned

Answer: a
Explanation: The flux will lead the induced current and emf by 90°.

4. In a three phase induction motor, rotor current in each phase lags behind the generated emf in that phase to rotor by a power factor angle of __________
a) atan(r2/x2)
b) atan(x2/r2)
c) atan(x1/r1)
d) atan(r1/x1)

Answer: b
Explanation: The power factor angle is atan(x2/r2).

5. In a three phase induction motor of rotor impedance as (0.2+j0.2), rotor current in each phase lags behind the generated emf in that phase to rotor by a power factor angle of __________
a) 45°
b) 135°
c) 90°
d) 0°

Answer: a
Explanation: The power factor angle would be atan(0.2/0.2) = 45°.

6. For the three phase induction motor having leakage impedance, the maximum generated emf would be attained at an angle of θ having a purely resistive load is?
a) 90 + θ
b) θ
c) 90 – θ
d) -θ

Answer: a
Explanation: Due to leakage reactance there will be a lagging of angle θ in the excitation voltage with the main flux. So the maximum is attained at 90°+θ.

7. For a slip ring induction motor having leakage impedance of (1+j), the maximum generated emf would be attained at __________
a) 135°
b) 45°
c) -45°
d) 0°

Answer: a
Explanation: Due to leakage reactance there will be a lagging of angle θ in the excitation voltage with the main flux. So the maximum is attained at 90°+θ.

8. In an induction motor, the stator is also known as __________ and the rotor as ___________
a) field winding, armature winding
b) armature winding, field winding
c) armature winding, compensating winding
d) armature winding, interpole winding

Answer: a
Explanation: In an induction motor, the stator is also known as field winding, and the rotor as armature winding.

9. For a 6-pole three phase squirrel cage induction motor has flux density wave of four poless, then the rotor induced poles will be?
a) 4
b) 6
c) 2
d) 10

Answer: a
Explanation: For a squirrel-cage induction motor the rotor will have the induced poles will be same as flux density poles which are induced inside the machine while working.

10. The external resistance can be inserted in rotor circuit of __________
a) wound rotor induction motor
b) slip ring induction motor
c) wound rotor as slip ring induction motor
d) neither of motors

Answer: a
Explanation: External resistance can be inserted only in the wound rotor as does not get shorted as like squirrel cage motor.

11. Starting torque induced in a three phase induction motor in a direction of rotating magnetic field depends on __________
a) number of poles squared
b) inverse of number of poles
c) number of poles
d) number of number poles cubic

Answer: a
Explanation: T = (pi/8).(P^2) φ (F^2)cos(θ).

12. Starting torque induced in a three phase induction motor in a direction of rotating magnetic field depends on __________

```
(i) rotor mmf per pole
(ii) rotor power factor angle
(iii)type of rotor winding
```

a) (i), (ii)
b) (ii), (iii)
c) (i), (iii)
d) (i), (ii), (iii)

Answer: a
Explanation: Starting torque induced in a three phase induction motor depends on rotor mmf per pole and rotor power factor angle.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Principle of Operation".

1. The rotor of a three phase induction motor can never attain synchronous speed.
a) True
b) False

Answer: a
Explanation: Because then there will be no torque developed and flux cutting.

2. The direction of rmf when a single phase supply is given to stator of three phase induction motor is?
a) Zero
b) Ns
c) 2Ns
d) -Ns

Answer: a
Explanation: There will be no rmf generated as a single phase is only fed to the three phase of induction motor.

3. The direction of rmf when a three phase supply is given to stator of three phase induction motor is?
a) Zero
b) Ns
c) 2Ns
d) -Ns

Answer: b
Explanation: There will be rotating magnetic field will be produced causing the emf to be induced and the current will flow in the rotor at a speed of synchronous speed.

4. Two three phase induction motors A and B are identical in all respects except that motor A has a larger air-gap than motor B. Which motor will have more no load current?
a) A
b) B
c) Both A and B
d) Neither A nor B

Answer: a
Explanation: As the air gap of motor A is more, it will require more flux to excitation and so the no load current.

5. Two three phase induction motors A and B are identical in all respects except that motor A has a larger air-gap than motor B. Which motor will have poorer power factor?
a) A
b) B
c) Both A and B
d) Neither A nor B

Answer: a
Explanation: Due to larger air gap of motor A, it will need more of exciting current. So the no load angle will increase and power factor will deteriorate.

6. Two three phase induction motors A and B are identical in all respects except that motor A has a larger air-gap than motor B. Which motor will have better full-load power factor?
a) A
b) B
c) Both A and B
d) Neither A nor B

Answer: b
Explanation: At full load conditions, the excitation current is not very high and so the power factor improves.

7. A three phase induction motor is sometimes calles a generalized transformer in so far as voltage and frequency transformation has been concerned. How a three phase induction motor operates when rotor frequency is equal to stator frequency?
a) It will not operate
b) It will operate as induction motor only
c) It will operate as induction generator
d) It will operate in braking mode

Answer: a
Explanation: As the rotor and stator frequencies are equal, there will be no slip and so the zero emf will be produced.

8. A three phase induction motor is sometimes called a generalized transformer in so far as voltage and frequency transformation has been concerned. How a three phase induction motor operates when rotor frequency is greater than stator frequency?
a) Rotor will be driven against rmf
b) Rotor will be driven in direction of rmf
c) No emf will be induced
d) The losses will be maximum

Answer: a
Explanation: As the rotor rotates at larger speed than the stator, the rmf speed is less than the rotor speed and it tries to rotate in the opposite direction to rmf.

9. A three phase induction motor is sometimes called a generalized transformer in so far as voltage and frequency transformation has been concerned. How a three phase induction motor operates when rotor frequency is less than stator frequency?
a) It operates as induction motor
b) Emf is induced in rotor
c) Rmf will rotate at synchronous speed
d) All of the mentioned

Answer: d
Explanation: It will operate as induction motor.

10. A three phase induction motor is sometimes called a generalized transformer in so far as voltage and frequency transformation has been concerned. Then the rotor emf E2 and the rotor current I2 are zero at __________
a) Ns
b) 2Ns
c) Zero
d) Slip of 50%

Answer: a
Explanation: The rotor emf and current are zero at the speed of synchronous speed of the machine.

11. During no load test the wattmeter reading will be __________

```
I. stator copper loss
II. stator core loss
III. rotor core loss
IV. friction and windage losses
V. Rotor copper loss
```

a) I, II, IV
b) II, III, IV
c) I, III, II, IV
d) II, IV

Answer: a
Explanation: Blocked rotor test will give stator losses and the friction and windage losses.

12. If use auto transformer method starting to start an induction motor to replace star-delta method, then the required tapping on the transformer will be __________
a) 57.73%
b) 86.7%
c) 57%
d) 66.66%

Answer: a
Explanation: k = 1/1.73 = 57.73%.

13. During the blocked rotor test the wattmeter reading will be __________

```
I. stator copper loss
II. stator core loss
III. rotor core loss
IV. friction and windage losses
V. Rotor copper loss
```

a) I, V
b) II, III, IV
c) I, III, II, IV
d) II, IV

Answer: a
Explanation: Blocked rotor test will account for copper losses.

14. The starting method for a 3-phase squirrel-cage induction motor which is inferior in view of poor starting torque per ampere of line current drawn is?
a) series-inductor method of starting
b) direct-on-line starting
c) auto-transformer method
d) star-delta method

Answer: a
Explanation: Due to inductor method, reactance increases and the starting torque decreases.

15. Reactor method of starting is preferred over resistance method because __________

```
I. power factor improves
II. increase starting torque
III. lower losses
IV. more effective in reducing voltage
```

a) III, IV
b) I, II, III
c) II, III, IV
d) I, II

Answer: a
Explanation: By reactor method of starting, losses will be lesser and voltage reduction is effective than the resistance method of starting.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Rotor EMF, Current and Power”.

1. Rotor leakage reactance for a three phase slip ring induction motor with slip ‘s’ is?
a) s(x2)
b) (x2)/s

c) x2
d) (x2)(s^2)

Answer: a
Explanation: It is s*x2.

2. In an induction motor, when the number of stator slots is equal to an integral multiple of rotor slots?
a) machine will fail to start
b) machine will get heated
c) high starting torque will be achieved
d) discontinuity in torque slip characteristic

Answer: a
Explanation: Machine fails to start as the stator slots and rotor slots become equal.

3. Two of the supply terminals to a three phase induction motor gets interchanges while regular scheduling work. When the machine is switched on, then it will __________
a) rotate in opposite direction
b) rotate in same direction
c) not start
d) get heated and winding will burn

Answer: a
Explanation: As the supply phase sequence is reversed, the machine's developed emf will also be reversed.

4. The rotor of the induction motor must never run at synchronous speed because then the relative speed between the rotating flux and rotor will be __________
a) zero and hence torque will be zero
b) zero, and torque will be maximum
c) maximum and hence, torque will be zero
d) maximum, and torque will also be zero

Answer: a
Explanation: At synchronous speed the slip will be zero and so the torque.

5. The voltage actually used to set up the working flux in the three phase induction motor is __________
a) equal to applied voltage
b) less than applied voltage
c) more than applied voltage
d) equal to rotor induced emf.

Answer: a
Explanation: The actual working flux requirement is met by the applied voltage and it is same as the applied voltage to it.

6. If the three phase supply is fed to the stator and it is running at its normal operating conditions. Then the synchronous speed can be defined as speed at which?
a) stator magnetic field rotates
b) rotor magnetic field rotates
c) rotor rotates
d) flux is set up in the rotor

Answer: a
Explanation: If it is fed from stator then the synchronous speed is also w.r.t. stator.

7.If the three phase supply is fed to the rotor and it is running at its normal operating conditions. Then the synchronous speed can be defined as speed at which?
a) stator magnetic field rotates
b) rotor magnetic field rotates
c) rotor rotates
d) flux is set up in the rotor

Answer: b
Explanation: If it is fed from rotor then the synchronous speed is also w.r.t. rotor.

8. The mmf produced by the current of the three phase induction motor __________
a) is standstill with respect to stator mmf
b) rotates at the speed of rotor in air gap
c) rotates at slip speed with respect to stator mmf
d) rotates at synchronous speed with respect to rotor

Answer: a
Explanation: The mmf produced will also be at synchronous speed and it will be stationary with respect to stator mmf which itself rotates at synchronous speed.

9. In an induction motor slip will be negative when the __________
a) rotor rotates at speed more than synchronous speed and in the direction of the rotation of stator field
b) stator magnetic field and rotor rotate in opposite direction
c) rotor rotates at speed less than synchronous speed and in the opposite direction of the rotation of stator field
d) rotor rotates at speed more than synchronous speed and in the opposite direction of the rotation of stator field

Answer: a
Explanation: s = (Ns-Nr)/Ns; Slip is negative when rotor rotates at speed more than synchronous speed and in the direction of the rotation of stator field.

10. A 3-phase induction motor is operating at slip ‘s’. If the slip is reversed, its slip at the instant will be __________
a) 2-s
b) zero
c) 2+s
d) 1-s

Answer: a
Explanation: For the reversed phase sequence the slip becomes 2-s.

11. In a three phase induction motor, voltage between the slip rings at standstill is 50 V. At full load the slip is 0.04. The voltage between slip rings at full load is?
a) 2V
b) 50V
c) 20V
d) 5V

Answer: a
Explanation: E2 = s*E = 0.04*50 = 2V.

12. A three phase induction motor is connected to 400V, 50 hz supply. If the stator to rotor turn ratio is 2, the standstill rotor induced voltage per phase is?
a) 115.5 V
b) 231 V
c) 346 V
d) 200 V

Answer: a
Explanation: Emf at secondary per phase = (400/1.73)/2 = 115.47 V.

13. The torque developed in the three phase induction motor depends on __________

```
(i) standstill rotor phase emf
(ii) rotor power factor
```

a) (i) only
b) (ii) only
c) both (i) and (ii)
d) none of the mentioned

Answer: c
Explanation: The electromagnetic torque developed in the ac machine depends on the rotor emf and the power factor.

14. If a 400 V, 50 hz star connected, 3-phase squirrel cage induction motor is operated from 400V and 75 Hz supply. The torque that the motor can now provide while drawing rated current from the supply will __________
a) reduce
b) increase
c) remains same
d) increases or reduces based on the rotor resistance.

Answer: a
Explanation: The reactance will increase and so the torque will decrease.

15. For a constant load torque, the supply voltage of a squirrel cage induction motor is reduced by a factor of 0.5, its rotor current is modified by a factor is?
a) 2
b) 0.5
c) 4
d) 0.25

Answer: a
Explanation: For constant torque the product of emf and current should be constant.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Induction Motor Phasor Diagram”.

1. The rotor of the slip ring induction motor is connected to an ac source and stator is short circuited. If the rotating magnetic field is rotates clockwise, the rotor rotates in __________
a) anticlockwise
b) clockwise
c) remains stationary
d) any of the mentioned

Answer: a
Explanation: Rotor will rotate in anticlockwise direction as the net speed w.r.t. stator should be stationary.

2. Rotor leakage impedance at starting is different from its value at normal running conditions.
a) True
b) False

Answer: a
Explanation: The rotor leakage impedance depends on the slip of the machine. Slip varies with the running conditions.

3. If the hysteresis is neglected in the induction machine, then the the air gap flux ________ the resultant mmf.
a) is in phase with
b) lags
c) leads by a small angle
d) can not decide the nature of the operation

Answer: a
Explanation: When the hysteresis loss is neglected, then the air gap flux will be in phase with the resultant mmf.

4. On increasing the starting torque of the induction motor, the maximum torque is also increased.
a) False
b) True

Answer: a
Explanation: It is false, as the starting torque and the maximum torque are independent of each other.

5. Approximately the efficiency of the rotor of the induction motor depends on the __________
a) rotor speed
b) synchronous speed
c) rotor speed and synchronous speed
d) magnetic field speed

Answer: c
Explanation: Efficiency of the rotor is approximately equal to ratio of speed of rotor to synchronous speed.

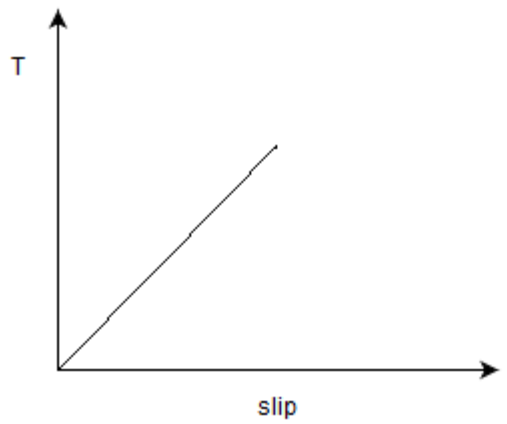
6. A 400, 3-phase, 50 Hz, 4 pole induction motor takes a line current of 10 A with 0.86 pf lagging. What is the stator input?
a) 5.95 kW
b) 6.95 kW
c) 4.45 kW
d) 8.38 kW

Answer: a
Explanation: P = 1.73*V*I*cosθ = 1.73*400*10*0.86 = 5.958 kW.

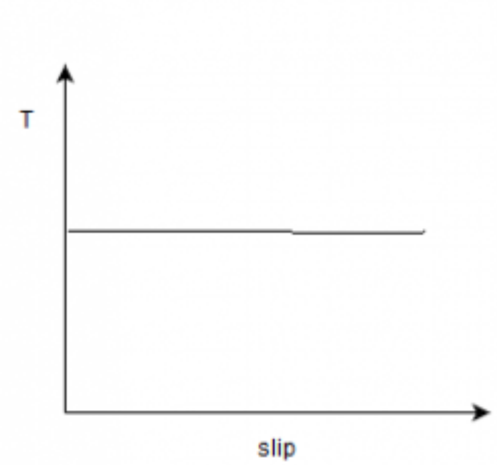
7. The power input to the 3-phase induction motor is 60 kW. The stator losses total 1 kW. Find the mechanical power developed at the slip of 3%.
a) 57.23 kW
b) 58 kW
c) 56.8 kW
d) 59 kW

Answer: a
Explanation: Air gap power = 60-1 = 59 kW
Pm = (1-s)Pag = 0.97*59 = 57.23 kW.

8. Choose the most appropriate. The torque slip characteristic of the induction motor at the slip of 3-6 %.



a)



b)

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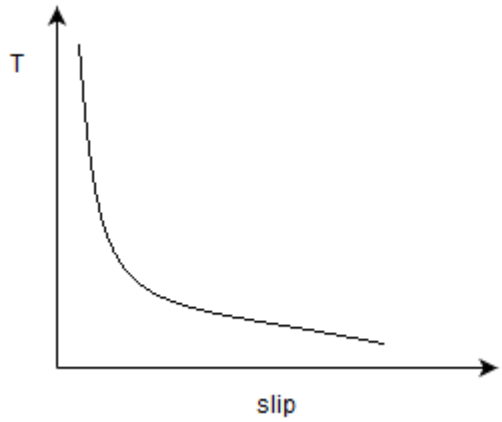
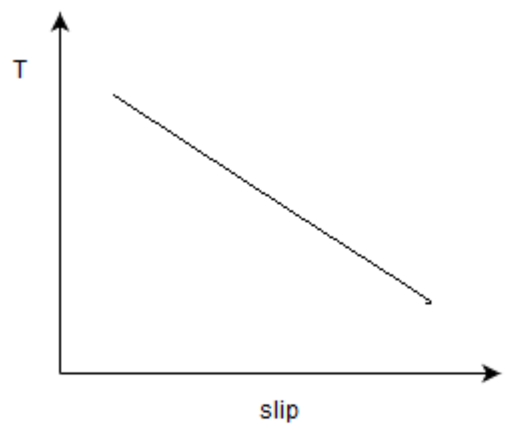
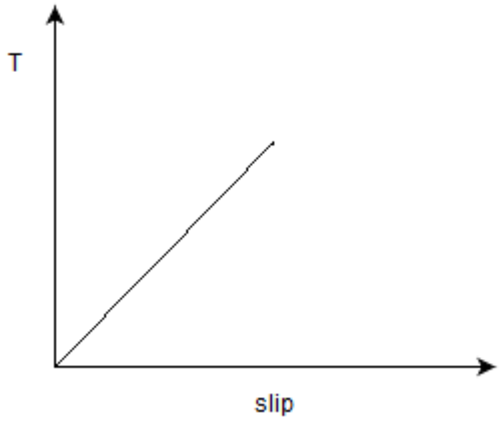


c)

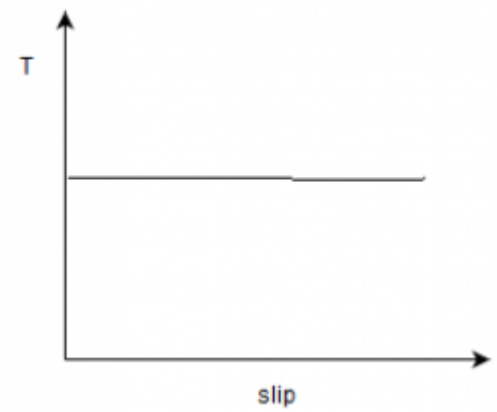
d) 

Answer: a
Explanation: At low slip regions, T α s*V^2/R2.

9. The torque and the slip characteristic is most correctly related by which of the following below in the region of 30-50% operation of slip.



a)



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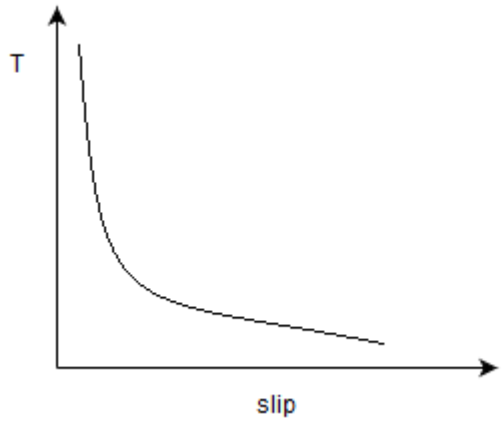
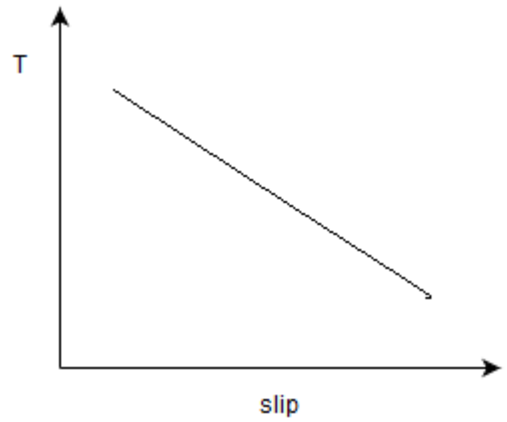


c)

d) 

Answer: c
Explanation: At the higher values of the slip, T α 1/s.

10. An induction motor X operating at the slip of 3%. An induction motor Y operating at slip of 40%.
a) Machine X is only stable
b) Machine Y is only stable
c) Both the machine X and Y are stable
d) Neither X nor Y is stable

Answer: a
Explanation: Induction motor operates stable in the low slip regions as the losses are reduced.

11. A 3-phase induction motor had the maximum rated torque of 40 N-m while the load torque applied to it is 55 N-m.
a) The machine will become unstable
b) The machine will operate in stable region
c) The machine will get heated up
d) The machine will run at dangerously high speed

Answer: a
Explanation: Induction motor is unstable when the load torque is more the the maximum torque of the machine.

12. I. Maximum torque can be achieved by inserting an additional resistance at desired slip in the rotor.
II. Maximum torque can be altered by adding the external resistance in the rotor.
a) Only I is true
b) Both I and II are true
c) Neither I nor II is true
d) Only II is true

Answer: a
Explanation: Maximum torque is independent of the resistance.

13. If the frequency is reduced by 50% for a 3-phase, 50 Hz induction motor having 4 poles. The slip at which the maximum torque occurs becomes __________
a) 2*s
b) s
c) 1/2s
d) 1/s

Answer: a
Explanation: s = r/x
s α 1/f.
If the frequency is reduced to half, slip increases to twice.

14. If the voltage of a three phase induction motor if increased to 200%, then the slip if the machine changes to __________
a) 1/s
b) s
c) 1/2s
d) 2*s

Answer: c
Explanation: The slip will remain independent of the operating voltage.

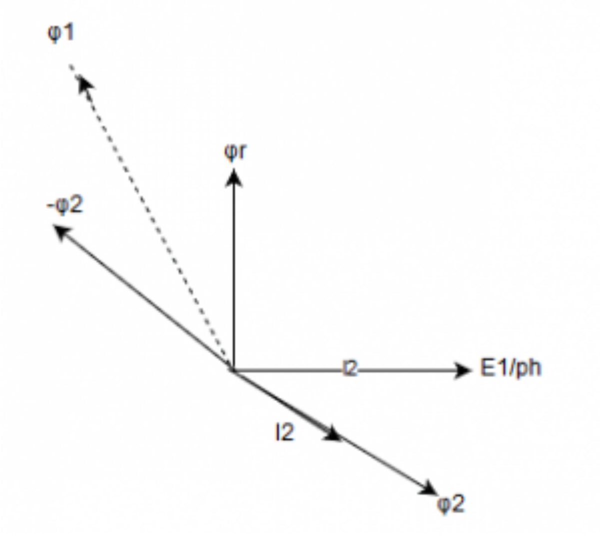
15. If the voltage and frequency of the induction machine is reduced to 50% of the operating region,the slip of the machine will be?
a) 2*s
b) s
c) 1/2s
d) 1/s

Answer: a
Explanation: Slip α 1/f; Even though the flux remains constant as the v/f ratio is constant.

16. If the operating voltage of the induction motor is increased by twice while keeping the frequency of the operation constant. Then the new starting torque will be?
a) 4*T
b) 1/4*T
c) T
d) 2*T

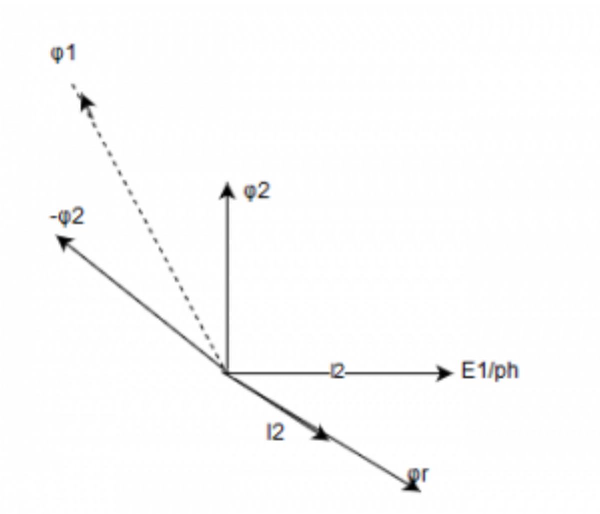
Answer: a
Explanation: Tst α V^2.
T2/T1 = (2/1)^2
T2 = 4*T1.

17. The phasor diagram for the induction motor is?



a)

b)



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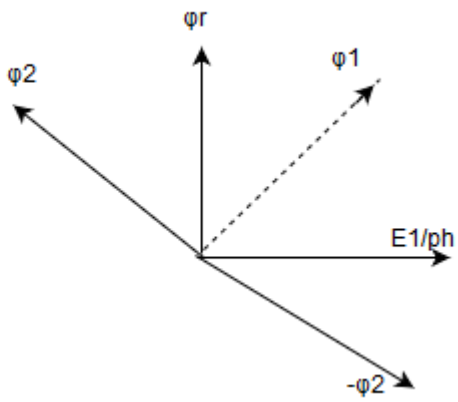

c)

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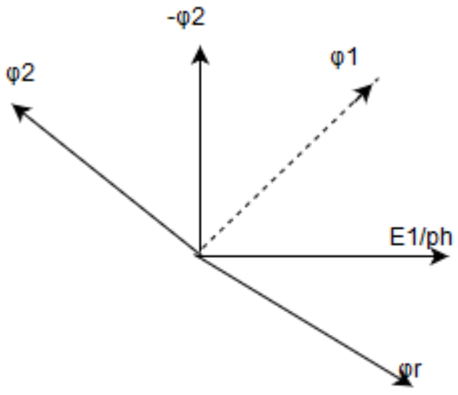
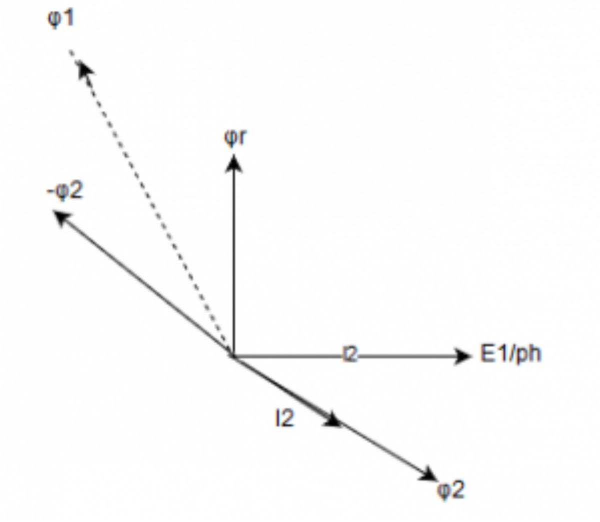


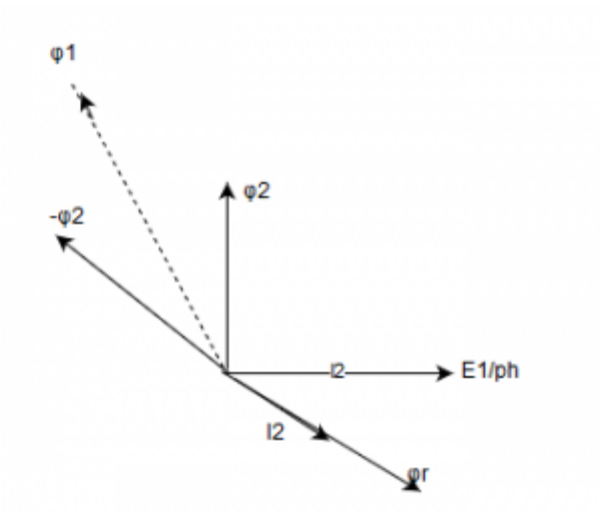
d)

Answer: a
Explanation: Relative space angle between the two rotating magnetic fields is 90+θ.

18. The phasor diagram for the induction generator is best represented by?

a) 

b)



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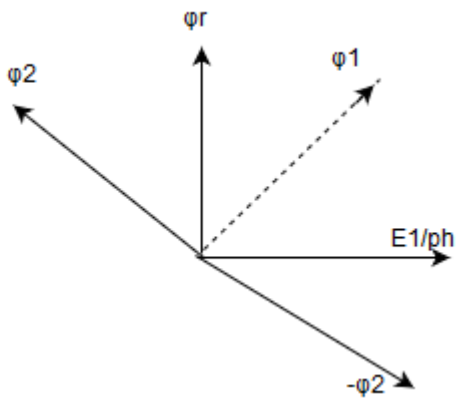
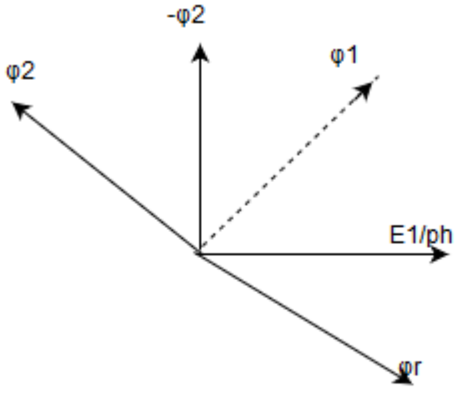


c)

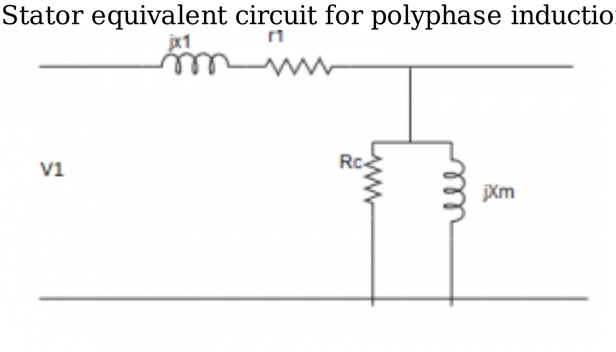


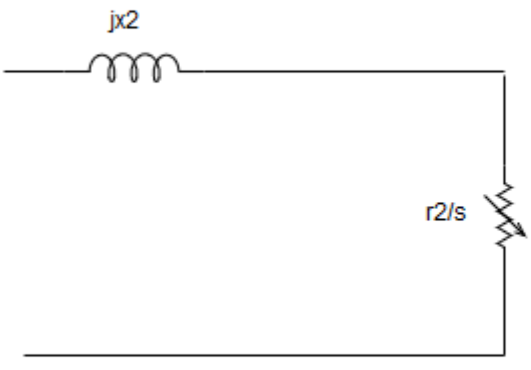
d)

Answer: c
Explanation: Relative space angle between the two rotating magnetic fields is 90-θ.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Equivalent Circuit".

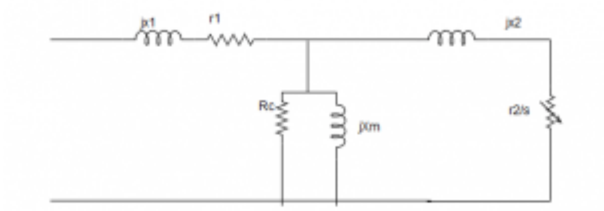
1. Stator equivalent circuit for polyphase induction motor is?

a) 

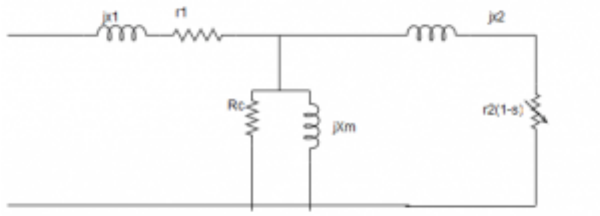
b) 

d)

c)

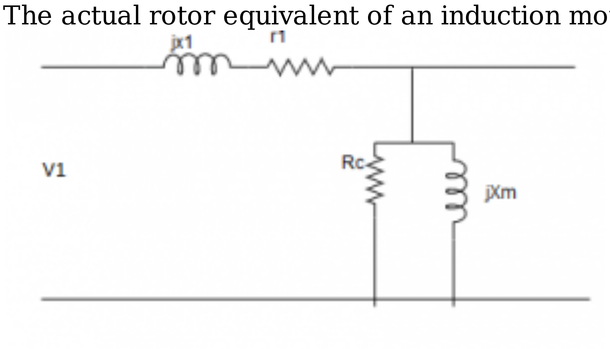


d)

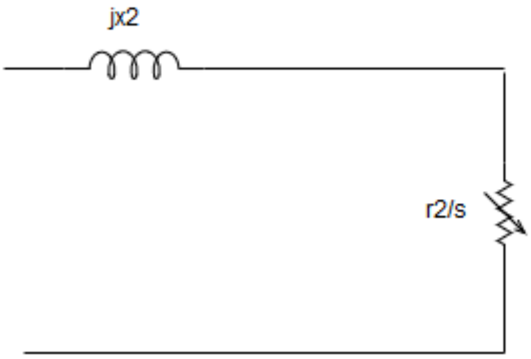


Answer: a
Explanation: The Rc and Xm represent the copper losses and the core losses in the stator.

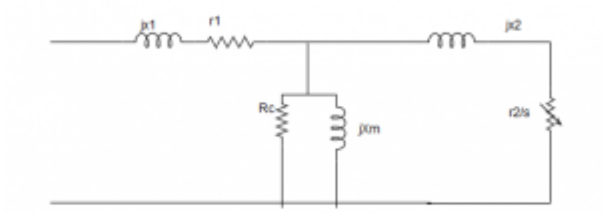
2. The actual rotor equivalent of an induction motor is best depicted by?



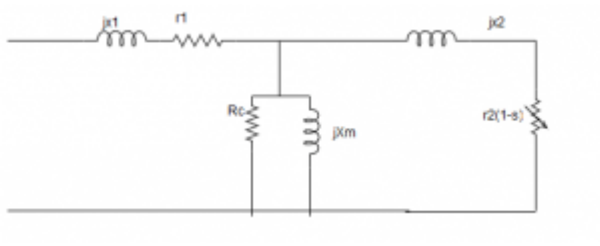
a)



b)

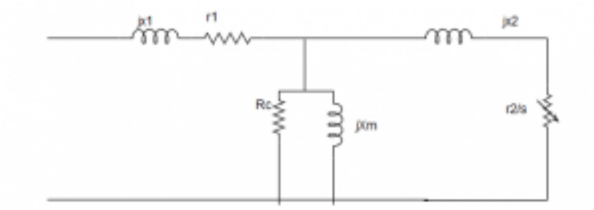


c)

d) 

Answer: b
Explanation: Taking the actual reactance which is slip dependent in the circuit.

3. Rc in the below circuit represents?



a) core loss of induction motor
b) no load losses of induction motor
c) iron losses of induction motor
d) copper losses of induction motor

Answer: a
Explanation: The shunt resistance will represent only the core loss of the induction motor.

4. The electrical anlogous of the mechanical load in the induction machine is given by?
a) (r2)*(1-s)/s
b) (r2)
c) (r2)/s
d) (r2)/(1-s)

Answer: a
Explanation: Mechanical load is represented by a factor (1-s)/s of the rotor resistance.

5. The actual rotor resistance referred to the stator if the induction motor is?
a) r2
b) (r2)/s
c) (r2)/(1-s)
d) (r2)*(1-s)/s

Answer: a
Explanation: The actual resistance will be r2 only.

6. The leakage reactances are less than their values at the full load operating conditions. Why?
a) Due to large inrush current during starting
b) Due to very low saturation
c) Due to speed is not same as synchronous speed
d) All of the mentioned

Answer: a
Explanation: During the start, there will be large inrush currents flowing in the machine, which cause saturation and so the leakage reactance decreases at start.

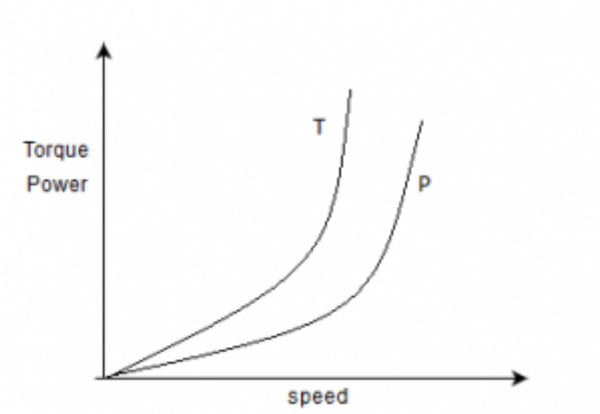
7. The leakage reactance and the rotor resistance are constant throughout the operation in an induction motor.
a) True
b) False

Answer: b
Explanation: No, the reactance changes with the variation in the slip of the machine.

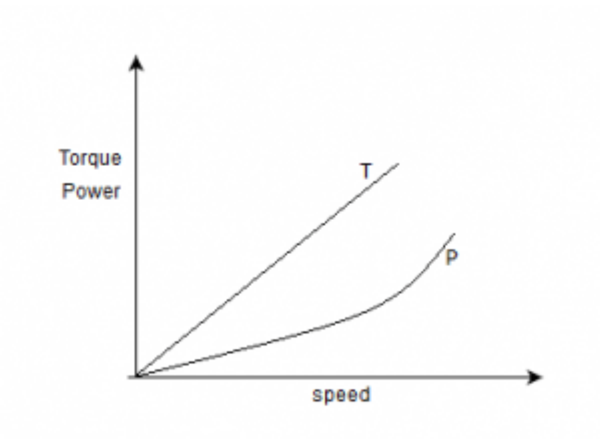
8. At standstill the equivalent of the 3-phase induction motor is similar to __________
a) short-circuited two winding transformer
b) open circuit two winding transformer
c) stand still synchronous motor
d) none of the mentioned

Answer: a
Explanation: For s=1 at standstill, so it same as the short circuit of the transformer for the induction motor.

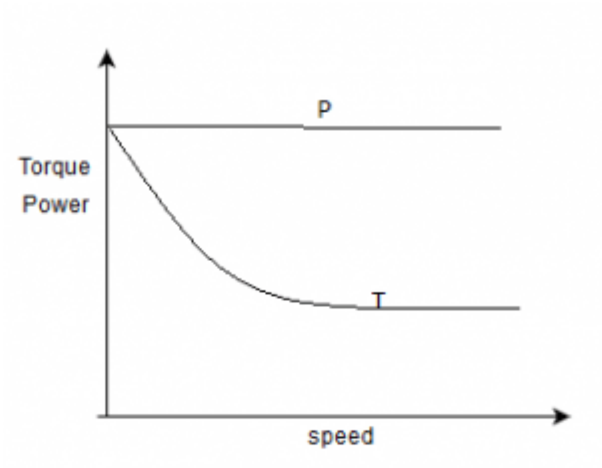
9. The graph for the induction motor operating with load torque proportional to square of the shaft speed.

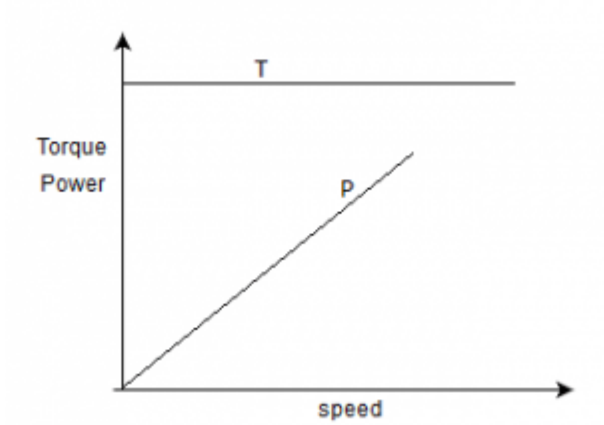


a)



b)

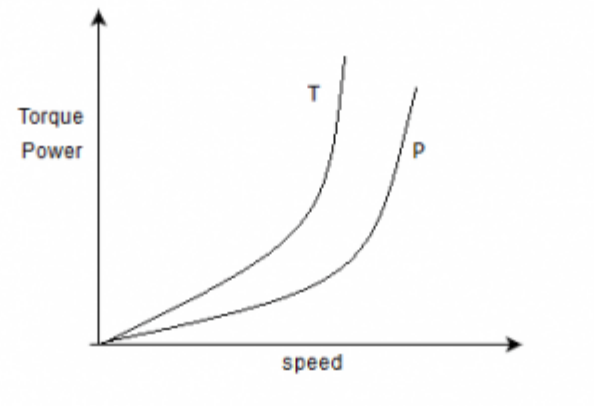
c) 

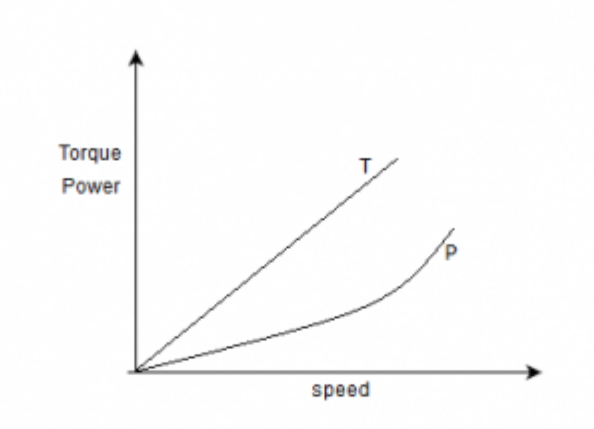


d)

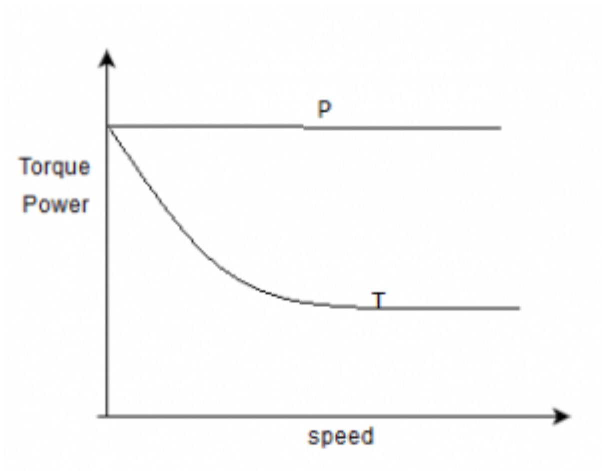
Answer: a
Explanation: Torque α (speed)^2; Power = torque*speed.

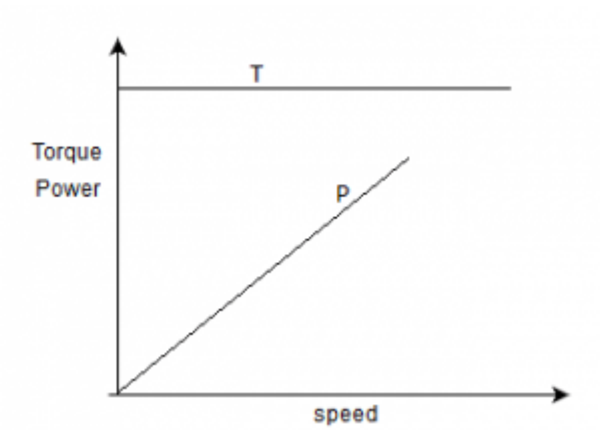
10. An induction motor is operating for the load with torque developed proportional to the shaft speed. The characteristics below is?

a) 



b)

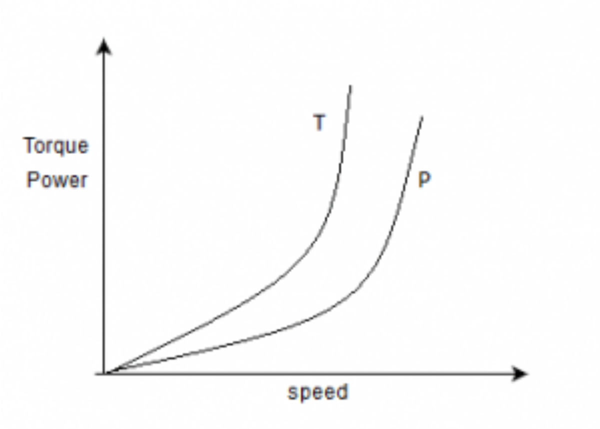
c) 



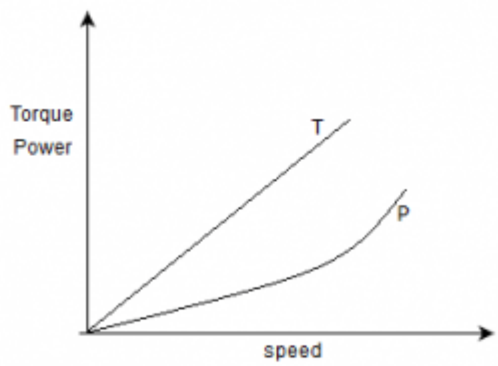
d)

Answer: b
Explanation: Torque α (speed); Power = torque*speed.

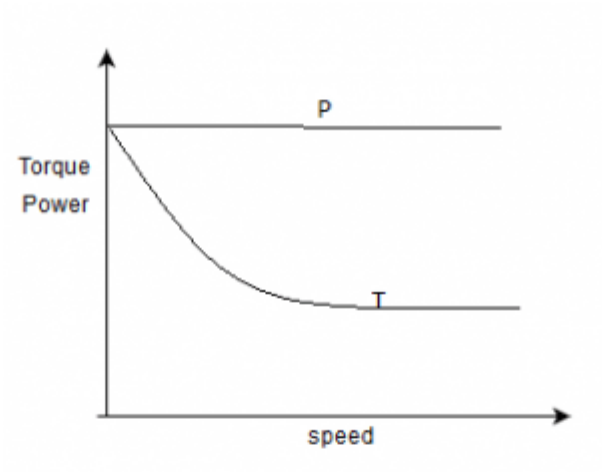
11. The characteristics required of the induction motor to match that of the load for load torque independent of the shaft speed is?

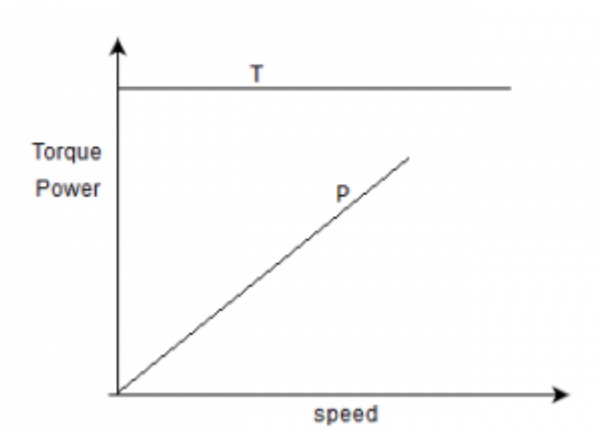


a)



b)

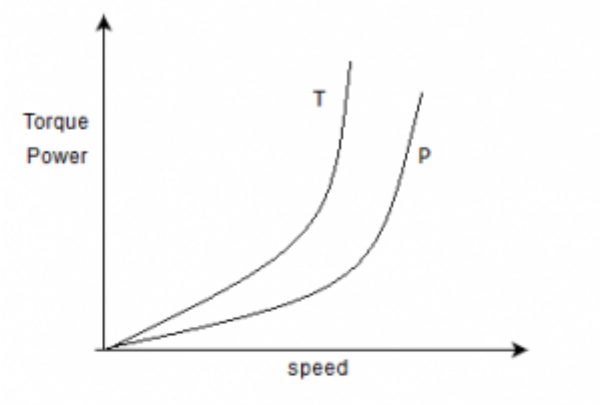
c) 



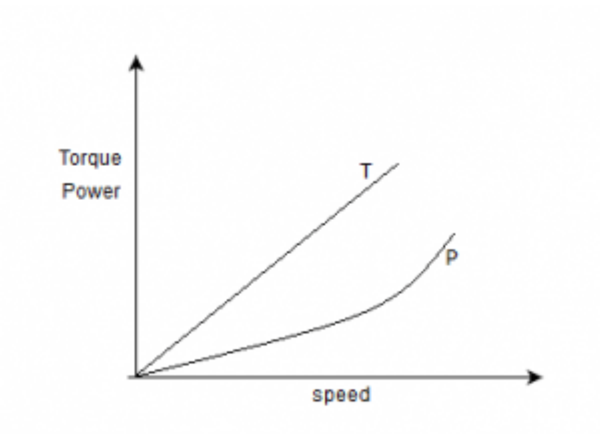
d)

Answer: b
Explanation: Torque = constant ; Power = torque*speed;

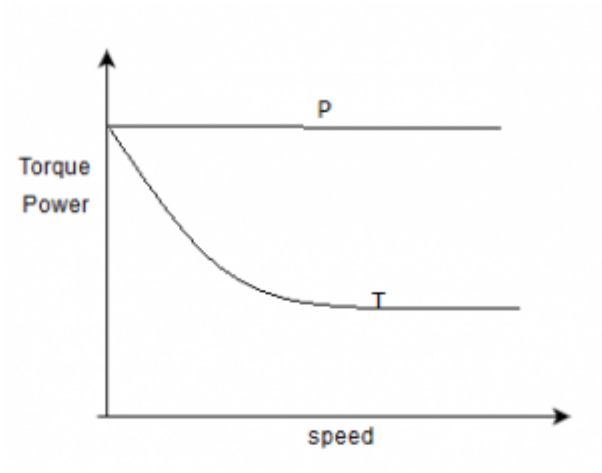
12. The characteristics required of the three phase induction motor to match that of the load with the criteria of load torque inversely proportional to the shaft speed is?



a)



b)



c)

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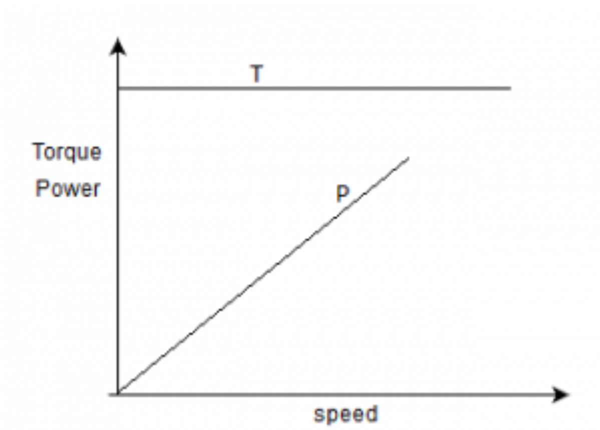


d)

Answer: d
Explanation: Torque α 1/(speed); Power = torque*speed;

13. In a 3-phase induction generator which is self excited, load has been increased. To keep the frequency of the generated voltage constant, speed of the induction machine should be __________
a) increased
b) decreased
c) maintained less than rated synchronous speed
d) maintained more than rated synchronous speed

Answer: a
Explanation: Frequency should be increased to maintain the speed constant.

14. A 3-phase induction machine is running at super synchronous speed. For the machine to be self excited it __________
a) draws reactive power from mains
b) draws real power from mains
c) feeds reactive power to mains
d) generates emf by gradual voltage build up

Answer: a
Explanation: To provide the reactive power for the machine, it will draw reactive power from a source.

15. Induction generators will deliver power at __________
a) leading p.f.
b) lagging p.f.
c) unity p.f.
d) zero p.f.

Answer: a
Explanation: Induction generator will deliver power at leading p.f.

16. A star connected capacitor bank is connected to the induction motor having capacitance C and VA rating as VAs. If the capacitor bank is replaced by a delta bank then?
a) C = C/3, VA = VAs
b) C = 3C, VA = VAs
c) C = C, VA = VAs/3
d) C = C/3, VA = VAs/3

Answer: a
Explanation: The VA rating will not change due the configuration, but the capacitance will change due to the delta configuration to C/3.

17. A delta connected capacitance bank is preferred over a star connected bank. This is done to ensure __________
a) lesser capacitance
b) easy calculation
c) easier connection
d) all of the mentioned

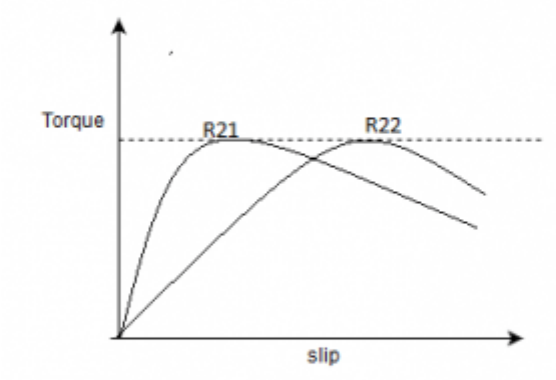
Answer: a
Explanation: Delta connected bank will have lesser capacitance than star connected and so the better power factor improvement.

18. If it is desired to approximate the efficiency of an induction motor operating at slip ‘s’, then its efficiency is given by?
a) 1-s/1+s
b) 1/1+s
c) s/s+1
d) s/1-s

Answer: a
Explanation: Approximately efficiency is given as 1-s/1+s for an IM.

This set of Electrical Machines Questions and Answers for Experienced people focuses on “Analysis of the Equivalent Circuit”.

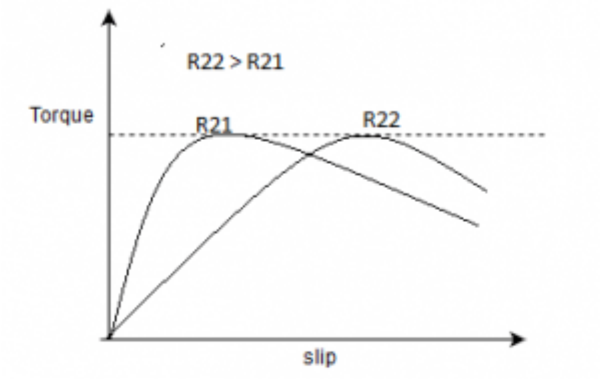
1. Below is the torque slip characteristic of the induction machine. What can be inferred from it?

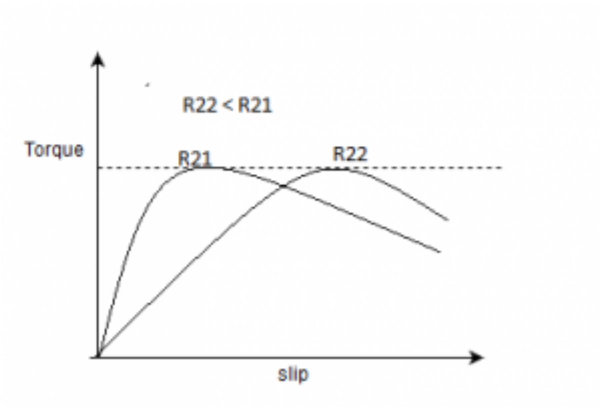


a) R22 > R21
b) R22 < R21
c) R22 = R21
d) R22 = -R21

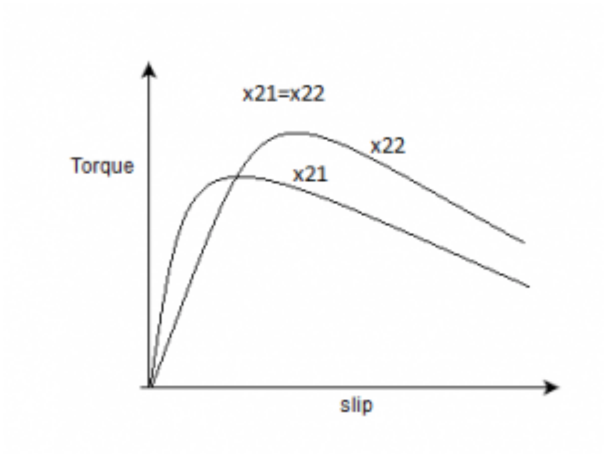
Answer: a
Explanation: As rotor resistance increases, the starting torque will increase but not the maximum torque. But the slip at which the maximum torque occurs will change.

2. Choose the most appropriate from the following characteristics of 3 phase induction motor torque-slip characteristics.

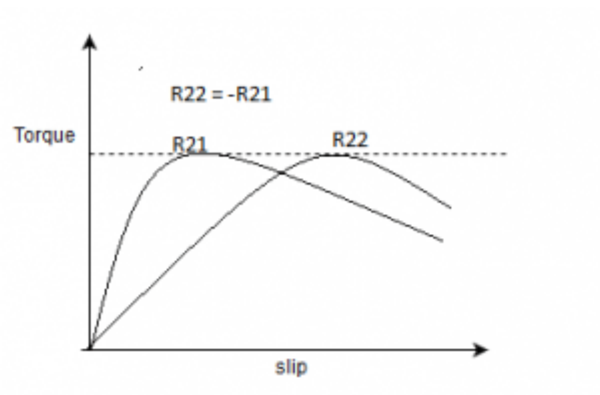
a) 



b)



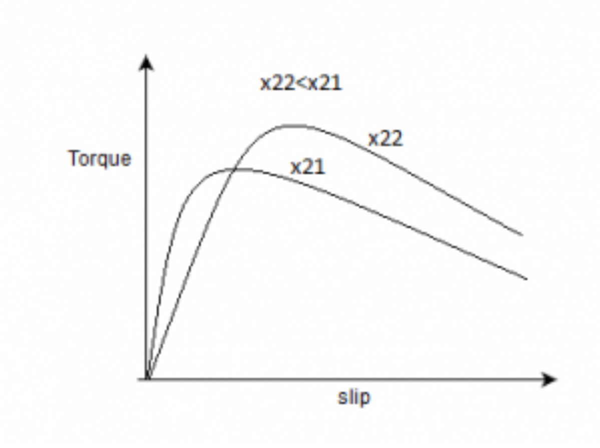
c)

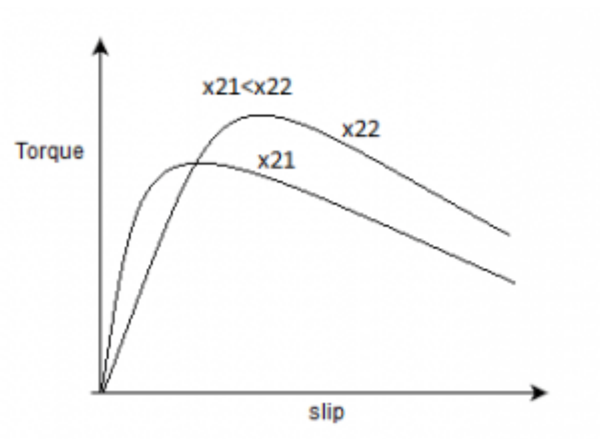


d)

Answer: a
Explanation: As rotor resistance increases, the starting torque will increase but not the maximum torque. But the slip at which the maximum torque occurs will change.

3. If the reactance of the 3-phase slip ring induction motor is increased then the torque-slip characteristic varies as?

a) 



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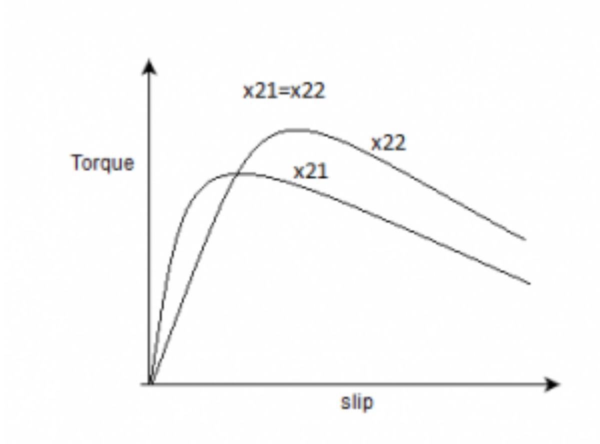
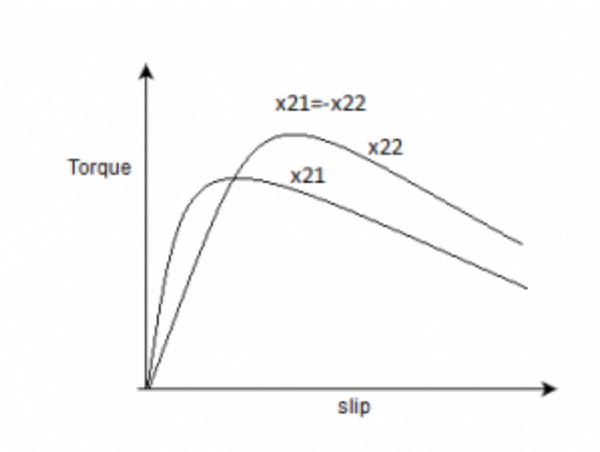


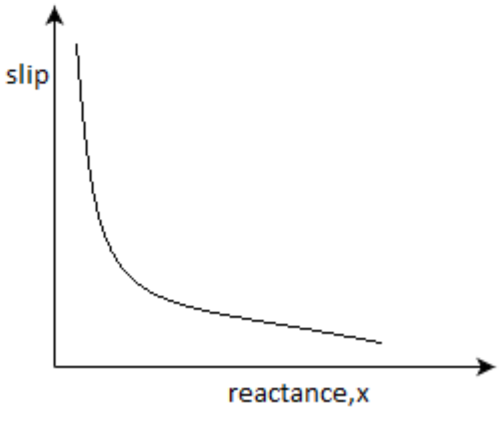
c)



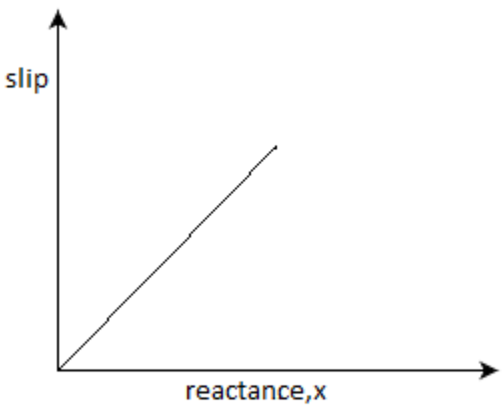
d)

Answer: a
Explanation: Torque is inversely proportional to reactance

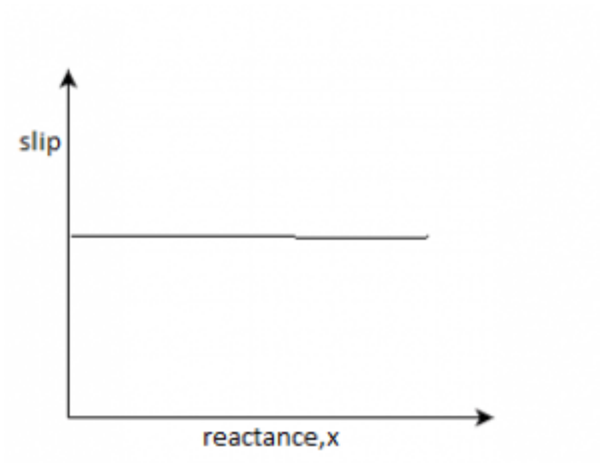
4. The reactance vs slip is given by?



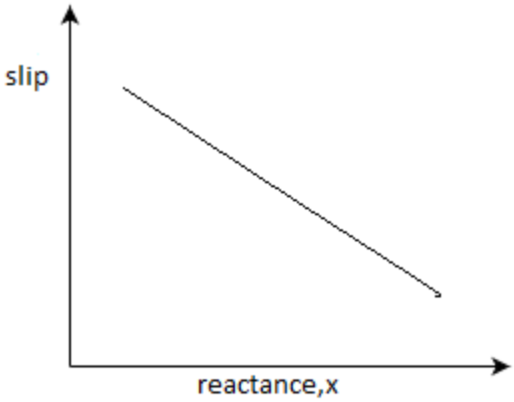
a)



b)



c)

d) 

Answer: a
Explanation: Slip is inversely proportional to the slip.

5. Induction generator is equivalent to __________
a) underexcited alternator
b) dc generator
c) over excited alternator
d) leading over excited alternator

Answer: a
Explanation: It is similar to underexcited alternator.

6. When an induction generator is connected to an infinite bus, it __________
a) requires no capacitor bank
b) requires star connected capacitor bank
c) requires delta connected capacitor bank
d) requires any capacitor bank

Answer: a
Explanation: There is no requirement of the capacitor bank when induction generator is connected to infinite bus.

7. Torque produced by induction generator is negative.
a) True
b) False

Answer: a
Explanation: Because the developed torque is produced opposite to the rotating field.

8. Slip greater than unity is obtained practically by __________
a) plugging

b) changing phase sequence
c) changing stator leads
d) any of the mentioned

Answer: d
Explanation: The direction of the rotating field can be reversed by any one of the methods.

9. Changing the rotor resistance will also affect __________
a) starting torque, speed, current
b) maximum torque, speed, current
c) maximum torque, speed, current, starting torque
d) speed and current

Answer: a
Explanation: Rotor resistance does not alter the maximum torque of the induction machine.

10. At starting, developed mechanical power is ______ and developed torque is _______
a) zero, not zero
b) zero,zero
c) not zero, zero
d) not zero, maximum

Answer: a
Explanation: At start, torque is not zero.
P α (1-s)/s; so it is zero at s = 1.

11. Mechanical power developed in the braking region of the induction motor is __________
a) negative
b) positive
c) zero
d) any of the mentioned

Answer: a
Explanation: slip is more than one, so Pm will be negative.

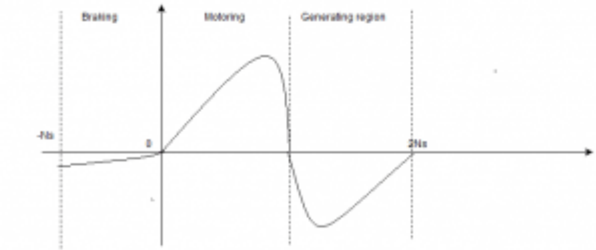
12. Developed torque during plugging is __________
a) negative
b) positive
c) zero
d) any of the mentioned

Answer: b
Explanation: Torque will not be negative in braking mode in the induction motor.

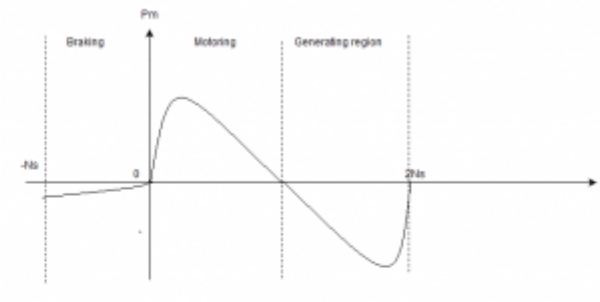
13. In the 3-phase induction motor developed torque during plugging is _______ mechanical power developed in the braking region of the induction motor is _______
a) positive, negative
b) negative, positive
c) positive, positive
d) negative, negative

Answer: a
Explanation: Tem is positive while Pm will be negative in braking or plugging operation.

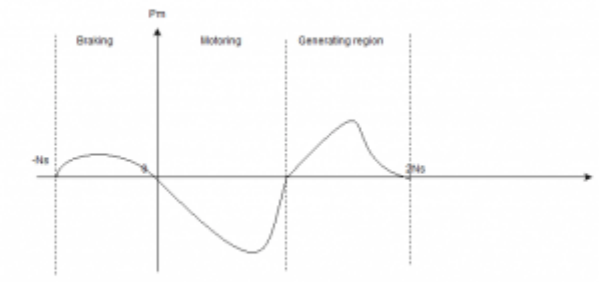
14. The power slip characteristic is given as?



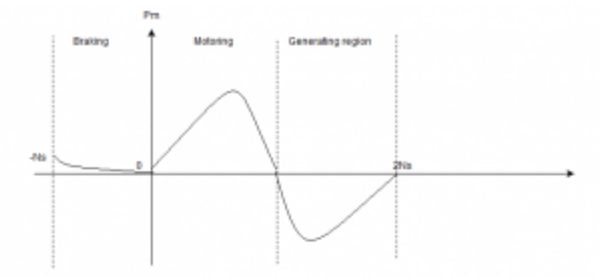
a)


Pm
Braking
Motoring
Generating region
-Ns
0
2Ns

b)


Pm
Braking
Motoring
Generating region
-Ns
0
2Ns

c)

d) 

Answer: a
Explanation: Mechanical power developed is negative in braking and generating mode and it is zero at starting.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Operating (or Performance) Characteristics of Induction Motors”.

1. A 10 kW, 400 V, 3-phase, 4-pole, 50 Hz induction motor develops the rated output at rated voltage with its slip rings shorted. The maximum torque equal to twice the full load torque occurs at the slip of 10% with zero external resistance in the rotor circuit. The slip at the full load torque will be?
a) 2.7%
b) 5%
c) 3.7%

d) 10%

Answer: a
Explanation: Tfl/Tem = 2/((sm/sf)+ (sf/sm))
1/2 = 2/((0.1/sf)+(sf/0.1))
s^2-0.4s+0.01=0
s=0.0268.

2. A 10 kW, 400 V, 3-phase, 4-pole, 50 Hz induction motor develops the rated output at rated voltage with its slip rings shorted. The maximum torque is twice the full load torque occurs at the slip of 10% with zero external resistance in the rotor circuit. The speed at the full load torque will be?
a) 1460 rpm
b) 1400 rpm
c) 1360 rpm
d) 1470 rpm

Answer: a
Explanation: 1/2 = 2/((0.1/sf)+(sf/0.1))
s = 2.68%
rotor speed = (1-0.0268)=1460rpm.

3. A 10 kW, 400 V, 3-phase, 4-pole, 50 Hz induction motor develops the rated output at rated voltage with its slip rings shorted. The maximum torque is twice the full load torque occurs at the slip of 10% with zero external resistance in the rotor circuit. An external resistance is now tripled in the rotor circuit. Then the slip at which maximum torque occur for the same load torque is?
a) 0.3
b) 0.268
c) 0.03
d) 3

Answer: a
Explanation: The load torque is maintained constant.
So, r2/smT = X;
r2/x = 0.1
new value of slip will be, 3*r2/x=0.1
smT = 0.3.

4. A 10 kW, 400 V, 3-phase, 4-pole, 50 Hz induction motor develops the rated output at rated voltage with its slip rings shorted. The maximum torque is twice the full load torque occurs at the slip of 10% with zero external resistance in the rotor circuit. An external resistance is now tripled in the rotor circuit. Then the stator current will __________
a) remain constant
b) increase
c) decrease
d) any of the mentioned

Answer: a
Explanation: As the ratio of r2/s is constant, the changes will not be reflected to the stator.

5. Introducing the external resistance increases __________

```
(i) speed
(ii) output power
(iii) starting torque
```

a) (iii)
b) (ii), (iii)
c) (ii)
d) (i), (ii), (iii)

Answer: a
Explanation: External resistance only increases the starting torque.

6. Introducing the external resistance decreases __________

```
(i) speed
(ii) output power
(iii) starting torque
```

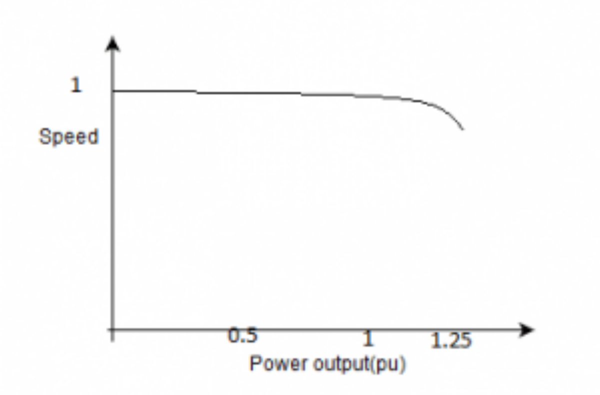
a) (iii)
b) (ii), (iii)
c) (i), (ii)
d) (i), (ii), (iii)

Answer: c
Explanation: Speed and the output power decrease with insertion of the external resistance in the circuit.

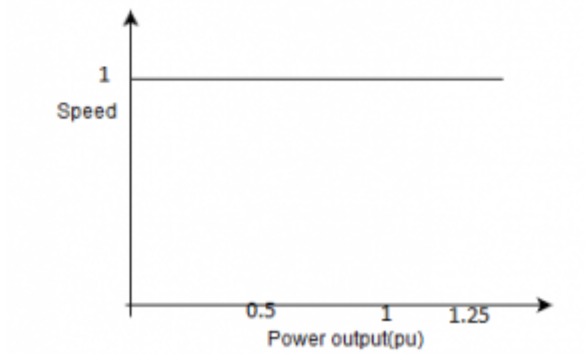
7. For a three phase induction motor, maximum torque is double the full load torque and starting torque is 1.6 times the full load torque. To get a full load slip of 5%, percentage reduction in the rotor resistance should be?
a) 62.7%
b) 75%
c) 60%
d) 35%

Answer: a
Explanation: Slip at which maxim torque occurs is calculated as smT=0.5.
r2/x2=0.5
for full load slip of 0.05, 1/2 = 2/((0.05/sf)+(sf/0.05))
smT2 = 0.186
reduction in resistance = (0.5×2-0.186×2)/0.5×2 = 63%.

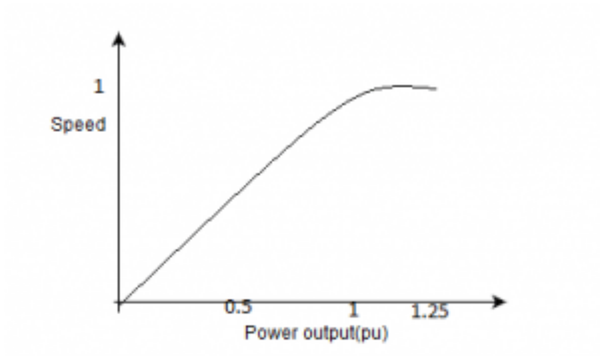
8. The speed-power output characteristic of a 3-phase induction motor is?

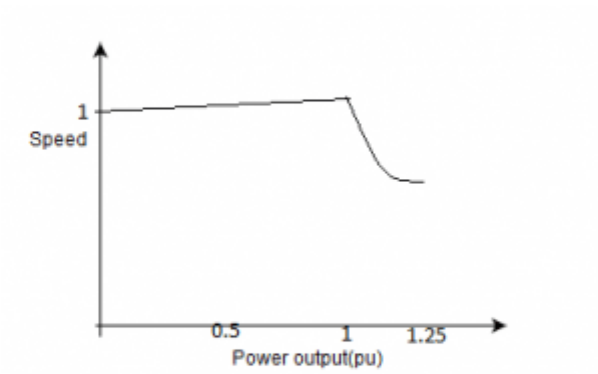


a)



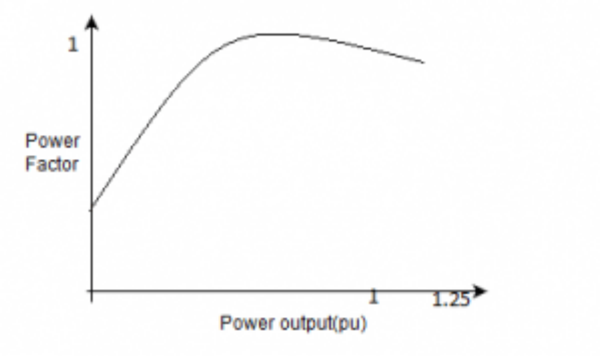
b)

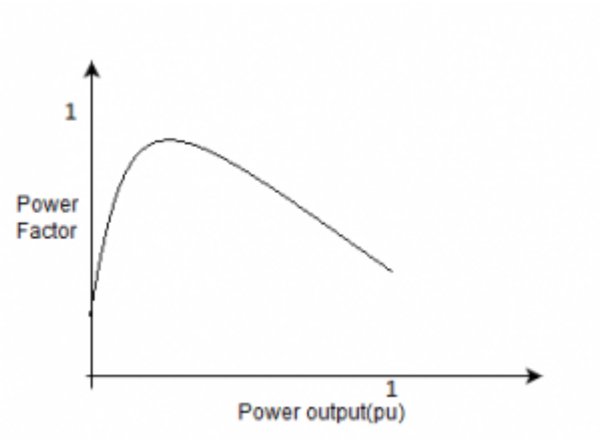
c) 

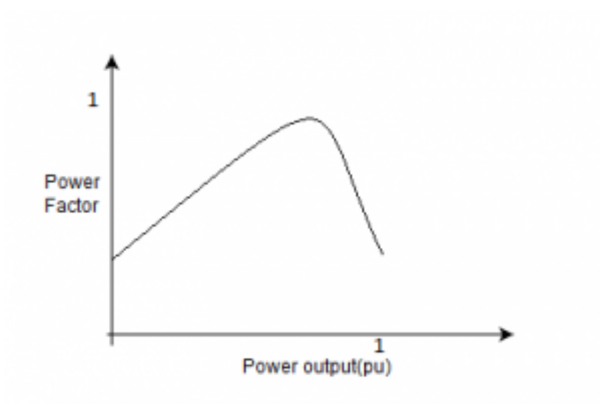
d) 

Answer: a
Explanation: At no load, rotor speed is near to synchronous speed and the operating slip is not very large, so there is small difference in operating speed and the synchronous speed.

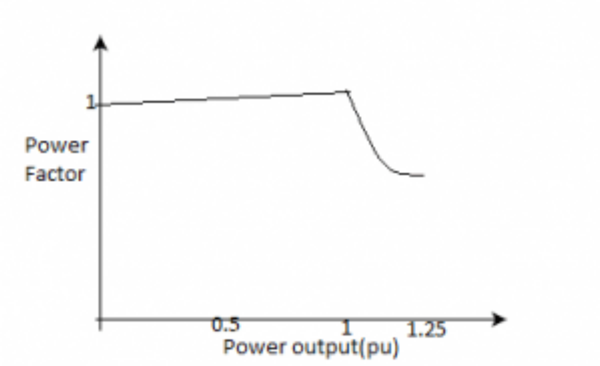
9. The power factor variation of the 3-phase induction motor is given by?

a) 

b) 

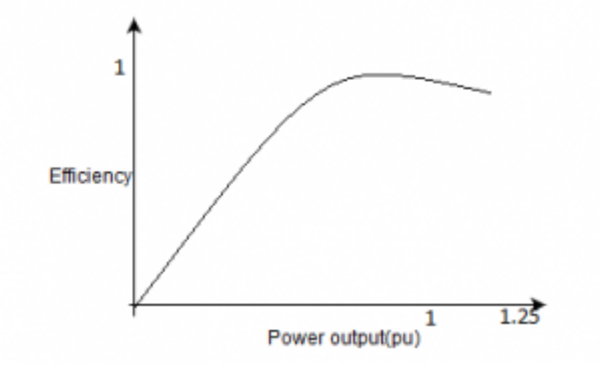


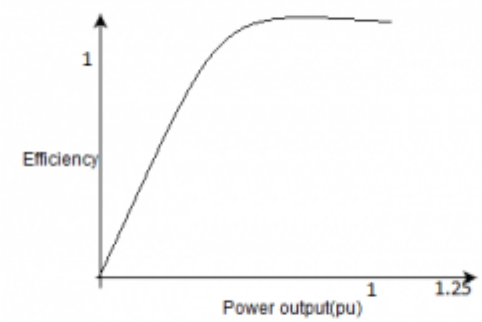
c)

d) 

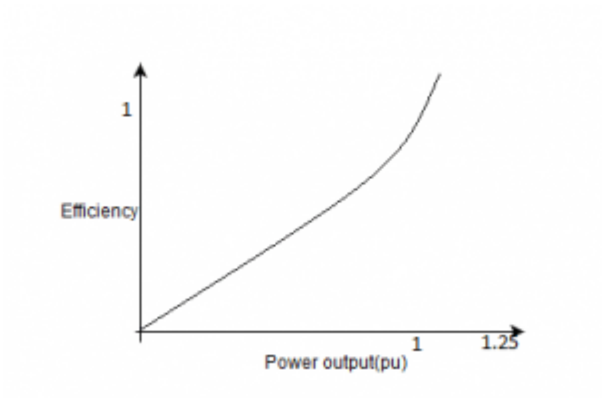
Answer: a
Explanation: None.

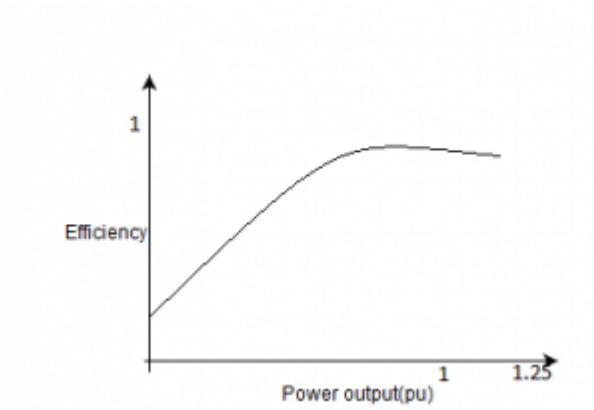
10. Four students had been conducting conducting experiments on the same induction motor for its efficiency characteristics. Which student has taken the best results?

a) 



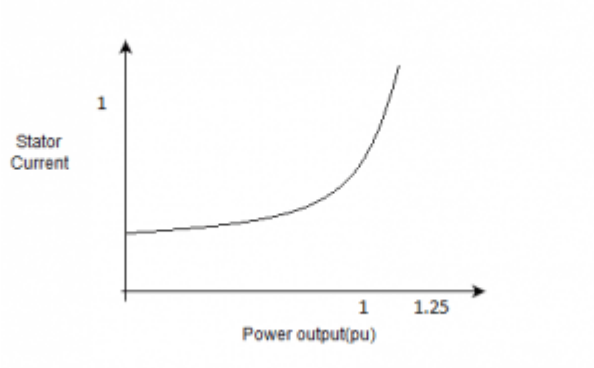
b)

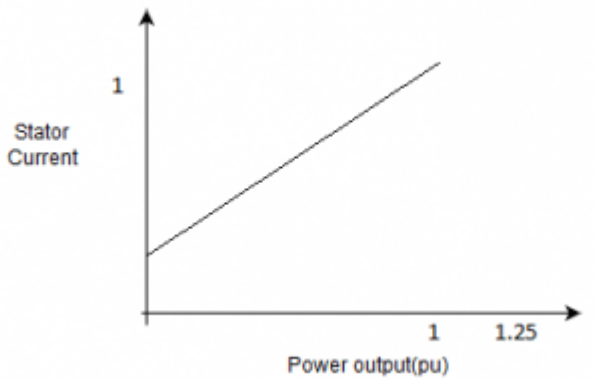

1
Efficiency
1
1.25
Power output(pu)
c)


1
Efficiency
1
1.25
Power output(pu)
d)

Answer: a
Explanation: At no load the shaft output is zero so the efficiency is also zero. At lower loads, fixed losses are more comparable to variable losses. As the load is increased, efficiency also rises.

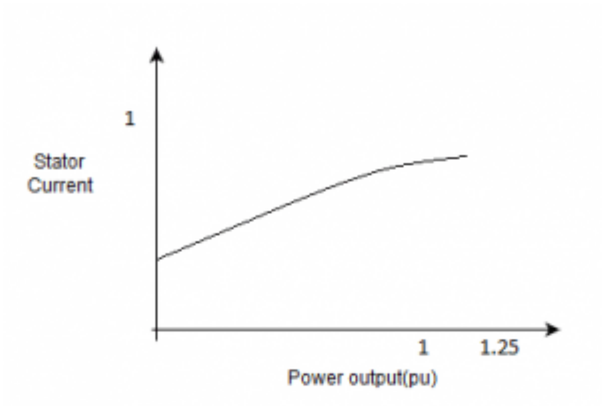
11. The stator current of the induction motor is given by which of the below?

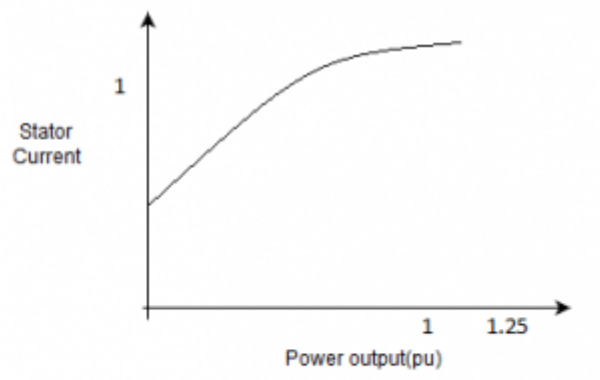
a) 



b)

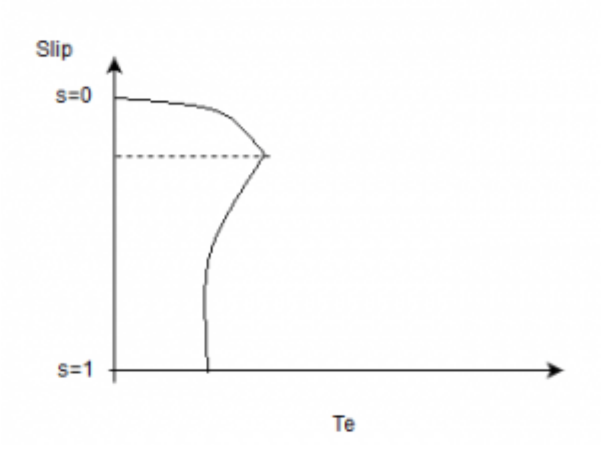
c)

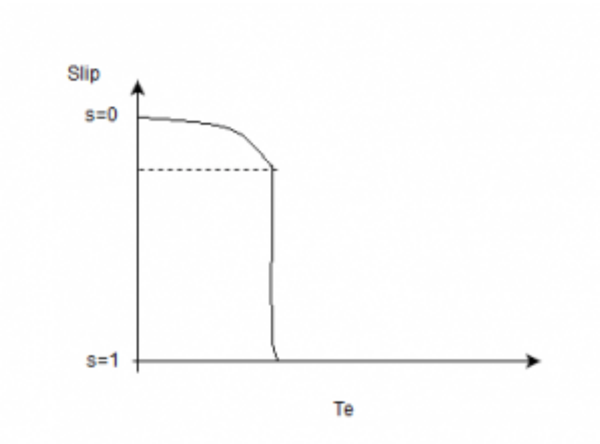


d) 

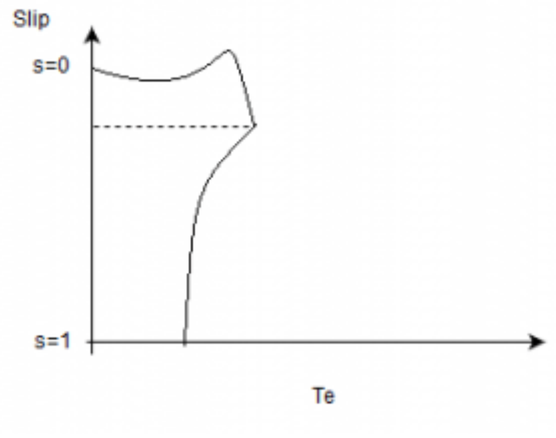
Answer: a
Explanation: The no-load current is about 30-50% of rated current. With increase in load current rises correspondingly. It also follows a semi-circle.

12. Slip vs the torque developed in an induction motor is?

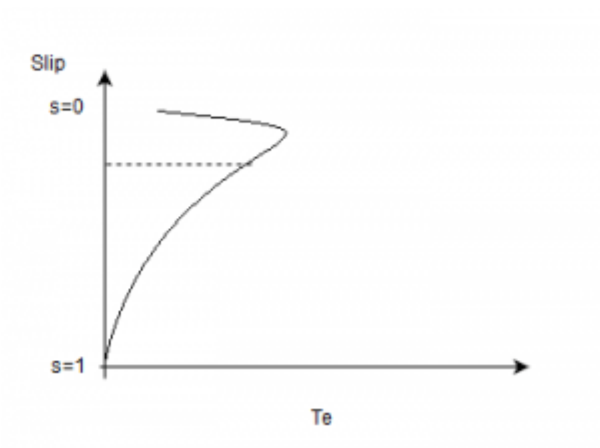
a) 



b)



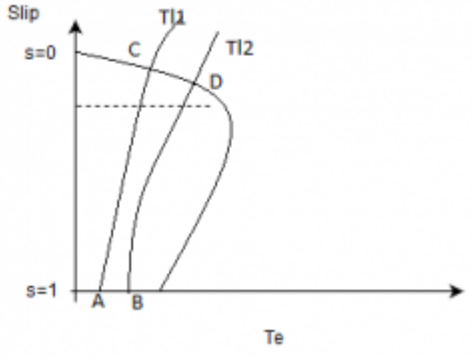
c)



d)

Answer: a
Explanation: Try to check the axes.

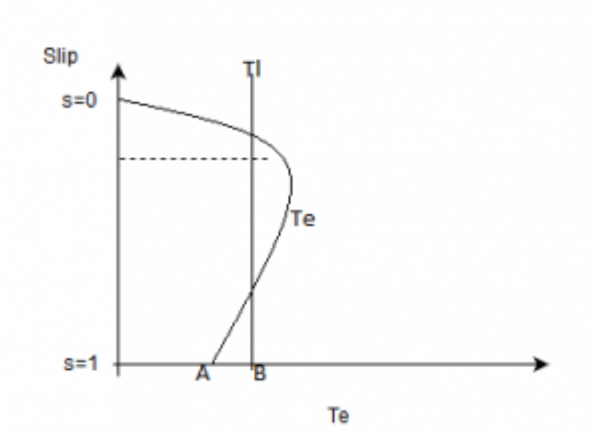
13. The stable point in the operation of the induction motor is?



a) C
b) D
c) B
d) A

Answer: a
Explanation: If the load torque shift to the Tl2, the motor speed will increase while load torque decreases.

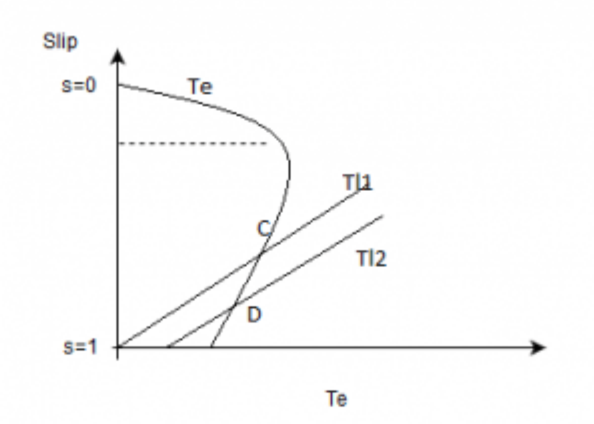
14. At which point shall the induction machine be operated to attain a stable operation?



a) The machine will not start
b) A
c) B
d) Both A as well as B

Answer: a
Explanation: None.

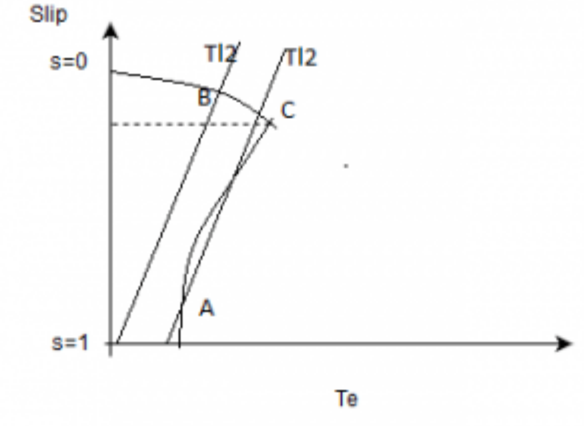
15. The stable point to use the induction motor possesing the below characteristic.



a) C
b) D
c) C and D
d) Machine will not start

Answer: a
Explanation: For the stable operation, (dTl/dn)>(dTe/dn).

16. Mark the stable operating point when the load torque shifts from Tl1 to Tl2.



a) A
b) A,B
c) B,C
d) A,C

Answer: a
Explanation: For the stable operation, (dTl/dn)>(dTe/dn).

17. A 3-phase, 50 Hz, 6-pole induction motor has a shaft output of 10kW at 930 rpm. Friction and windage losses is 1% of the output. Total stator losses is 600W. What is the rotor input?
a) 10860 W
b) 10100 W
c) 11460 W
d) 11000 W

Answer: a
Explanation: Full load slip = 1000-930/1000 = 0.07.
Friction losses = 0.01*10000 = 100 W
Pm = 10000+100 = 10100 W
Rotor input = 10100/0.93 = 108060 W

18. A 3-phase, 50 Hz, 6-pole induction motor has a shaft output of 10kW at 930 rpm. Friction and windage losses is 1% of the output. Total stator losses is 600W. What is the stator input?
a) 10860 W
b) 10100 W
c) 11460 W
d) 11000 W

Answer: c
Explanation: Full load slip = 1000-930/1000 = 0.07.
Friction losses = 0.01*10000 = 100 W
Pm = 10000+100 = 10100 W
Rotor input = 10100/0.93 = 108060 W

Stator input = Pg+600 = 11460 W.

This set of Electrical Machines Questions and Answers for Aptitude test focuses on "Determination of Equivalent Circuit Parameters".

1. Blocked rotor test comprises of ______________
a) rotor and stator copper losses.
b) rotor copper and stator core losses.
c) rotor core losses
d) stator copper losses

Answer: a
Explanation: Blocked rotor test consists of copper losses of stator and rotor winding copper losses.

2. A 10kW,400V, 4-pole delta connected induction motor gave the following test results:

```
No-load test: 400V, 8A, 250 W
Blocked rotor test: 90V, 35A, 1350 W
```

The dc resistance per phase is 0.6 ohms. The no load rotational losses is?
a) 204W
b) 304W
c) 196W
d) 186W

Answer: a
Explanation: Pr = 250-3*64/3*(0.6*1.2) = 204W.

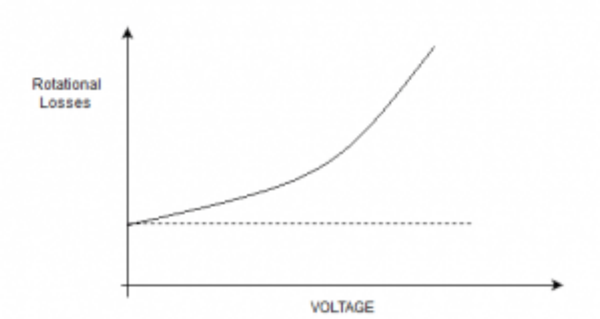
3. A 10kW,400V, 4-pole delta connected induction motor gave the following test results:

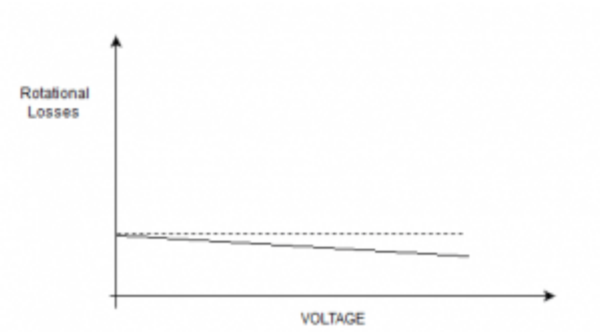
```
No-load test: 400V, 8A, 250 W
Blocked rotor test: 90V, 35A, 1350 W
```

The dc resistance per phase is 0.6 ohms. The effective stator resistance is?
a) 0.72 ohms
b) 0.6 ohms
c) 0.3 ohms
d) 1.2 ohms

Answer: a
Explanation: Reff = 1.2*r; Due to delta connected rotor.

4. While conducting the tests on the 3-phase induction motor, the variation of rotational losses with respect to voltage can be obtained as?

a) 

b) 

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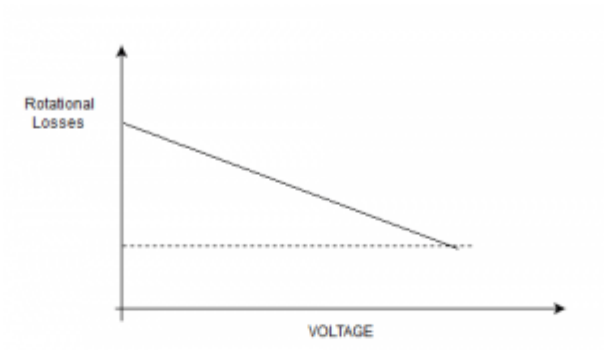
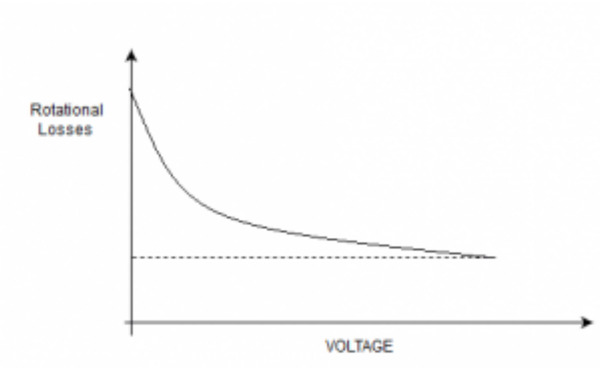
c) 

d) 

Answer: a
Explanation: Core loss is zero for, zero applied voltage but the friction and windage losses will be present in the machine which need to be overcome.

5. The external rotor resistance is _____________
a) gradually cut out as motor picks up the speed
b) fixed for a stable point
c) removed instantalLy as the motor is started
d) added or reduced as per the efficiency requirement

Answer: a
Explanation: External resistance is gradually cut out after picking up the speed.

6. The speed of the squirrel-cage induction motor can be changed by varying slip.
a) True
b) False

Answer: b
Explanation: For squirrel-cage induction motor, the rotor get shorted and it can not be altered.

7. The speed characteristic of the induction motor is analogous to _____________
a) dc shunt motor
b) synchronous motor
c) cumulative compound motor
d) stepper motor

Answer: a
Explanation: As the speed practically remains constant and lesser than than the rated speed, it is similar to dc shunt motor.

8. If the squirrel-cage induction motor is replaced by a solid cylinder in an induction motor its slip will _____________
a) increase
b) decrease
c) be same
d) zero

Answer: a
Explanation: Reactance of the rotor will decrease as the leakage wil reduce, so the slip will increase.

9. Number of the slip rings required for the satisfied operation of an induction motor is?
a) number of phases
b) number of poles
c) halve of number of poles
d) double the phases

Answer: a
Explanation: Slip rings number is same as the phase of the supply.

10. I. An induction can never operate at leading power factor.
II. Speed of the induction motor can be made more than synchronous speed and still it will work as motor.
a) I is true, II is false
b) I is true, II is true
c) I is false, II is true
d) I is false, II is also false

Answer: a
Explanation: Speed more than Ns will be an induction generator not motor.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Power Factor Control of Three Phase Induction Motors".

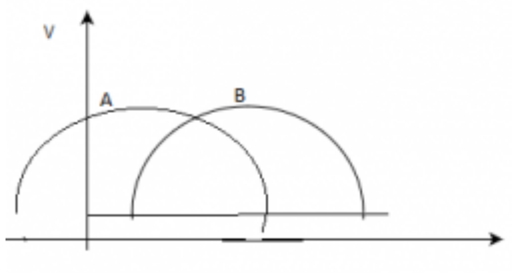
1. The 3-phase induction motor operates at lagging power factor due to ________

```
I. Leading magnetizing current necessary to produce the working flux.
II. Voltage drops in the leakage impedance.
III. Lagging magnetizing current which lags by 90° to the voltage
```

a) II, III
b) I, II
c) II
d) I, II, III

Answer: a
Explanation: Magnetizing current is lagging in nature and also the leakage impedance increases the power factor angle.

2. Choose the most appropriate option regarding the power factor control of the induction motor.



a) A: with capacitor
b) B: with capacitor
c) A: with capacitor, B: with capacitor
d) A: with no capacitor, B: with capacitor

Answer: a
Explanation: Leading stator current shifts to the left.

3. Which tests are to be conducted to draw circle diagram for a given induction motor?

```
A. Running light test
B. Blocked rotor test
C. Voltmeter-Ammeter test
```

a) A, B, C
b) A, B
c) B, C
d) A,C

Answer: a
Explanation: All the three tests results are needed to plot the circle diagram.

4. Which tests are to be conducted to draw circle diagram for a given induction motor?

```
A. Running light test
B. Slip test
C. Voltmeter-Ammeter test
```

a) A, C
b) A, B, C
c) B, C
d) A, B

Answer: a
Explanation: Slip test is conducted on the synchronous machine.

5. If an unbalanced supply is fed to an induction motor, it will cause excessive heating of ____________
a) rotor
b) stator
c) rotor shaft
d) all of the mentioned

Answer: a
Explanation: Unbalanced supply will cause most heating of rotor winding than any other part.

6. If one of the three phases of the induction motor fails due to fault. The motor will ____________
a) stop and do permanent damage if it was running overloaded
b) continue running but will draw more current if it was operating at rated load
c) will not be affect the operation if light loaded
d) any of the mentioned

Answer: d
Explanation: All the possibilities can happen if one of the phase is removed.

7. Which of the following will not happen if one of the phases to the induction motor is not available?
a) Motor will start but operate at lower speed
b) It will hum but not start
c) It will continue to operate below 57.7% of rated load
d) External means are needed to make it run at rated speed

Answer: a
Explanation: Motor will not start if one of the phases is missing.

8. Induction motor can be fed from ____________
a) either rotor or stator
b) stator
c) rotor
d) neither stator nor rotor

Answer: a
Explanation: It can be fed from either side at one time.

9. In double cage induction motor, inner cage has ____________
a) small resistance and large reactance
b) high resistance and high reactance
c) small resistance and small reactance
d) high resistance and small reactance

Answer: a
Explanation: In the bottom cage, the air gap is less, so the leakage reluctance is less and more the leakage reactance.

10. Static capacitors are used to control power factor of slip ring induction motor only.
a) True
b) False

Answer: b
Explanation: Static capacitors are also used to improve power factor of the slip ring as well as wound rotor induction motors.

11. A 3-phase, 400 V, 50 Hz delta connected induction motor has power factor of 0.35 when delivering 30% of its load. If it is star connected, then its?
a) p.f. increased and the stator current decreases
b) p.f. worsened and the stator current decreases
c) p.f. increased,and the stator current increases
d) p.f. does not change,and the stator current increase

Answer: a
Explanation: In star connection, resistance decrease than delta connected.

12. A 3-phase induction machine is operating on 3-phase fixed frequency ac mains at a per unit slip of 1.5. Then which of the following statements follow the working condition?

```
I. It draws electrical power from the mains.
II. It draws mechanical power through the shaft.
```

```
III. It delivers electrical power to the mains.
IV. It delivers mechanical power through the shaft.
```

a) I, IV
b) I, II
c) II, III
d) III, IV

Answer: a
Explanation: The slip is positive so it is operating as a motor and in the braking mode.

13. A 3-phase induction machine is operating on 3-phase fixed frequency ac mains at a per unit slip of 1.5. Then machine is operating in generating mode.
a) True
b) False

Answer: b
Explanation: It is braking mode.

14. As per the condition given, if a 3-phase squirrel-cage induction motor is operating at a slip of -0.05 then machine will?
a) draw mechanical strength and deliver electrical power to mains
b) draw electrical power from mains and deliver mechanical strength to shaft
c) draw electrical power from shaft and deliver mechanical strength through mains
d) any of the mentioned

Answer: a
Explanation: It is in generating mode as the slip is negative.

15. If the induction motor connected to a power grid draws real power P and reactive power Q. If it is made to run as a generator, then P and Q will be?
a) negative, positive
b) positive, positive
c) positive, negative
d) negative, negative

Answer: a
Explanation: Induction motor will always need reactive power as it is single excited machine.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Induction Generator".

1. A 3-phase induction motor can also be run as _______________
a) synchronous generator
b) induction generator
c) dc shunt motor
d) any of the mentioned

Answer: b
Explanation: For the same machine if the slip is made negative by raising the speed above synchronous speed.

2. Induction generator _____________
a) can not work in isolation
b) can work in isolation
c) should work in parallel with synchronous generators
d) any of the mentioned

Answer: c
Explanation: Induction generator needs the continuous flux and it can be either provided by the bus or the synchronous generator.

3. A self excited induction generator _____________
a) must have static capacitor bank
b) can have static capacitor bank
c) should have static capacitor bank

d) any of the mentioned

Answer: a
Explanation: To provide the lagging reactive power, it is must that it should be have a source of lagging reactive power.

4. For an induction motor to work in isolation, it should have _____________
a) lagging reactive power source
b) leading reactive power source
c) leading reactive power sink
d) any of the mentioned

Answer: a
Explanation: It must be connected to capacitors which can be the source for lagging reactive power.

5. The magnetization curve in the induction generator working in isolation has similar characteristic as _____________
a) dc shunt generator
b) dc cumulative field generator
c) synchronous generator
d) all of the mentioned

Answer: a
Explanation: The voltage build up process of the induction generator is similar to that of the dc shunt generator.

6. If the residual flux is absent in the rotor iron of the isolated induction generator _____________

a) it will not run
b) it will run as induction motor
c) it will burn the winding
d) it will not affect the characteristic of the generator

Answer: a
Explanation: If the residual flux of the isolated induction generator is not present, then voltage build up will not take place.

7. Voltage build up in an isolated induction generator depends on _____________

```
A. Capacitor bank value
B. Residual magnetism of the rotor iron
C. Residual magnetism of the stator iron
```

a) A, B
b) A, B, C
c) B
d) A, C

Answer: a
Explanation: Voltage build up will depend on capacitance and the residual magnetism of the rotor iron.

8. I. Voltage of an externally excited induction generator can not be controlled.
II. Frequency of an externally excited induction generator can be controlled.
a) I is true, II is false
b) I is true, II is true
c) I is false, II is false
d) I is false, II is true

Answer: a
Explanation: Voltage and frequency of the externally excited induction generator can not be controlled, because they run in parallel with the existing 3-phase systems.

9. What is/are the shortcomings of an induction generator in real time system?
a) It needs considerable amount of reactive power

b) Efficiency is poor
c) It can work at leading power factor only
d) All of the mentioned

Answer: d
Explanation: All are the disadvantages of an induction generator.

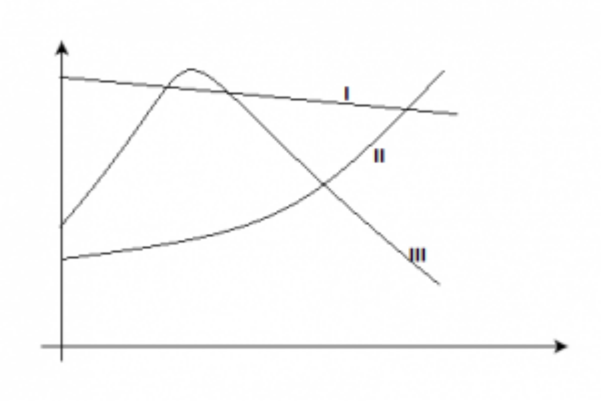
10. Induction generator is self excited machine.
a) True
b) False

Answer: b
Explanation: No, induction machine is first run as motor and then as generator. So it needs the current to set up the flux continuously.

11. Induction generator can only work at leading reactive power.
a) True
b) False

Answer: a
Explanation: Because it can not supply any lagging power factor.

12. Choose the correct match for the corresponding characteristics of a 3-phase induction motor.



x-axis	y-axis	
A. stator current	power output	(P) Curve I
B. torque	slip	(Q) Curve II
C. speed	power output	(R) Curve III

a) A-II, B-III, C-I
b) A-III, B-II, C-I
c) A-III, B-I, C-II
d) A-I, B-II, C-III

Answer: a
Explanation: Speed will remain constant for a fair amount of operating range. Torque will be linear in small slip regions.

13. Which is the most acceptable application field where an induction generator can be used?
a) wind power system
b) steam power system
c) hydro power system
d) nuclear power station

Answer: a
Explanation: Induction generator is widely acceptable in low speed and low power operation like wind power systems.

14. A 3-phase induction motor has full load efficiency of 0.7 and a maximum efficiency of 0.85. It is operated at a slip of 0.6 by reduced voltage method. The efficiency of the motor at this operating point is?
a) less than 0.35
b) greater than 0.35
c) in the range of 0.8 to 0.2
d) none of the mentioned

Answer: a
Explanation: For the slip more than 40%, the efficiency reduces more than 50% for an induction motor.

15. Two three phase squirrel-cage induction generator are identical in all respects except the fact that the slot depths in machine B is more than that of A. Machine B as compared to machine A, will have __________
a) less pull out torque but better power factor
b) more pull out torque but poor power factor
c) less pull out torque and poor power factor
d) more pull out torque and better power factor

Answer: a
Explanation: As the slot depth in machine B is more than that of A, B will have higher reactance as the leakage flux will be lesser.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Applications of Polyphase Induction Motors".

1. Wound rotor induction motor is most appropriate for the applications requiring _______________
a) high starting torque
b) variable starting torque
c) fixed starting torque
d) all of the mentioned

Answer: b
Explanation: A wound rotor induction motor can have variable starting torque.

2. Relatively a squirrel-cage induction motor is advantageous over wound rotor type induction motor of identical rating due to ____________
a) less conductor material used.
b) lower leakage flux
c) ruggedness
d) all of the mentioned

Answer: d
Explanation: A squirrel-cage induction motor is more efficient than a wound rotor induction motor.

3. Relatively a squirrel-cage induction motor is advantageous over wound rotor type induction motor of identical rating due to ____________
a) less conductor material used
b) larger leakage flux
c) large starting torque
d) all of the mentioned

Answer: a
Explanation: Squirrel cage induction motor has lesser starting torque.

4. We can not operate a cage induction motor on a variable frequency load due to ____________
a) no availability of varying the speed
b) availability of variable speed

c) low starting torque
d) fixed slip

Answer: a
Explanation: We can not increase or decrease the rotor resistance of a cage induction motor, hence it is not suitable for a variable frequency.

5. Speed control is possible for ________ and not possible for ___________
a) induction motor, synchronous motor
b) induction motor, differential motor
c) synchronous motor, synchronous-induction motor
d) dc motor, induction motor

Answer: a
Explanation: Speed can be adjusted for a induction motor while it can not be altered for a synchronous motor operating at normal speed.

6. Which of the following can be done using a synchronous motor but not by induction motor?
a) Power factor improvement
b) Supplying mechanical load
c) Power factor improvement and supply mechanical load
d) None of the mentioned

Answer: a
Explanation: Induction motor is a singly excited machine and it always needs exciting current to set up the flux in the machine.

7. The torque in an induction motor varies as _______ and in synchronous motor as __________
a) square of voltage, proportion to voltage
b) proportion to voltage, proportion to voltage
c) proportion to voltage, square of voltage
d) square of voltage, square of voltage

Answer: a
Explanation: Torque in induction motor varies as square of the voltage and in synchronous motor as linear to voltage.

8. If a 3-phase 350V, 50Hz squirrel-cage induction motor is run at 55 Hz supply, then?

```
A. Starting torque will increase
B. Maximum torque will increase
C. Maximum torque will remain same
D. Starting torque will decrease
E. Operating speed will rise
```

a) C, D, E
b) A, C, E
c) A, B
d) E

Answer: a
Explanation: Frequency is increased, so the starting torque will decrease. Speed will increase as slip will reduce.

9. When a 3-phase 350V, 50Hz squirrel-cage induction motor is run at 35 Hz supply, then?

```
A. Starting torque will increase
B. Maximum torque will increase
C. Maximum torque will remain same
D. Starting torque will decrease
E. Operating speed will rise
```

a) A, C
b) A, B, E
c) A, B
d) C, D, E

Answer: a
Explanation: Frequency is decreased so the slip increases. Starting torque will increase and the maximum torque will remain same.

10. Reducing the poles of a 3-phase induction motor, it __________
a) will decrease maximum power factor
b) will increase maximum power factor
c) will make no change in power factor
d) can not be depicted

Answer: a
Explanation: If number of poles reduces, speed increases, slip decreases, reactance increases, power factor angle increases and so the power factor decreases.

11. When the poles of a 3-phase wound rotor induction motor increased, it __________
a) will decrease maximum power factor
b) will increase maximum power factor
c) will make no change in power factor
d) can not be depicted

Answer: b
Explanation: If number of poles increases, speed decreases, slip increases, reactance decreases, power factor angle decreases and so the power factor increases.

12. A 3-phase induction motor taking a line current of 200 A, is started by direct switching. If an auto transformer of with 50% tapping is made to be used, the motor line current and supply line current will be respectively?
a) 100, 50
b) 50, 100
c) 50, 200
d) 50*1.73, 200

Answer: a
Explanation: The motor line current will reduce by a fold of four times and the line current by half.

13. A 3-phase induction motor is running for a constant load torque at rated voltage and frequency. If both the frequency and voltage are halved following will be the related statements ignoring the stator losses.

```
A. The difference between actual speed and synchronous speed remains same.
B. Per unit slip remains same
C. Stator current remains same
D. Air gap flux remains same
```

a) A, C, D
b) A, B, C, D
c) B, C, D
d) C, D

Answer: a
Explanation: Per unit slip varies as the reactance will change as the frequency has been halved.

14. No load test has been conducted on an induction motor for different supply voltages and input power vs voltage plot has been drawn. The curve is extrapolated to intersect the y-axis. This point is?
a) friction and windage losses
b) core losses
c) stray losses
d) all of the mentioned

Answer: a
Explanation: The extrapolated point is friction and windage losses of the induction machine.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Circle Diagrams of Induction Machines".

1. Circle diagram of an induction motor is graphical representation of ______________
a) its equivalent circuit
b) its rotor equivalent
c) its stator equivalent
d) its stationary equivalent circuit

Answer: a
Explanation: Circle diagram gives information about the equivalent circuit of the induction motor.

2. Circle diagram depicts the relation between ______________
a) stator current and the slip variation
b) rotor current and stator current
c) slip variation and the power factor
d) slip variation and the losses of the machine

Answer: a
Explanation: Circle diagram shows extermeties of stator current and the slip variation.

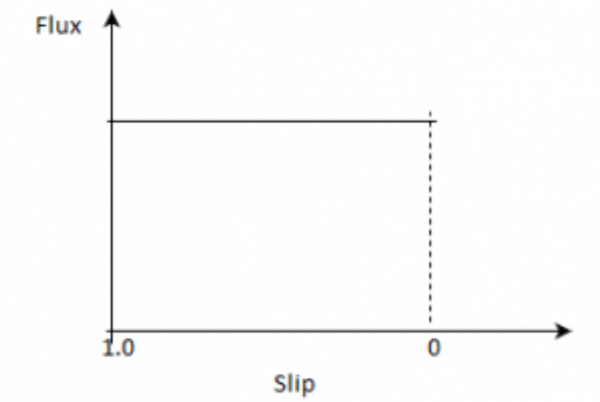
3. A 10kW, 50 Hz, 3-phase induction motor develops the rated torque at 1440rpm. If the load torque is reduced to half, then the motor speed is?
a) 1470rpm
b) 1410rpm
c) 1400rpm
d) 1444rpm

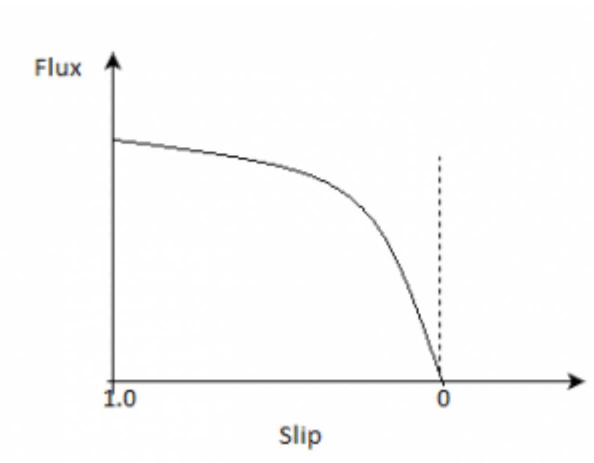
Answer: a
Explanation: Slip = 0.04
T2/T1 = s2/s1
s2 = (1/2)*0.04 = 0.02
Nr = (1-0.02)*1500 = 1470 rpm.

4. A 10kW, 50 Hz, 3-phase induction motor develops the rated torque at 1440rpm. If the load torque is reduced to half, then the power output that can now be obtained is?
a) 5 kW
b) 5.3 KW
c) 4.6 kW
d) 8 kW

Answer: a
Explanation: s2 = (1/2)*0.04 = 0.02
P = (10000*60*2*3.14*1470)/(2*2*3.14*1460*60)
P = 5.03 kW.

5. In a 3-phase induction motor, the flux per pole will vary with the slip is?

a) 

b) 

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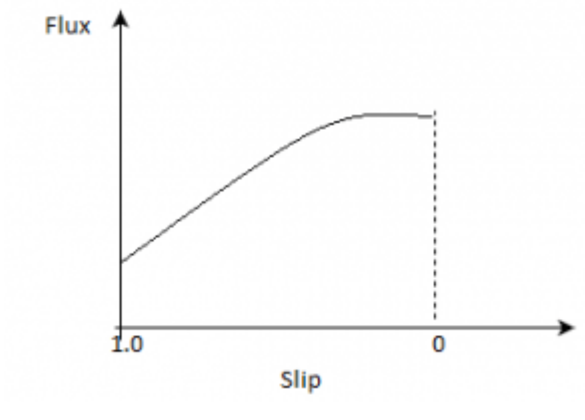
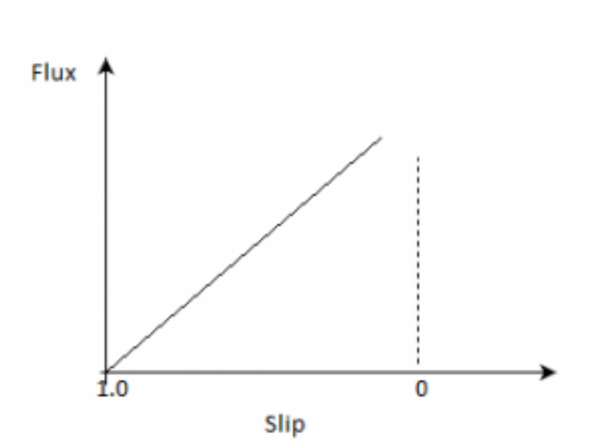
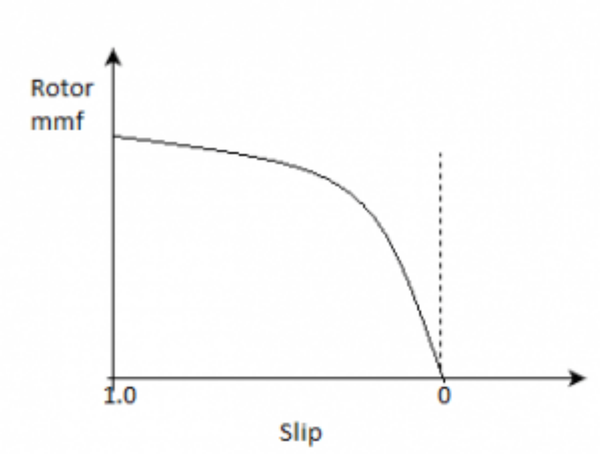
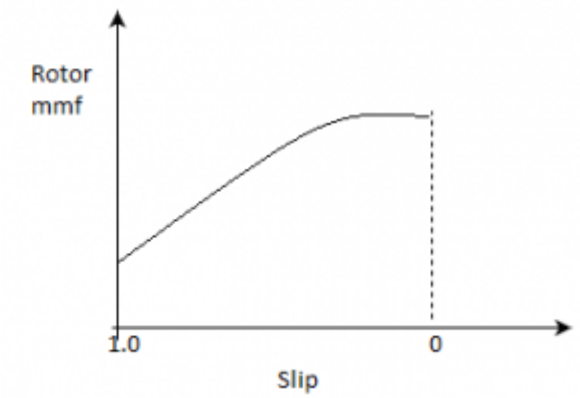
c) 

d) 

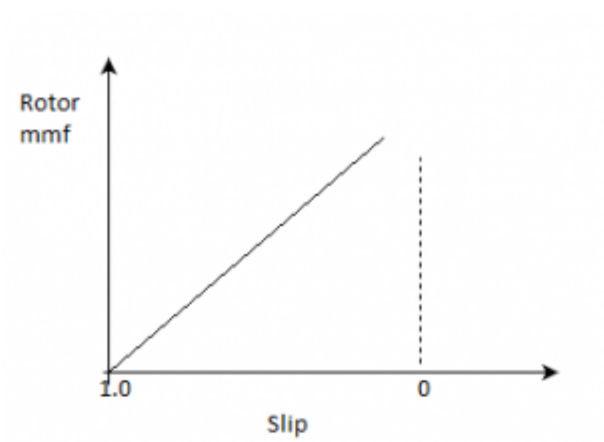
Answer: a
Explanation: Flux remains constant throughout the operation of the induction motor.

6. The rotor mmf per pole in the 3-phase, 4-pole induction motor varied with slip is?

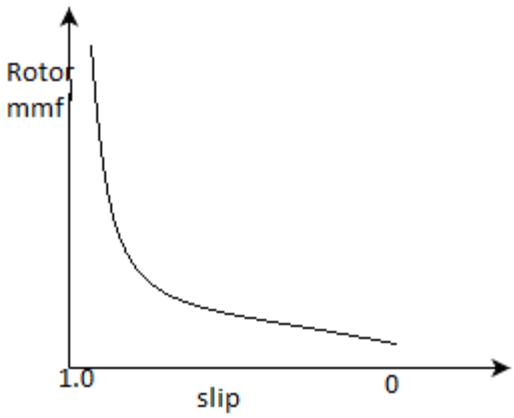
a) 

b) 

c)



d)

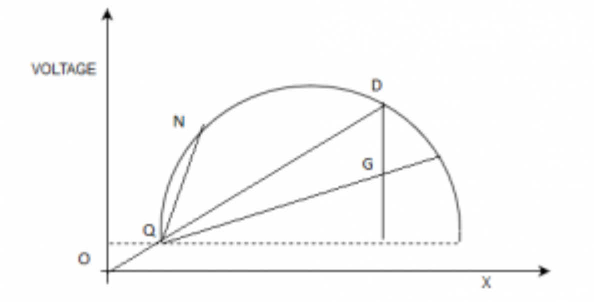


Answer: a
Explanation: As slip decreases, the rotor current decreases so the rotor mmf.

7. Blocked rotor test is conducted to find the _____________
a) leakage impedance
b) leakage reactance
c) stator impedance
d) rotor impedance

Answer: a
Explanation: Blocked rotor test determines the leakage impedance and so the core losses.

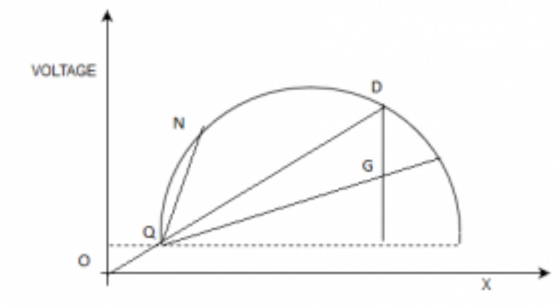
8. In the below circle diagram, OG represents?



a) Rated torque
b) Maximum torque
c) Rated power output
d) Losses

Answer: a
Explanation: OG is the rated torque.

9. In the following circle diagram of the induction motor, QN is the _____________



a) rotor current referred to stator
b) stator current
c) stator current referred to rotor
d) no load input to rotor

Answer: a
Explanation: It is rotor current referred to stator.

10. Stator resistance can be measured using Kelvin’s double bridge.
a) True
b) False

Answer: a
Explanation: Stator has very low resistance, so it is most accurately observed by using a kelvin’s double bridge.

11. If the no load test is conducted at its rated frequency but less than the rated voltage, then the wattmeter reading will be _____________
a) reduced
b) more than previous reading
c) remain same
d) none of the mentioned

Answer: a
Explanation: No load losses will reduce, so the power consumption.

12. If the no load test is conducted at its rated frequency but less than the rated voltage, then the mechanical losses will _____ and the constant losses will _________
a) constant, reduce
b) constant, rise
c) reduce, rise
d) constant, constant

Answer: a
Explanation: Mechanical losses remain always constant, but the stator losses will reduce as the voltage has been decreased.

13. No load power factor of the induction motor will __________ if the no load test is conducted at its rated frequency but less than the rated voltage.
a) improve
b) degrade

c) remain same
d) none of the mentioned

Answer: a
Explanation: It will improve.

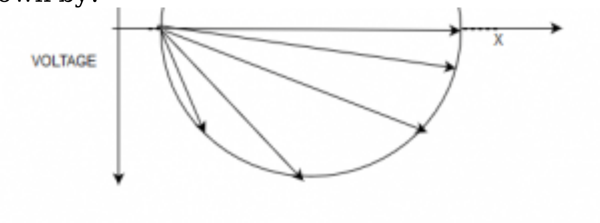
14. If the no load test is conducted at its rated voltage but less than the rated frequency.

```
A. The wattmeter reading will be more than previous.
B. The power factor will also improve.
```

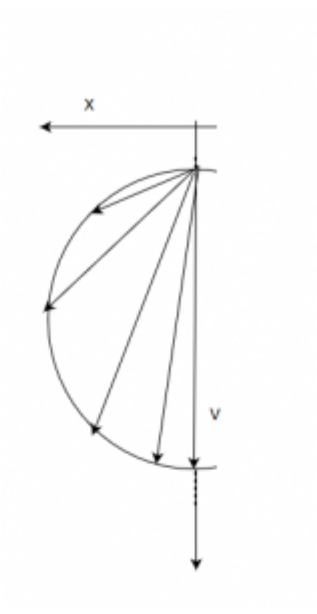
a) Only A is true
b) Only B is true
c) Both A as well as B are true
d) None of the mentioned

Answer: a
Explanation: Flux increases as flux = V/f. So the magnetizing current also increases. Power factor decreases.

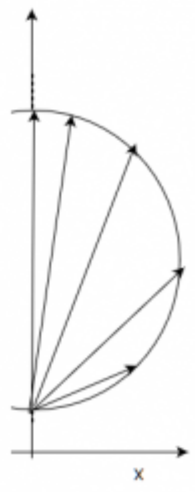
15. Circle diagram for the fixed rotor resistance and variable reactance is most appropriately shown by?



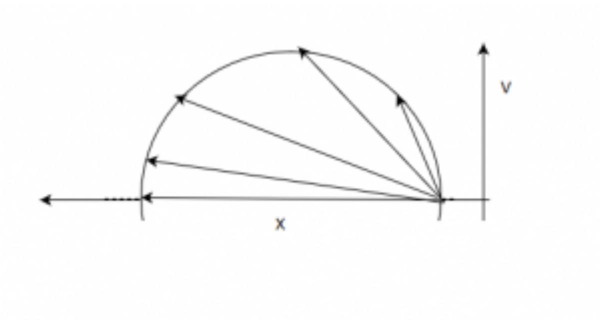
a)



b)



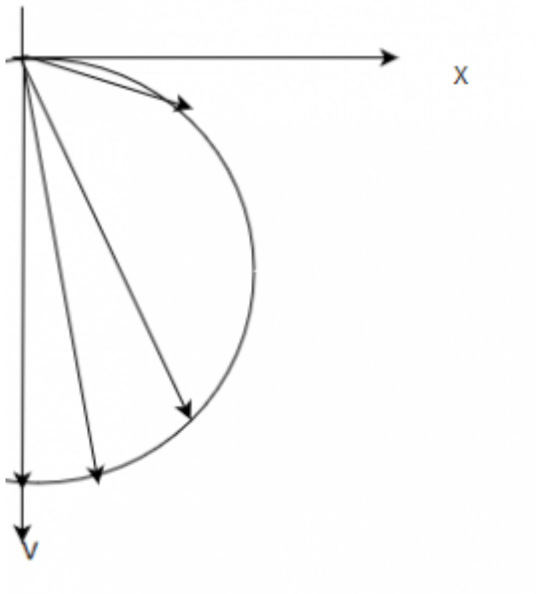
c)



d)

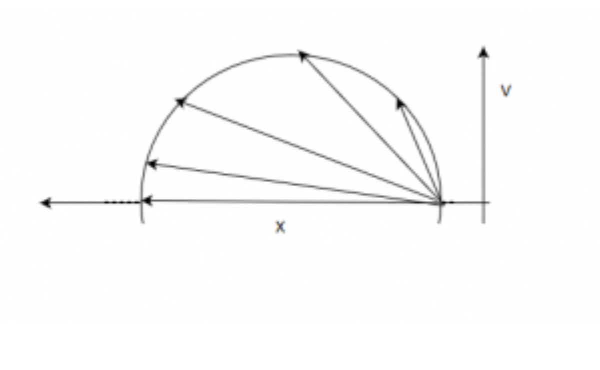
Answer: a
Explanation: |I| = |V/Z|
θ = atan(x/r), Here reactance is variable, which maps a semicircle in its locus diagram.

16. Circle diagram for the variable rotor resistance and fixed reactance is most appropriately shown by

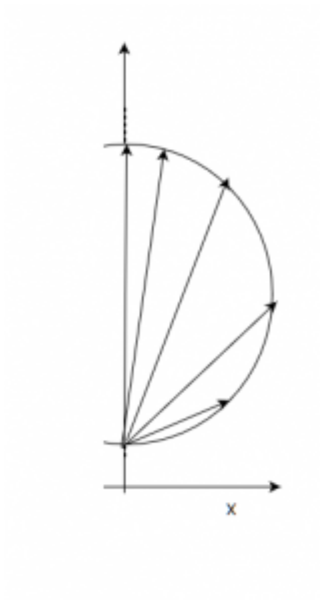


a)

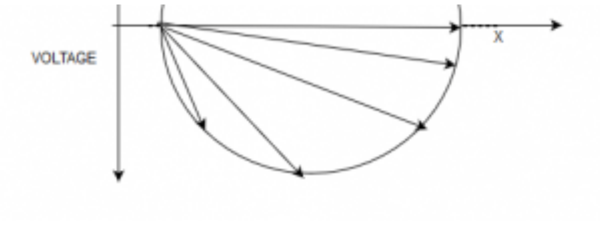
b)



b)



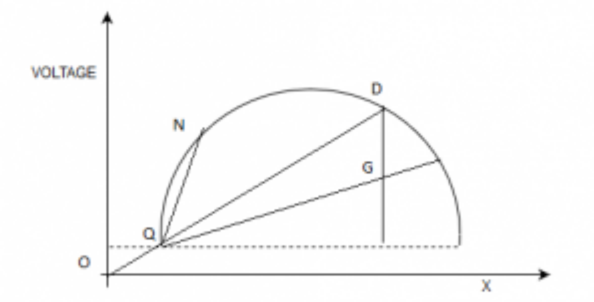
c)



d)

Answer: a
Explanation: |I| = |V/Z|
θ = atan(x/r), Resistance is varying, so the locus will be a semi circle.

17. Use the below circle diagram to choose the correct option.

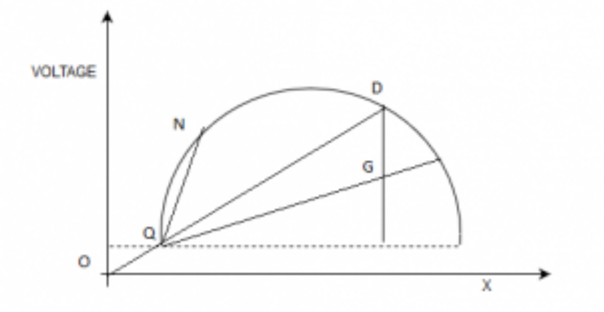


a) CF: Rotor copper loss, FG: Stator copper loss, GE: Fixed losses.

b) FG:Rotor copper loss, CF: Stator copper loss, GE: Fixed losses.
c) GE:Rotor copper loss, FG: Stator copper loss, CF: Fixed losses.
d) FG:Rotor copper loss, CF: Stator copper loss, CF: Core losses.

Answer: a
Explanation: GE is fixed losses. From the F to top the rated rotor copper losses occur.

18. In the following circle diagram, what is CC'?



a) full load condition
b) no load condition
c) fixed losses
d) rated full load losses

Answer: a
Explanation: It is full load condition.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Starting of Polyphase Induction Motors".

1. Voltage induce in the induction motor is highest at ___________
a) starting
b) standstill
c) rated speed
d) any of the mentioned

Answer: a
Explanation: At starting when slip is 1, the voltage induced is maximum.

2. Starters are required in the induction motor because ___________
a) of high starting current

b) they are not self starting
c) torque produced is very low at starting to overcome inertia
d) all of the mentioned

Answer: a
Explanation: Starters are needed in induction motors to limit the starting current.

3. Full voltage starting of induction motor may cause ___________
a) dip in the voltages
b) high inrush current
c) high losses
d) all of the mentioned

Answer: a
Explanation: Starting induction motor on full load will cause high inrush current which furthe causes dip in the bus voltage.

4. For a 4-pole, 50 Hz induction motor has starting current as 5 times to that of the full load current working at a speed of 1450rpm. The ratio of starting to full load torque will be?
a) 0.83
b) 0.17
c) 0.67
d) 1

Answer: a
Explanation: Tst/Tfl = (Ist/Ifl)^2*slip
Tst/Tfl = 25*0.033
= 0.83

5. Starting methods applicable to both squirrel-cage and slip ring induction motors is/are ___________

```
A. DOL starting
B. Auto transformer starting
C. Rotor resistance starting
```

a) A, B
b) A, B, C
c) B, C
d) A, C

Answer: a
Explanation: Rotor resistance method can only be used with slip ring induction motor.

6. The method which employs reduction of the voltage while induction motor starting is?

```
A. DOL starting
B. Auto transformer starting
```

a) Only A
b) A, B
c) Only B
d) Neither A nor B

Answer: a
Explanation: Direct online starting uses reduction in voltage.

7. The method which employs raising of the voltage while induction motor starting is?

```
A. DOL starting
B. Auto transformer starting
```

a) Only A
b) A, B
c) Only B
d) Neither A nor B

Answer: d
Explanation: None of the starting methods use increase in the starting voltage.

8. External methods of induction motor starting is employed to ___________
a) Reduce the voltage
b) Reduce the current
c) Improve efficiency
d) All of the mentioned

Answer: a
Explanation: External methods like auto transformer is used to mainly reduce voltage.

9. A 3-phase, 4-pole, 50 Hz induction motor is uses DOL method of starting. It is later replaced by reactance method of starting with a fraction of ‘x’, then the starting current reduces by?
a) x
b) x^2
c) 1/x
d) no change in the starting current

Answer: a
Explanation: The current will be reduced by a fraction of x.

10. A 3-phase, 4-pole, 50 Hz induction motor is uses DOL method of starting. It is later replaced by reactance method of starting with a fraction of ‘x’, then the starting torque reduces by?
a) x
b) x^2
c) 1/x
d) no change in the starting current

Answer: b
Explanation: Tst/Tfl = (x^2)(Ist/Ifl)^2*slip.

11. Series reactor method of starting has main disadvantage of ___________
a) lowering the starting power
b) increasing the starting current
c) increasing starting torque
d) all of the mentioned

Answer: a
Explanation: Main disadvantage of using reactors is that ot reduces the starting power of the machine and so the efficiency.

12. Series reactor method of starting has main disadvantage of lowering the starting power. This can be overcome by ___________
a) using series resistance
b) using parallel reactor
c) using parallel resistance
d) using series reactor

Answer: a
Explanation: Adding series resistance instead od reactors will help improving the starting power.

13. A 3-phase, 4-pole, 50 Hz induction motor is uses DOL method of starting. It is later replaced by auto transformer method of starting with a tapping ratio of ‘x’, then the starting current reduces by?
a) x
b) x^2
c) 1/x
d) no change in the starting current

Answer: b
Explanation: The starting current reduces by a fraction of x^2.

14. A 3-phase, 4-pole, 50 Hz induction motor is uses DOL method of starting. It is later replaced by auto transformer method of starting with a tapping ratio of ‘x’, then the starting torque will

be?
a) x *Tfl
b) x^2 *Tfl
c) 1/x *Tfl
d) no change in the starting current

Answer: a
Explanation: Tst/Tfl = (x^2)(Ist/Ifl)^2*slip.

15. For the application requiring high starting torque and minimum starting current, the most suitable starting method will be?
a) Auto transformer starting method
b) Reactance starting method
c) DOL method
d) Star-Delta method

Answer: a
Explanation: Auto transformer provides the maximum starting torque.

16. Auto transformer method of starting has most acceptable method for the starting of the induction motor due to ___________
a) maximum torque
b) maximum reduction of inrush current
c) variable tapping
d) all of he mentioned

Answer: a
Explanation: Maximum torque, reduction of inrush current and variable turns ratio makes it a popular method of starting of IM.

This set of Electrical Machines test focuses on “Starting of Polyphase Induction Motors-II”.

1. A 3-phase induction motor is fed at the stator at a frequency f. If the rotor speed is Nr and synchronous speed is Ns, then the absolute speed of the resultant flux in space is?
a) Ns
b) (Ns+Nr) if the flux rotates in the same same direction as the rotor
c) (Ns-Nr) if the flux rotates in the same same direction as the rotor
d) Nr

Answer: a
Explanation: The flux speed in space will be Ns irrespective of any rotor speed.

2. Which of the following is correct?

```
I. Leakage reactance is dependent on supply current.
II. Magnetizing reactance is dependent on the air gap flux.
```

a) I, II
b) II
c) I
d) None of the mentioned

Answer: a
Explanation: Leakage flux depends on the load current and the magnetizing reactance depends on the air gap flux.

3. Which of the following is correct?

```
I. Rotor resistance is dependent on the speed.
II. Core loss does not depend on the supply frequency and voltage.
```

a) I
b) II
c) I, II
d) None of the mentioned

Answer: a
Explanation: Core loss does depend on the supply ‘V’ and ‘f’.

4. The stator of a 3-phase, six pole induction motor’s stator is connected to 50 Hz supply while its rotor is fed from a 20 Hz supply. The possible speeds at which the machine will run will be?

```
(i) 1600rpm   (ii) 600rpm (iii) 1400rpm (iv) 400 rpm
```

a) (ii), (iii)
b) (ii), (iv)
c) (i), (iii)
d) (i), (iv)

Answer: a
Explanation: Stator speed = 120*50/6 = 1000 rpm
Rotor speed = 120*20/6 = 400 rpm
Hence the possible speeds could be 1400rpm or 600rpm.

5. For a 3-phase 4-pole induction motor has open circuited slip rings. The frequency across the slip rings is 75 Hz. Then we can conclude that the motor is run at a speed of ___________

```
(i) 750rpm   (ii) 1500rpm (iii) 2250rpm (iv) 3750 rpm
```

a) (i), (iv)
b) (i), (iii)
c) (ii), (iii)
d) (ii), (iv)

Answer: a
Explanation: Stator speed = 120*50/4 = 1500 rpm
Rotor speed = 120*50/4 = 2250 rpm
Hence the possible speeds could be 750rpm or 3750rpm.

6. A 3-phase slip ring IM is has its copper bars replaced by the aluminium bars in the machine. With the above change ____________
a) starting torque increases, maximum torque remains same, smT increase
b) starting torque increases, maximum torque remains same, smT remains same
c) starting torque increases, maximum torque remains increases, smT increase
d) starting torque decreases, maximum torque remains same, smT decrease

Answer: a
Explanation: As the resistance has been changed as the aluminium has replaced copper, it will not affect the maximum torque.

7. A 3-phase slip ring IM is has its copper bars changed by the aluminium bars in the machine. With the above change ____________
a) starting torque remains same
b) starting torque increase
c) starting torque decrease
d) maximum torque increase

Answer: a
Explanation: Resistance increase, so the starting torque increase.

8. A center ammeter connected to the rotor end circuit of a 6-pole,50 Hz, induction motor makes 45 complete oscillations in a minute. Then the rotor speed and the speed of stator field w.r.t. rotor is?
a) 985, 15
b) 970, 1000
c) 985, 985
d) 985, 970

Answer: a
Explanation: Rotor frequency = s*f1 = 45/60 = 0.75 Hz.
s = 0.75/50 = 0.015

rotor speed = 1000(1-0.015) = 985 rpm.
Speed of stator field w.r.t. rotor = Ns-Nr = 1000-985=15 rpm.

9. Choose from the below which can be obtained by the equivalent circuit of an electrical machine?
a) Complete performance characteristics of the machine
b) Temperature coefficients of the machine components
c) Type of protection to be used in the machine
d) Design parameters of the windings

Answer: a
Explanation: Equivalent circuit can help to give the complete performance characteristics of an electrical machine.

10. If one of the supply fuses blows off and gets open circuited, then for the connected induction machine continues to run with increased slip.
a) True
b) False

Answer: a
Explanation: It is true because as one of the phase is missing, it will lead to decrease in speed assuming machine was providing the rated load.

11. Due to the line to ground fault, phase ‘a’ in the induction motor phase supply gets cut, then machine ____________
a) continues to run with excessive supply current
b) continues to run with reduced slip
c) stalls
d) all of the mentioned

Answer: a
Explanation: It continues to run at lowered speed but with increased current.

12. For 3-phase induction motor, as load increases from no load towards the full load then the ____________
a) power factor improves
b) power factor remains same
c) power factor varies linearly
d) power factor increases till 40% load and then decreases

Answer: a
Explanation: Overall during the operation power factor improves as the reactance reduces and the power factor angle reduces.

13. For 3-phase induction motor, as load increases from no load towards the full load, torque ________ slip.
a) increases in proportion to
b) decreases in proportion to
c) remains constant to
d) increases hyperbolically to

Answer: a
Explanation: For the lower slip, torque will increase proportionally to the slip as verified by the torque slip characteristic.

14. As a 3-phase induction motor, as load increases from no load towards the full load.

```
A. power factor improves
B. torque increases
C. air gap flux falls steeply
```

a) A, B
b) B, C
c) A, B, C
d) A, C

Answer: a
Explanation: Air gap flux increases as the load increase.

15. Torque-slip characteristic of an induction motor is linear in the smaller slip values, because ____________
a) effective rotor resistance is very large compared to reactance
b) rotor resistance is equal to stator resistance
c) rotor resistance is equal to rotor reactance
d) rotor reactance almost equal to stator reactance

Answer: a
Explanation: It is because effective resistance value(r2/s) is far more than reactance and so the torque is linear in this region.

16. If a 3-phase induction motor is fed from the rotor short circuiting the stator terminals, frequency of the current flowing in the short-circuited stator is?
a) slip frequency
b) supply frequency
c) zero
d) frequency corresponding to the rotor speed

Answer: a
Explanation: In the stator the flux developed will revolve with a speed of slip frequency.

17. A constant torque variable power drive of induction machine has ____________
a) constant air gap flux.
b) constant slip
c) variable air gap flux, constant slip
d) constant slip, constant air gap flux

Answer: d
Explanation: A constant torque drive should have constant flux and hence constant air gap flux. Also it should have constant slip.

18. If an emf at slip frequency is injected at an angle α with existing rotor induced emf, then the ____________
a) power factor only improves
b) speed changes
c) power factor improves and speed changes
d) power factor worsens and speed changes

Answer: a
Explanation: Power factor increases as the net angle decreases.

This set of Basic Electrical Machines Questions and Answers focuses on “Armature Windings”.

1. Concentrated winding differ from distributed winding with the concern of __________
a) identical magnetic axis
b) two magnetic axis
c) no magnetic axis
d) physical spacing

Answer: a
Explanation: Concentrated winding have all turns on one magnetic axis.

2. DC machines have _________ windings and synchronous machines use _______ windings.
a) closed,open
b) open, closed
c) open, open
d) closed, closed

Answer: a
Explanation: All the commutator machines use closed winding as it has nothing to deal with reactance. In ac machines, the winding can be converted
to star to delta and vice versa.

3. We can place closed windings in __________
a) ac commutator machine
b) stepper motor
c) ac machine
d) dc machine

Answer: a
Explanation: Closed windings are placed only in commutator as it does not need any reconnections later.

4. Which of the following machines can be used to place open slot winding?
a) ac machine
b) ac commutator machine, ac machine
c) dc machines
d) all of the mentioned

Answer: a
Explanation: Only ac machines are used for open type of winding inside the machine.

5. The simplex lap winding has the range of winding pitch of __________
a) (-2,2)
b) (-1,1)
c) more than 2
d) less than 1

Answer: a
Explanation: For a progressive winding, forward pitch – backward pitch = winding pitch
yb = coil sides/P +or-1 (m)
Here m is such that to make yb an odd integer.

6. The commutator pitch for a simplex lap winding is equal to __________
a) 1 and -1
b) 1
c) -1
d) 2 to -2

Answer: a
Explanation: It is either 1 or -1.

7. A 200V dc machine has 4 poles and 40 coils, having simplex lap winding. The number of commutator segments which required in the given machine will be?
a) 40
b) 20
c) 80
d) 26

Answer: a
Explanation: It is a simplex winding and so one segment of commutator will be needed for each coil.

8. Commutator segments in a DC shunt machine is equal to the number of __________
a) coil sides
b) turns
c) coils
d) slots

Answer: a
Explanation: Commutator segments are placed as per the coil sides in the machine.

9. We can employ dummy coils in a DC machine to __________
a) compensate reactance voltage
b) reduce armature reaction
c) provide mechanical balance to the armature
d) improve the waveforms generated inside the commutator

Answer: a
Explanation: Dummy coils are placed inside so that to provide mechanical support to dc machine and they do not take part in the emf development.

10. In AC machines we should prefer double layer winding over single layer windings because __________
a) it requires identical coils
b) it is economical to use
c) it offers lower leakage reactance
d) all of the mentioned

Answer: a
Explanation: Double layer winding enables more usage of the space and lesser air gaps so the leakage flux also reduces and efficiency improves.

11. For an electrical machine with C number of coils and P poles, the distance between the coils connected by an equalizer ring is?
a) C/P
b) C/2
c) 2C/P
d) C/2P

Answer: c
Explanation: Backward pitch for an equalizer ring = number of coils/pole pairs = C/P/2 = 2C/P.

12. With a P-pole DC machine with armature current Ia, the current per brush arm for a lap connected windings is?
a) Ia/P
b) Ia/2P
c) 2Ia/P
d) Ia/4P

Answer: c
Explanation: Current per brush (lap winding) = total armature current/Number of pole pairs.

13. For a given dc machine it is advised to use the dummy windings for a stable operation. But if it has be replaced as it unused component in the machine, then we must __________
a) S/P/2 should not be an integer
b) S/P/2 should be integer
c) S/P should be integer
d) S/P should not be an integer

Answer: a
Explanation: If slots per pole pair is not integer than all the winding will be completed without adding any dummy coil.

14. While doing regular checks on the dc machine with the lap connected winding, it is reported to have ammeter fluctuations, this can be due to __________
a) different air gaps under poles
b) variable reluctances in the core
c) irregular design deformations
d) all of the mentioned

Answer: d
Explanation: In a lap winding configuration, if the machine as air gap variations due to the design aspects, it will give circulating current in the windings.

15. A 6-pole lap wound DC generator has a developed power of P watts and brush voltage of E volts. Three adjacent brushes of the machine had been found worn out and got open circuited. If the machine is operated with the remaining brushes, voltage and power that could be obtained from the machine are __________
a) E, P
b) E, 2P/3
c) E/P, 2P/3
d) E, P/3

Answer: a
Explanation: Taking Kirchoff’s law into study here, the voltage across the winding will remain same.
But the current will reduce in the overall winding as the resistance has increased, so power will decrease by 1/3.

16. Consider a dc machine having its armature wound in lap fashion having 12 coils and each resistance 0.1 ohms. If it is measured resistance between two adjacent commutator segments, the result will be __________
a) 0.092 ohms
b) 1.1 ohms
c) 1.8 ohms
d) 0.92 ohms

Answer: a
Explanation: There are 11 resistance which are in parallel to one resistance. So taking the equivalent resistance of 11 series connected resistance and the one single resistance of the commutator segment.
R(eq) = 0.1||1.1 = 0.0917.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Ideal Two Winding Transformer”.

1. Which of the following statements support the ideal transformer features?

```
I. Zero winding resistance
II. Zero leakage flux
III. Constant core losses
```

a) I, II
b) III
c) I, III
d) I, II, III

Answer: a
Explanation: Ideal transformer has zero or very small core or copper losses.

2. Which of the following statements support the ideal transformer features?

```
I. Zero winding resistance
II. Zero leakage flux
III. Negligible core losses
```

a) I, II, III
b) III
c) I, III
d) I

Answer: a
Explanation: All the statements support the ideal nature of a transformer.

3. Which of the following statements support the ideal transformer features?

```
I. Zero winding resistance
II. Constant permeability
III. Constant core losses
```

a) I, II
b) III
c) I, III
d) I

Answer: a
Explanation: Ideal transformer has constant permeability so that the magnetization of the core remains linear.

4. Which of the following statements support the ideal transformer features?

```
I. Zero winding resistance
II. Constant permeability
III. Constant core losses
Iv. Zero leakage reactance
```

a) I, II, III, IV
b) III, IV
c) I, III
d) I, IV

Answer: a
Explanation: An ideal transformer should be free from all types of losses and must have a linear magnetization of the core material.

5. Which of the following statements support the ideal transformer features?

```
I. Variable winding reactance
II. Constant permeability
III. Constant core losses
```

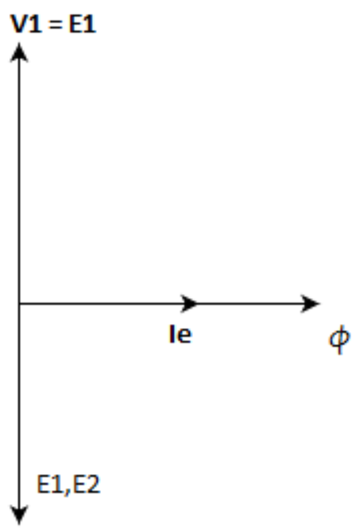
a) I, II
b) III
c) II, III
d) I

Answer: c
Explanation: There should not be any leakage reactance of the winding so that leakage flux is zero and complete coupling takes place.

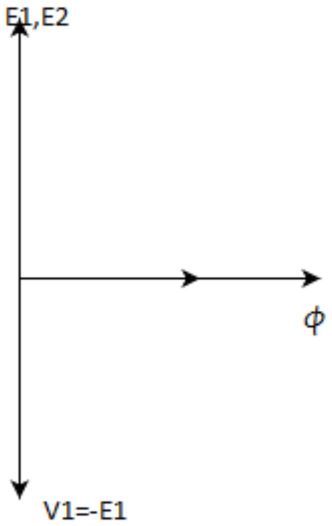
6. The voltage induced at the end of primary terminals of a two winding transformer consisting of N turns is?
a) -N*dϕ/dt
b) N*dϕ/dt
c) -dϕ/dt
d) -N*dt/dϕ

Answer: a
Explanation: Emf is induced based on the electromagnetic induction principle for N turns winding.

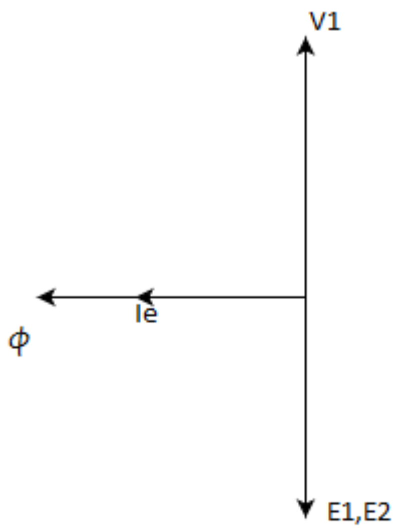
7. Identify the phasor diagram for an ideal transformer at no load.



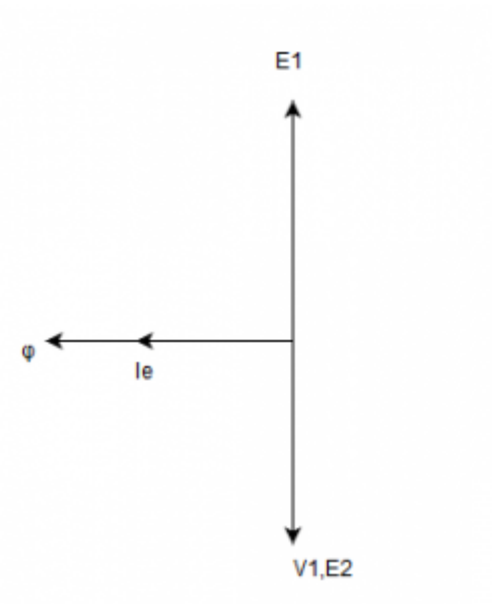
a)



b)



c)



d)

a) zero
b) V1
c) V1/2
d) 2*V1

Answer: a
Explanation: In an ideal transformer, the induced emf lags the flux by 90degrees.

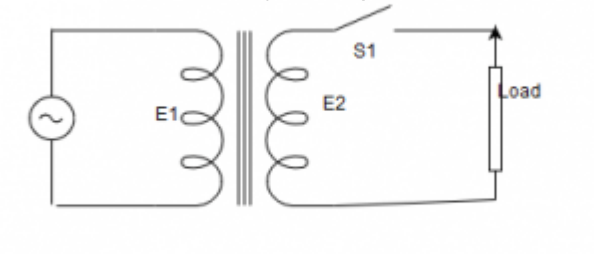
8. Consider a 2-winding transformer as below. If the switch is open then the emf induced across the load ‘Zl’ having transformation ratio of 2 is?
a) zero
b) V1
c) V1/2
d) 2*V1

Answer: a
Explanation: As the secondary switch is kept open, the voltage across load will be zero.

9. Consider a 2-winding transformer as below. If the switch is open then the emf induced across the secondary having transformation ratio of 2 is?
a) zero
b) V1
c) V1/2
d) 2*V1

Answer: d
Explanation: V2/V1 = 2
S, V2 = 2*V1.

10. Consider a 2-winding transformer as below. If the switch is kept open then the emf induced across the secondary having transformation ratio of '2' is?



a) zero
b) 2E1
c) E/2
d) E1

Answer: a
Explanation: The induced emf lags the flux by 90degrees.

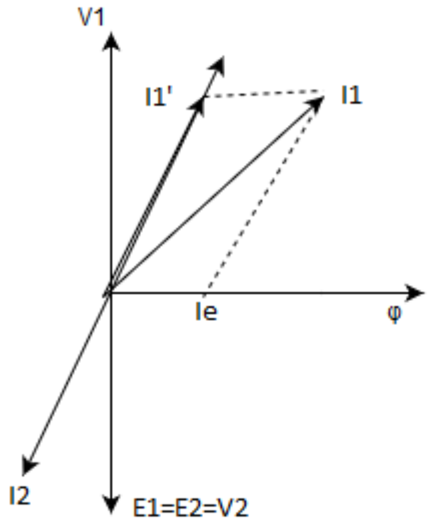
11. Which of the following statement is true?

```
I. Core flux in an ideal transformer remains constant.
II. Core flux is independent of the load current.
```

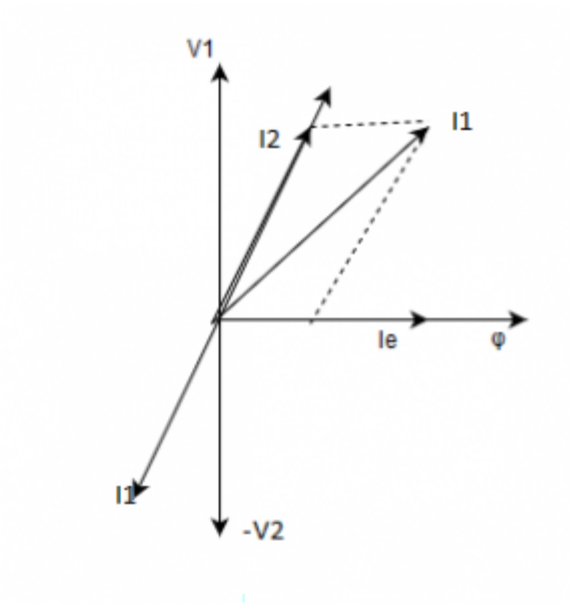
a) I
b) II
c) I,II
d) none of the mentioned

Answer: a
Explanation: Any changes in the secondary circuit of the transformer is reflected automaticaly in the primary winding so the net core flux remains constant.

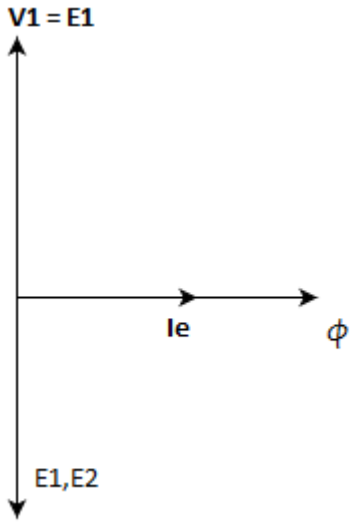
12. If it is happened to place an inductive load to a two winding transformer, then the phasor diagram for such a loading will be?



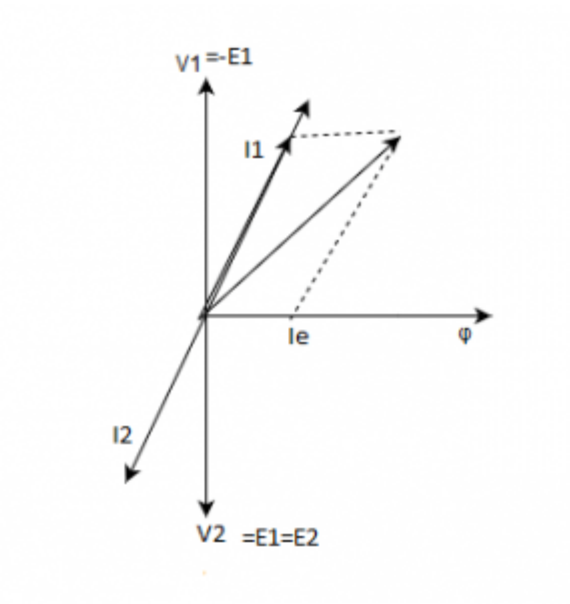
a)



b)



c)



d)

Answer: a
Explanation: I2 will lag behind the V2 by the angle θ.

13. Which of the following assumptions about the transformer supports the fact that the instantaneous power input and output of a transformer is equal?

```
I. Zero winding resistance
II. Constant permeability
III. Constant core losses
Iv. Zero leakage reactance
```

a) I,II,III,IV
b) III,IV
c) I,III
d) I,IV

Answer: c
Explanation: If the impedance overall is zero for a transformer, then the losses ocurring in a transformer will be zero. So the efficiency is 100%.

14. Which of the following statements are incorrect for an ideal transformer?

```
I. Voltages - inverse ratio
II. Current - direct ratio
III. Impedance - direct ratio squared
Iv. Power - remains same
```

a) I,II,III,IV
b) III,IV
c) I,II
d) I,IV

Answer: c
Explanation: Voltages are transformed in direct ratio of the turns ratio. and current as inverse turns ratio.

15. Which of the following statements are correct for an ideal transformer?

```
I. Voltages - Direct ratio
II. Current - Inverse ratio
III. Impedance - Direct ratio squared
Iv. Power - Remains same
```

a) I,II,III,IV
b) III,IV
c) I,III
d) I,IV

Answer: a
Explanation: All the matches are correct.

16. Which of the following statements are correct for an ideal transformer?

```
I. Voltages - inverse ratio
II. Current - direct ratio
III. Impedance - direct ratio squared
Iv. KVA - remains same
```

a) I,II,III,IV
b) III,IV
c) I,III
d) I,IV

Answer: b
Explanation: Voltages are transformed in direct ratio of the turns ratio. and current as inverse turns ratio in a 2-winding transformer.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Transformer Construction".

1. The primary and secondary of a transformer are _________ coupled but ________ connected.
a) magnetically, not electrically
b) electrically, not magnetically
c) magnetically, also magnetically
d) electrically, also electrically

Answer: a
Explanation: Transformer is the machine which has physical spacing and has magnetic circuit to exchange the voltage.

2. We can employ transformers for a power range of __________
a) lower and higer values
b) lower values
c) higher values
d) medium values

Answer: a
Explanation: A transformer can be put in use upto a varying range of the power and it is usually available in readily in market.

3. A transformer has comparitively much higher efficiency than a similar induction machine due to __________
a) small air gaps
b) no moving parts
c) strong coupling
d) all of the mentioned

Answer: d
Explanation: Transformer does not has any moving components so losses are anyway reduced and also the coupling is very strong between two sides.

4. It was needed that to isolate dc noise coming from the transmitted signal, to attain the same which machine can be used without suffering significant loss?
a) transformer
b) dc machine
c) induction machine
d) stepper motor

Answer: a
Explanation: We should use transformer to achive the isolation of dc.

5. Which is the most widely used material in the core of the transformer?
a) cold rolled grain oriented sheet steel
b) cold rolled grain steel
c) soft iron
d) steel

Answer: a
Explanation: CRGO has magnetization in the rolling direction and low core losses and very high permeability than present materials.

6. The leakage flux is the flux in side the transformer which?
a) links either of the windings
b) links both of the windings
c) yoke of the core
d) windows of the core

Answer: a
Explanation: Leakage flux is meant to to be loss as it does not link two windings.

7. It is advised that staggering of the butt joints __________
a) reduces reluctance of the path
b) increases air gap

c) increases mechanical strength
d) all of the mentioned

Answer: c
Explanation: Staggering is done for the steel butt joints of the transformer to gain more mechanical strength as the continuous air gap reduces the same.

8. Consider two transformers X and Y having exact ratings, but have flux densities of 1.5T and 2T respectively. The weight of the transformer A per KVA will be __________
a) more than that of B
b) lesser than that of B
c) equal to that of B
d) can not be said from the given data

Answer: a
Explanation: Flux density = flux/Area.
Hence A has more area than B and so weight of A will be more than that of B.

9. Consider two transformers X and Y having identical ratings, but have flux densities of 1.5T and 2T respectively. The weight of the transformer B per KVA will be __________
a) more than that of A
b) lesser than that of A
c) equal to that of A
d) can not be said from the given data

Answer: b
Explanation: Flux density = flux/Area.
Hence A has more area than B and so weight of B will be less than that of A.

10. Transformers do not require any type of cooling as it well ventilated.
a) True
b) False

Answer: b
Explanation: It is wrong to say that transformers do not need any cooling. It does need various types of cooling like oil cooling, air cooled etc.

11. A coupling magnetic field inside a rotating machine or static machine like transformers must involve with __________
a) mechanical parts
b) electrical parts
c) both electrical and mechanical
d) either of the electrical or mechanical parts

Answer: a
Explanation: The coupling field should interact with both the electrical as well as mechanical parts in order to achieve electromechanical energy conversion.

12. A coupling magnetic field inside a rotating machine or static machine like transformers must involve with __________

```
I. electrical system to extract energy from electrical system.
II. mechanical system to extract energy from electrical system.
```

a) Only I is true
b) Only II is true
c) I and II are true
d) I and II are false

Answer: b
Explanation: The energy conversion which involves both electrical as well as mechanical systems must have mutual field.

13. I. Pulse transformers use soft ferrites.
II. The transformers used in the radio recievers use air core.
a) Only I is true

b) Only II is true
c) I and II are true
d) I and II are false

Answer: c
Explanation: Pulse transformers are used in isolation transformer and need high permeablity.

14. Stepping of the core is implemented in the core to __________
a) reduce conductor material and copper losses
b) reduce core loss
c) to provide mechanical strength
d) to reduce magnetizing current

Answer: a
Explanation: Stepping of the core is done so that the copper material reduces.

15. Core type transformers have, LV and HV windings are arranged such that __________
a) Half LV near the core and half HV outside LV on each limb
b) LV one one limb and HV on the other
c) Half LV outside the core and half HV inside LV on each limb
d) LV and HV windings are sandwiched

Answer: a
Explanation: Core windng has first of all both the windings on the same limb and HV is placed outside to have tappings to the transformer.

16. The shell type transformers have, LV and HV windings are arranged such that __________
a) Half LV near the core and half HV outside LV on each limb
b) LV one one limb and HV on the other
c) Half LV outside the core and half HV inside LV on each limb
d) LV and HV windings are sandwiched

Answer: d
Explanation: Shell type windng has mix of LV and HV winding sandwiched over each other.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Transformer Phasor Diagram”.

1. The output voltage seen at the CRO connected at the secondary terminals is square wave. Then the flux density used for energizing the primary is?
a) triangular
b) sinusoidal
c) saw tooth wave
d) square wave

Answer: a
Explanation: $E = -N*d\phi/dt$. Integration of square wave will be triangular in nature.

2. The non linear magnetization curve of a practical transformer will introduce ______________
a) heating
b) higher order harmonics
c) magnetostriction
d) all of the mentioned

Answer: d
Explanation: If the magnetization is non linear in nature then it will cause a saturation in the core and harmonics will be introduced to cause humming sounds.

3. Transformer action requires a ____________
a) constant magnetic flux
b) increasing magnetic flux
c) alternating magnetic flux
d) alternating electric flux

Answer: c
Explanation: As per the Faraday’s laws, the emf will be induced when flux is time varying as in

transformer, there is no moving part.

4. If a transformer is fed from a 220V and dc supply rather than a 1-phase ac supply, then the transformer will ____________
a) burn its windings
b) operate normal
c) will not operate
d) will give very small leakage flux

Answer: a
Explanation: Dc is nothing but ac at zero frequency. So the reactance offered will be zero at dc and the current will be limited only by the small resistance of the winding which will produce very high amount of current to flow through the windings, so burning them up.

5. In an ideal transformer, the impedance can be transformed from one side to the other ____________
a) in direct proportion to square of turns-ratio
b) in direct proportion to turns-ratio
c) in inverse proportion to square turns-ratio
d) in inverse proportion to turns-ratio

Answer: a
Explanation: Impedance is transformed in square of the turns-ratio.

6. A transformer has sometimes more than two ratings depending upon the use of ____________
a) the cooling application
b) type of windings
c) type of core
d) type of insulation to be given

Answer: a
Explanation: Yes, with different types of the cooling methods, the losses can be varied and so the current and the voltages.

7. Considering a transformer at no load is excited at rated voltage. A small recognizable gap is made in the yoke of the limbs. With this altercation, the transformer core flux ____________
a) will decrease and magnetizing current will increase
b) will remain constant and magnetizing current will increase
c) as well as magnetizing current will increase
d) as well as magnetizing current both will decrease

Answer: b
Explanation: The reluctance of the path increases here after making the cut. so the magnetizing current will increase but the core flux will be same as it depends on the applied voltage not the reluctance.

8. In an oil filled transformer, the application of oil is for ____________
a) cooling
b) insulation
c) both cooling and insulation
d) preventing the accumulation of dust

Answer: c
Explanation: Oil can be used not only for cooling but also for insulation from the metallic parts.

9. We laminate transformer core to reduce ____________
a) eddy current loss
b) hysteresis loss
c) both eddy current and hysteresis loss
d) ohmic loss

Answer: a
Explanation: Laminations provide larger area so that the current path increases and current reduces.

10. Which of the following two are matched correctly?

```
I. Core flux - Depends on applied voltage
II. Leakage flux - Depends on winding current
```

a) I
b) II
c) I, II
d) none of the mentioned

Answer: a
Explanation: Both the statements are correct, as the leakage flux depends on the current flowing in the respective winding and the core flux depends on the voltage.

11. In case of a power transformer, the no load current in terms of rated correct is?
a) 10-20%
b) 2-6%
c) 15-20%
d) 30-50%

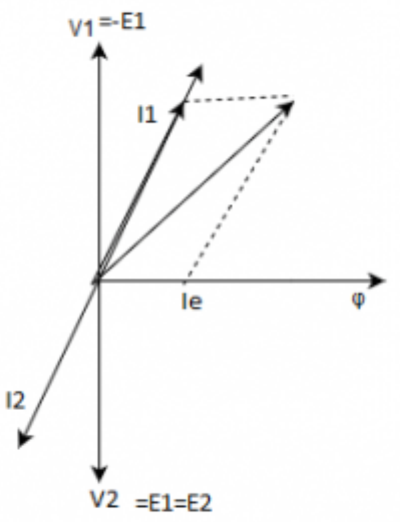
Answer: b
Explanation: The air gap is very less in the transformer, so the magnetizing current needed is around 2-6% only.

12. Energizing the transformer primary from a triangular wave voltage source makes the output voltage as ___________
a) zero
b) a sine wave
c) a triangular wave
d) a pulsed wave

Answer: c
Explanation: Output will follow the shape of input wave. As the primary input is triangular in shape, its secondary will also be same.

13. In a single phase transformer,the no-load current lags the applied voltage by ___________
a) 90°
b) about 75°
c) 0
d) about 110°

Answer: b
Explanation: Check the phasor diagram.



14. A 400/200V transformer has total resistance of 0.04 p.u on its L.V side. This resistance when referred to H.V side would be?
a) 0.04
b) 0.02
c) 0.01
d) 0.08

Answer: a
Explanation: The per unit value does not change from the winding side of a transformer.

15. Energising the transformer primary from a triangular wave flux makes the output voltage as ___________
a) square wave shifted by 90°
b) a sine wave
c) a triangular wave
d) a square wave

Answer: d
Explanation: E = -N*dϕ/dt.
Differentiation of triangular wave results in square wave.

This set of Electrical Machines Assessment Questions and Answers focuses on “Equivalent Circuit of Transformer”.

1. In a transformer if the frequency of the supply is varied then the magnetizing current in the core also varies.
a) True
b) False

Answer: b
Explanation: The magnetizing current does not depend on the frequency of the supply fed to it.

2. CRGO Laminations in a transformer are used to minimize ___________
a) eddy current loss
b) hysteresis loss
c) both eddy current and hysteresis loss
d) ohmic loss

Answer: c
Explanation: CRGO steel is rolled grain type domains which not only help for faster reversals but also the reduction of eddy current losses.

3. A single phase transformer has emf per turn having 2310/220 V, 50Hz transformer as 13 V. Then the estimated primary turns will be?
a) 189 turns
b) 179 turns
c) 176 turns
d) 190 turns

Answer: a
Explanation: N2 = Total secondary voltage/Emf per turn
= 220/13 = 16.92 = 17(approx)
For N2 = 17, N1 = 178.5. But it is not an integer, so this approximation is wrong.
If N2 = 18, N1=189 turns.

4. A single phase transformer has emf per turn having 2310/220 V, 50Hz transformer as 13 V. The core area is(in square cm)?
a) 393
b) 277.8
c) 358.92
d) 450.03

Answer: a
Explanation: Emf per turn = 1.44*f*flux density * Area*N2
Area = 220/(18*1.44*50*1.4) = 393 sq.cm.

5. If a transformer is fed from a dc rather than a 1-phase ac supply, then the transformer will ___________
a) burn its windings
b) operate normal
c) will not operate
d) will give very small leakage flux

Answer: a
Explanation: Dc is nothing but ac at zero frequency. So the reactance will be zero and the current will be limited solely by the small resistance of the winding which will produce very high amount of current to flow through the windings, so burning them up.

6. For a single phase transformer operating at normal operating conditions has useful flux of 1 Wb. If the machine is loaded at 0.8 p.f., then its mutual flux ___________
a) may decrease to 0.98 Wb
b) remains constant

c) may increase 1.02 Wb
d) may decrease to 0.8 Wb

Answer: a
Explanation: The mutual flux will decrease by a very small amount.

7. The flux involved in the emf equation of a transformer has ___________
a) rms value
b) average value
c) total value
d) maximum value

Answer: d
Explanation: The flux is always taken at its peak in the practical calculation cases.

8. If the frequency at the primary supply is varied gradually, then the secondary terminal voltage will ___________
a) not change
b) vary directly
c) will vary oppositely
d) will vary inverse of frequency

Answer: a
Explanation: The changes in the frequency is not reflected due to the flux density variation correspondingly.

9. There are two identical transformers A and B such that flux density applied to B is doubled. Then magnetizing current of B is?
a) larger than A
b) double of A
c) half of A
d) same as that of A.

Answer: a
Explanation: When we double the flux density, as per the magnetization curve of the core, the magnetizing current is much larger than double of the machine A.

10. A 20KVA, 2200/220 V, 50 Hz single phase transformer has the below parameters:

```
HV : r = 2.4  Ω, X = 6 Ω
LV: r = 0.03  Ω, X = 0.07 Ω
```

The primary reactance referred to secondary is?
a) 0.024 Ω
b) 0.06 Ω
c) 3 Ω
d) 7 Ω

Answer: b
Explanation: Primary reactance referred to secondary = x1*(N2/N1)^2 = 6*(220/2200)^2 = 0.06 Ω.

11. A 20KVA, 2200/220 V, 50 Hz single phase transformer has the below parameters:

```
HV : r = 2.4  Ω, X = 6 Ω, Primary
LV: r = 0.03  Ω, X = 0.07 Ω, Secondary
```

The secondary reactance referred to primary is?
a) 0.024 Ω
b) 0.06 Ω
c) 3 Ω
d) 7 Ω

Answer: d
Explanation: Secondary reactance referred to primary = x2*(N1/N2)^2 = 0.07*(2200/220)^2 = 7.0 Ω

12. A 20KVA, 2200/220 V, 50 Hz single phase transformer has the below parameters:

```
HV : r = 2.4  Ω, X = 6 Ω
LV: r = 0.03  Ω, X = 0.07 Ω
```

The primary resistance referred to secondary is?
a) 0.024 Ω
b) 0.06 Ω
c) 3 Ω
d) 7 Ω

Answer: a
Explanation: Primary resistance referred to secondary = r1*(N2/N1)^2 = 2.4*(220/2200)^2 = 0.024 Ω.

13. A 20KVA, 2200/220 V, 50 Hz single phase transformer has the below parameters:

```
HV : r = 2.4  Ω, X = 6 Ω
LV: r = 0.03  Ω, X = 0.07 Ω
```

The secondary resistance referred to primary is?
a) 0.024 Ω
b) 0.06 Ω
c) 3 Ω
d) 7 Ω

Answer: c
Explanation: Secondary resistance referred to primary = r2*(N1/N2)^2 = 0.03*(2200/220)^2 = 3.0 Ω.

14. In a transformer _______ decreases with increase of the leakage flux.
a) secondary terminal voltage
b) secondary induced voltage
c) primary induced voltage
d) all of the mentioned

Answer: a
Explanation: The leakage is modelled as the reactance which incurrs as a loss to the terminal voltage not the induced voltage.

15. The components needed to draw the phasor diagram of the transformer is?

```
A. load current
B. Equivalent circuit parameters
C. Load power factor
```

a) A, B, C
b) B
c) B, C
d) A, B

Answer: a
Explanation: All the mentioned quantities are must to draw the phasor diagram of a transformer.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Open Circuit and Short Circuit Test".

1. Power required during the open circuit and short circuit test is?
a) losses incurring in the transformer
b) executing the power requirements by measuring instruments
c) power for the core losses only
d) all of the mentioned

Answer: a
Explanation: The power measured while conducting the tests is the winding losses and the core losses.

2. The open circuit test results in finding which of the following parameters?

```
I. core losses
II. shunt branch parameters
III. turns ratio of transformer
```

a) I, II, III
b) I, II
c) II, III
d) I, III

Answer: a
Explanation: OC test gives the shunt branch parameters as well as the turns ratio by connecting a voltmeter at open circuited secondary terminals.

3. The open circuit test results in finding which of the following parameters?

```
I. core losses
II. shunt branch parameters
III. series parameters
```

a) I, II, III
b) I, II
c) II, III
d) I, III

Answer: b
Explanation: Series parameters are obtained by short circuit test results.

4. Which of the following informations are obtained from short-circuit test?

```
I. Ohmic losses at rated current
II. Equivalent resistance and leakage reactance
III. Core losses
IV. Voltage regulation
```

a) I, II, IV
b) II, III
c) I, II, IV
d) II, III, IV

Answer: a
Explanation: Core losses are found from OC test.

5. Which of the below estimations require results of both open circuit test and short circuit test?
a) Efficiency
b) Equivalent impedance of one side of the winding
c) Voltage regulation for exact circuit
d) All of the mentioned

Answer: a
Explanation: All the estimations asked will need results of both the tests.

6. To conduct the open circuit test, test is conducted on the _______________
a) l.v. side
b) h.v. side
c) primary
d) secondary

Answer: a
Explanation: OC test is performed on the l.v. side of the transformer because the l.v. winding will have lower stress on the insulation and no damage will occur.

7. To conduct the short circuit test, test is conducted on the ____________
a) l.v. side
b) h.v. side
c) primary
d) secondary

Answer: b
Explanation: To circulate the rated current in the winding, we should opt for lower value of the current so that winding will not damage.

8. A single phase transformer of 2200/220 V having rated l.v. current of 150 A has to undergo open circuit test on h.v. side. Which of the below instruments range should be used?
a) 6A, 200V
b) 150A, 22V
c) 60A, 220V
d) 6A, 20V

Answer: a
Explanation: Open circuit test is conducted on l.v. side, so the measuring instruments will be on the h.v. side.
So the current in the h.v. side will be around 3-6% of the rated.

9. A single phase transformer of 2000/200 V having rated l.v. current of 100 A has to undergo short circuit test on l.v. side. Which of the below instruments range should be used?
a) 200V,10A
b) 20V, 10A
c) 300V,100A
d) 200V,50A

Answer: a
Explanation: Short circuit test is conducted on h.v. side, so the measuring instruments will be on the l.v. side.
Rated current on the h.v. will be 10A and voltage will be around 5-12% to account for winding losses.

10. A single phase transformer of 2200/220 V having rated l.v. current of 150 A has to undergo open circuit test on h.v side. The instruments used are voltmeter of 200V and ammeter of 1A. Then the results ____________
a) will be wrong
b) will be accurate
c) of ammeter will burn
d) none of the mentioned

Answer: c
Explanation: The current in the h.v. winding will be around 10 A but the ammeter is of 1 A rating. So, it will burn off.

11. Which of the following conditions have to ensured for a short-circuit test?

```
A. L.v. is short circuited
B. It helps in calculation of voltage regulation
C. It is performed at rated voltage
```

a) A, B
b) A, B, C
c) B, C
d) A, C

Answer: a
Explanation: For conducting short circuit test, l.v. winding is short circuited and it is not performed at rated voltage.

12. Which of the following conditions have to ensured for a short-circuit test?

```
A. h.v. winding is short-circuited
B. It helps in calculation of voltage regulation
C. It is performed at rated voltage
D. l.v. winding is short-circuited
```

a) B, D
b) A, B, C
c) B, C, D
d) A, C

Answer: a
Explanation: For conducting short circuit test, l.v. winding is short circuited and it is not performed at rated voltage.

13. Transformers with high leakage impedance is used in ____________
a) arc welding
b) power distribution
c) power generating terminals
d) none of the mentioned

Answer: a
Explanation: The feature of the high impedance is extracted in the arc welding applications.

14. Which of the following conditions have to ensured for a open-circuit test?

```
A. Performed on L.V side
B. Leakage impedance can be obtained
C. It is performed at rated voltage
D. It gives magnetizing impedance
```

a) B, D
b) A, B, C
c) B, C, D
d) A, C, D

Answer: d
Explanation: Leakage impedance is not found from open-circuit test.

15. Which of the following conditions have to ensured for a open-circuit test?

```
A. Performed on L.V side
B. Leakage impedance can be obtained
C. It is performed at 10-12% of rated voltage
D. It gives magnetizing impedance
```

a) B, D
b) A, B, C
c) B, C, D
d) A, D

Answer: a
Explanation: Leakage impedance is not found from open-circuit test. And it is performed on the rated voltage to account for core losses.

16. Which of the following informations are not obtained from short-circuit test?

```
I. Ohmic losses at rated current
II. Equivalent resistance and leakage reactance
III. Core losses
IV. Voltage regulation
```

a) I, II
b) II, III
c) I, II, IV

d) II, III

Answer: d
Explanation: Core losses are found from OC test and the voltage regulation is not obtained from one single test here.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Transformer Losses and Efficiency".

1. Which of the statements made here are correct regarding the transformer?

```
I. Maximum voltage regulation occurs at the leading p.f.
II. Maximum voltage regulation occurs when load p.f. angle and
impedance angle of the leakage impedance are same.
III. V.R. at zero p.f. is always zero.
IV. V.R. of a transformer may be negative at leading p.f.
```

a) I, III
b) II, IV
c) 1, III
d) I, IV, III

Answer: b
Explanation: V.R. is always negative at leading p.f. and the load p.f. angle and impedance angle of the leakage impedance should be same for maximum V.R.

2. Which of the statements made here are correct regarding the transformer?

```
I. Maximum voltage regulation occurs at the leading p.f.
II. Maximum voltage regulation occurs when load p.f. angle and
impedance angle of the leakage impedance are same.
III. V.R. at zero p.f. is always zero.
IV. V.R. of a transformer may be negative at leading p.f.
```

a) I, II, III
b) II, IV
c) 1, III
d) I, IV, III

Answer: a
Explanation: V.R. is always negative at leading p.f. and the load p.f. angle.

3. Which of the statements made here are incorrect regarding the transformer?

```
I. Maximum voltage regulation occurs at the leading p.f.
II. Maximum voltage regulation occurs when load p.f. angle and
impedance angle of the leakage impedance are same.
III. V.R. at zero p.f. is always zero.
IV. V.R. of a transformer may be negative at leading p.f.
```

a) I,III
b) II,IV
c) 1,III
d) I,IV,III

Answer: a
Explanation: V.R. is always negative at leading p.f. and the load p.f. angle and impedance angle of the leakage impedance should be same for maximum V.R.

4. Which of the statements made here are incorrect regarding the transformer?

```
I. Maximum voltage regulation occurs at the leading p.f.
II. Maximum voltage regulation occurs when load p.f. angle and
impedance angle of the leakage impedance are same.
```

III. V.R. at zero p.f. is always zero.
IV. V.R. of a transformer may be negative at leading p.f.

a) I,II,III
b) IV
c) 1,III
d) I,IV,III

Answer: b
Explanation: V.R. is always negative at leading p.f. and the load p.f. angle.

5. Which of the following mentioned losses occur in a transformer?
a) Hysteresis losses; Eddy current losses; Dielectric losses; Stray load losses
b) Hysteresis losses; Eddy current losses;
c) Dielectric losses; Stray load losses
d) Hysteresis losses; Eddy current losses; Stray load losses

Answer: a
Explanation: Hysteresis losses-due to magnetic material; Eddy current losses-on the core area; Dielectric losses- due to insulation material; Stray load losses- due to leakage through the parts of the transformer.

6. Mutual flux _______ at the lagging loading and it ______ at the leading power factor.
a) decreases, increases
b) increases, increases
c) decreases, decreases
d) increases, decreases

Answer: a
Explanation: The mutual flux falls when the transformer is working at lagging p.f. and it increases at leading p.f.

7. It is possible to attain maximum efficiency in a transformer when the _______
a) core losses are equal to rated full load copper losses
b) core losses are more than rated full load copper losses
c) core losses and full load copper losses are constant
d) copper loss also becomes constant

Answer: a
Explanation: Maximum efficiency is achieved at the condition when fixed core losses and copper losses at rated condition are equal.

8. The efficiency of a 20 KVA, 2000/200 V, single phase transformer at unity pf is 98%. The total losses at this condition is?
a) 408W
b) 4.08kW
c) 204W
d) 2.04kW

Answer: a
Explanation: Efficiency = 1-(losses/input) = 1-(losses/output+losses)
0.98 = 1-(Losses/20000+losses)
Losses = 408 W.

9. The efficiency of a 20 KVA, 2000/200 V, single phase transformer at unity pf is 98%. The given total losses at full load is 200 W. The pu resistance is?
a) 0.01
b) 0.1
c) 1.0
d) 0.0196

Answer: a
Explanation: pu resistance = Ohmic losses/KVA = 200/20000 = 0.01 pu.

10. The load current at which maximum efficiency occurs is independent of the load power factor.

a) True
b) False

Answer: b
Explanation: Because Core losses and the effective resistance of the secondary are almost unaffected by load p.f.

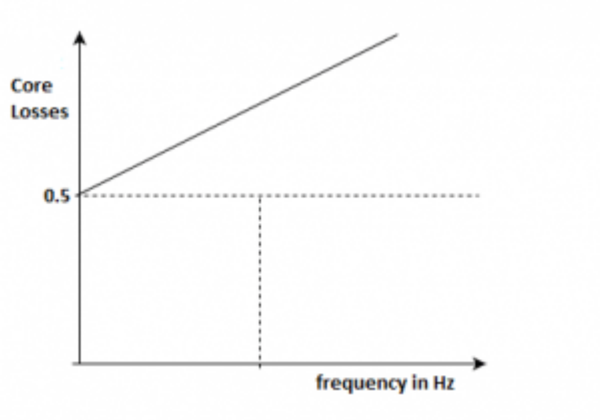
11. The full load voltage drop in a 1-phase transformer is 2% and 4% respectively due to resistance and leakage reactance. Then the voltage drop is maximum at ___________
a) 0.45 lagging
b) 0.45 leading
c) 0.9 lagging
d) 0.9 leading

Answer: a
Explanation: Z = 4.47; cosθ = percentage r/percentage z = 2/(4.47) = 0.45.

12. The full load voltage drop in a 1-phase transformer is 2% and 4% respectively due to resistance and leakage reactance. Then the voltage drop is zero at ___________
a) 0.45 lagging
b) 0.45 leading
c) 0.9 lagging
d) 0.9 leading

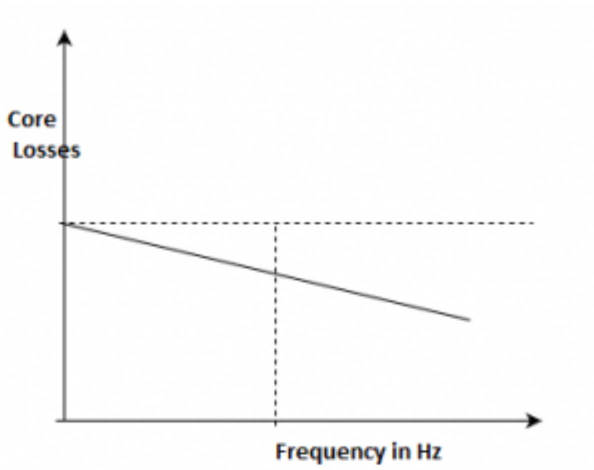
Answer: c
Explanation: Z = 4.47; cosθ = percentage x/percentage z = 4/4.47 = 0.89.

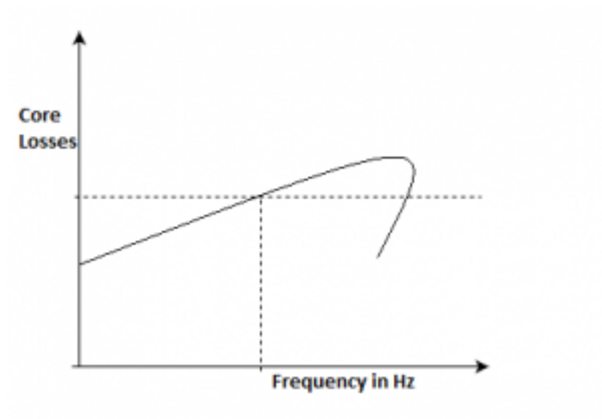
13. Core losses of a transformer as a function of frequency is best approximated by which of the below characteristics?



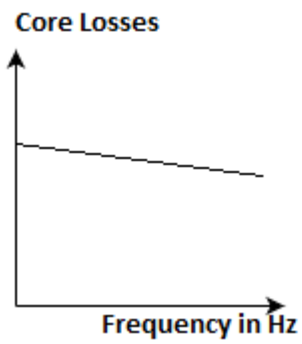
a)

b)



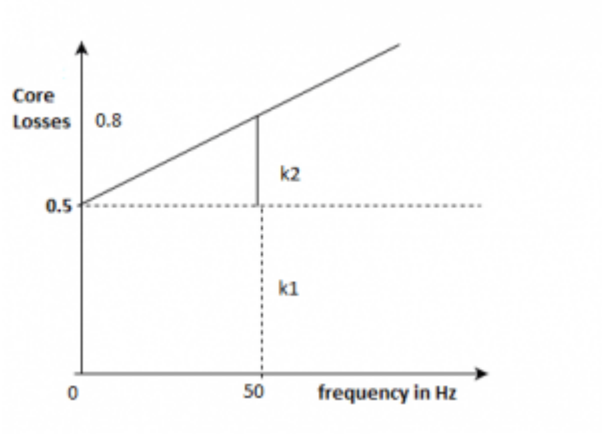


c)

d) 

Answer: a
Explanation: We can represent the core losses per cycle eq. as Pc/f = A+B*f, where A and B are constants.

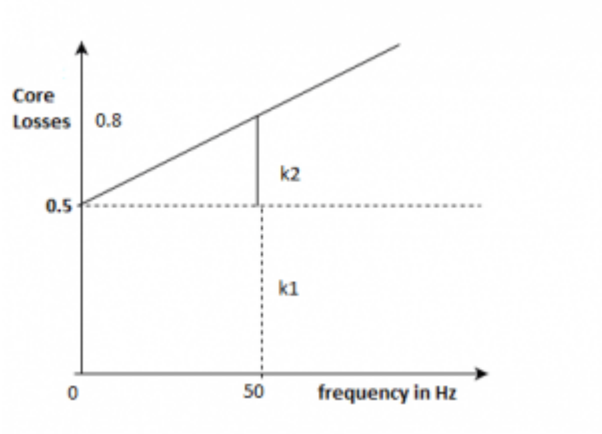
14. From the above graph of the core losses per cycle is, the hysteresis losses per phase for a transformer at a operating frequency of 40 Hz is?



a) 20W
b) 30W
c) 80W
d) 32W

Answer: a
Explanation: Ph = k1*f = 0.5*40 = 20W.

15. From the above graph of the core losses per cycle is, the eddy losses per phase for a transformer at a operating frequency of 40 Hz is?



a) 15 W
b) 20W
c) 35W
d) 32W

Answer: a
Explanation: Pe = k2*f ^{2} ;
Using the slope of the line, (k2)*50 = 0.8 – 0.5 = 0.3
(k2) = 0.006
Pe = 50*50*0.006 = 15 W.

16. The efficiency of a transformer can be calculated accurately from ____________
a) Open circuit test, Short circuit test
b) Open circuit test, Short circuit test, Sumpner’s test
c) Sumpner’s test
d) load test

Answer: a
Explanation: OC and SC tests together can help to estimate the most correct value of the efficiency for the given transformer.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Voltage Regulation of Transformer”.

1. A 10 kVA, 400/200 V, 1-phase transformer with 2% resistance and 2% leakage reactance. It draws steady short circuit current at which angle?
a) 45°
b) 75°
c) 135°
d) 0°

Answer: a
Explanation: The power factor angle will be atan(x/r) = 45°.

2. While conducting open circuit test and short circuit test on a transformer, status of low-voltage and high-voltage windings will be such that in _____________
a) OC test – h.v. open, SC test-l.v. short-circuited
b) OC test – l.v. open, SC test-h.v. short-circuited
c) OC test – l.v. open, SC test-l.v. short-circuited
d) OC test – h.v. open, SC test-h.v. short-circuited

Answer: a
Explanation: In conducting short circuit test, l.v. winding is short circuited. In OC test h.v. is open circuited.

3. While conducting testing on the single phase transformer, one of the student tries to measure the resistance by putting an ammeter across one terminal of primary and other to secondary, the reading obtained will be ____________
a) infinite
b) zero
c) finite
d) negative finite

Answer: a
Explanation: As the primary and secondary are physically isolated, the impedance will be infinite for not electrically connected circuit.

4. If the per unit leakage impedance for the primary of a transformer is ‘x’ on the given rated base value. If the voltage and volt-amperes are doubled, then the changed per unit impedance will be ____________
a) 0.5x
b) 2x
c) 4x
d) x

Answer: a
Explanation: pu(new base) = (x)*(MVA(new)/MVA(old))*(kV(old)/kV(new))^2
= x*2*(1/4)
= 0.5x.

5. If the per unit leakage impedance for the primary of a transformer is ‘x’ on the given rated base value. If the voltage and volt-amperes are halved, then the changed per unit impedance will be ____________
a) 0.5x
b) 2x
c) 4x
d) x

Answer: b
Explanation: pu(new base) = (x)*(MVA(new)/MVA(old))*(kV(old)/kV(new))^2
= x*0.5*(4/)
= 2x.

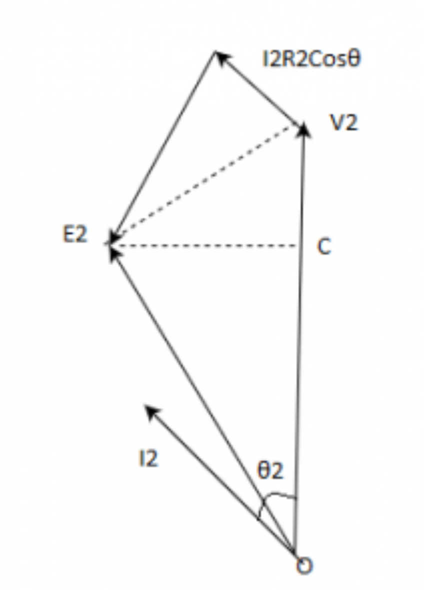
6. The voltage regulation for transformer is given by ____________
a) (E2-V2)/E2
b) (E2-V2)/V2
c) (V2-E2)/E2
d) (V2-E2)/V2

Answer: a
Explanation: Voltage regulation is the change in secondary voltage with secondary rated voltage.

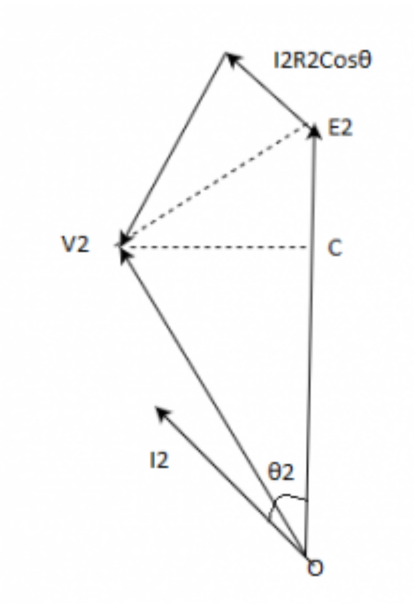
7. While estimating voltage regulation of a transformer, keeping ____________
a) primary voltage constant
b) secondary voltage constant
c) voltage changes constant at primary
d) all of the mentioned

Answer: a
Explanation: V.R. is calculated keeping the primary constant because then the core flux will change and the change of secondary voltage can not be fixed.

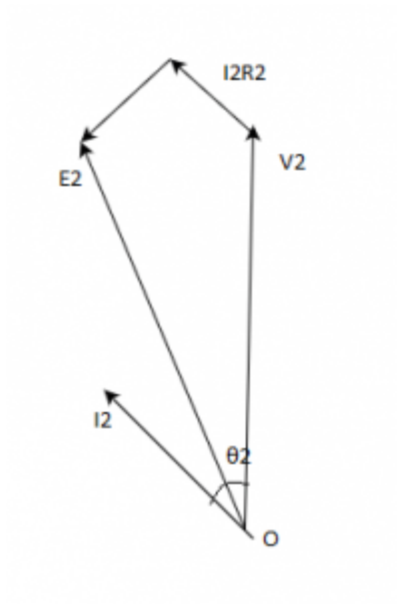
8. Identify the phasor diagram for the negative voltage regulation from the below diagrams.

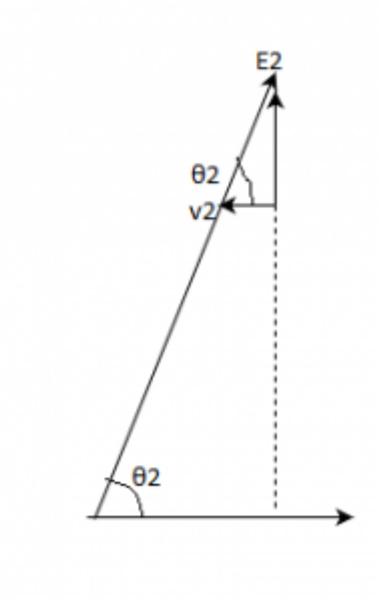
a) 

b)



c)

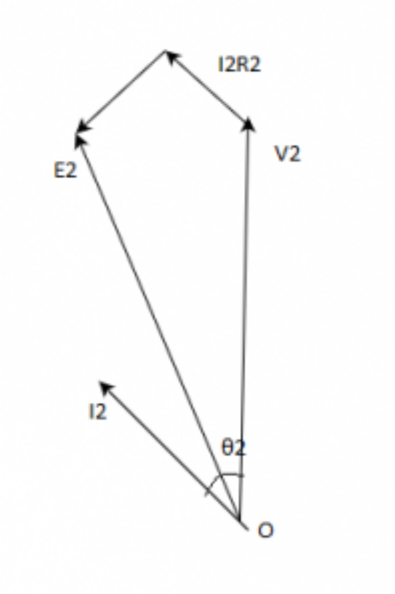


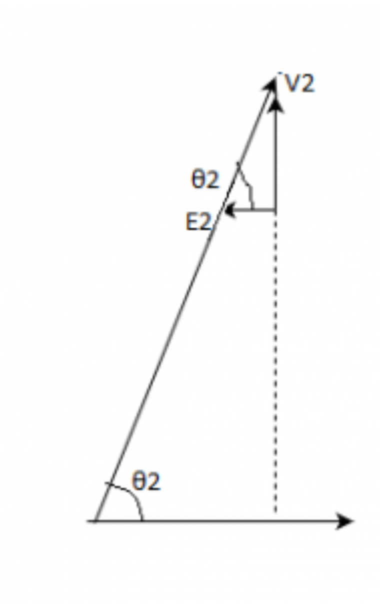


d)

Answer: a
Explanation: Negative V.R. is achieved at leading power factor.

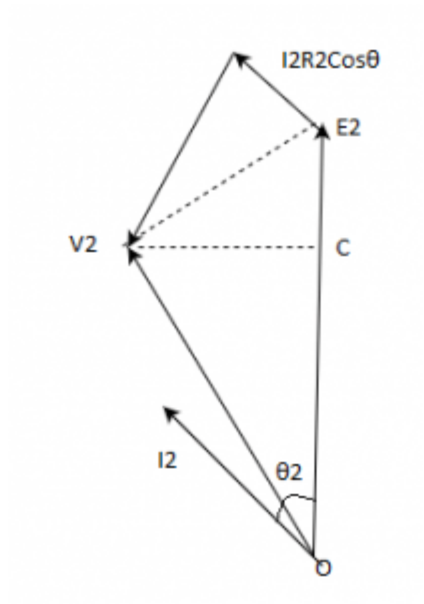
9. Identify the phasor diagram for the zero voltage regulation from the below diagrams.

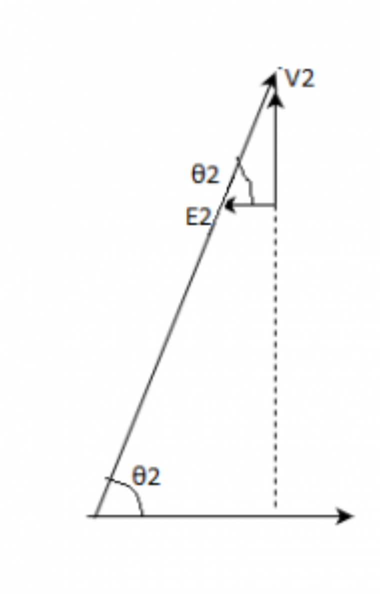
a) 



b)

c)

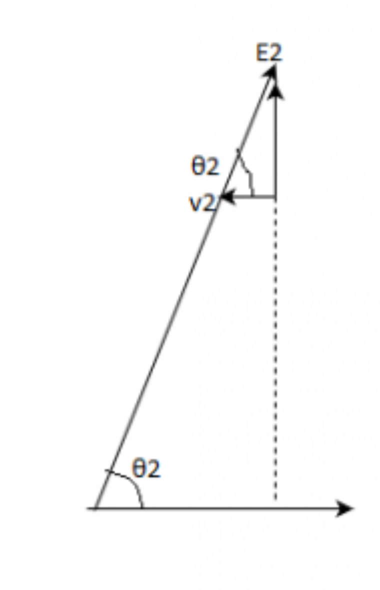




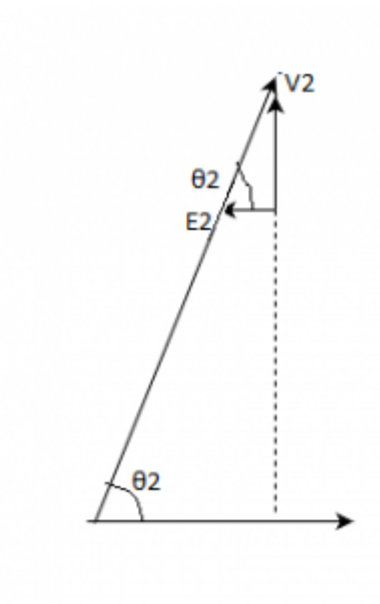
d)

Answer: a
Explanation: When E2=V2, then V.R. will be zero.

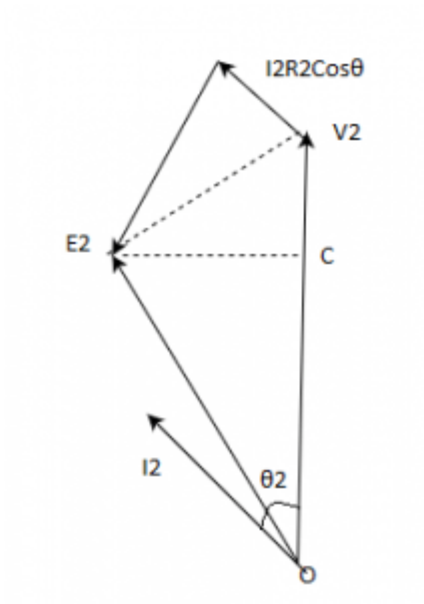
10. Identify the phasor diagram for the maximum voltage regulation from the below diagrams.



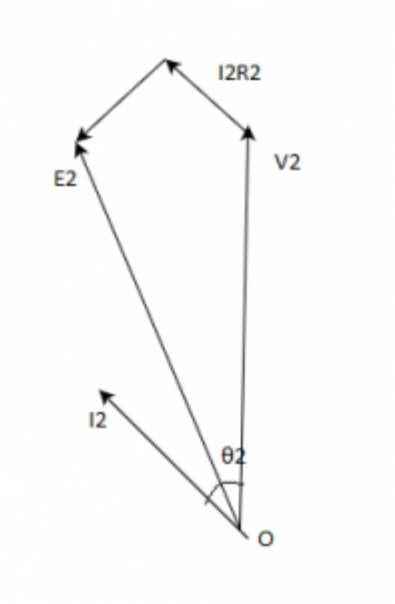
a)



b)

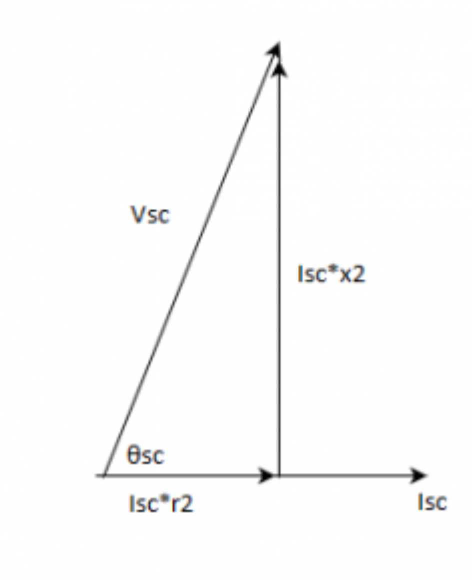
c) 

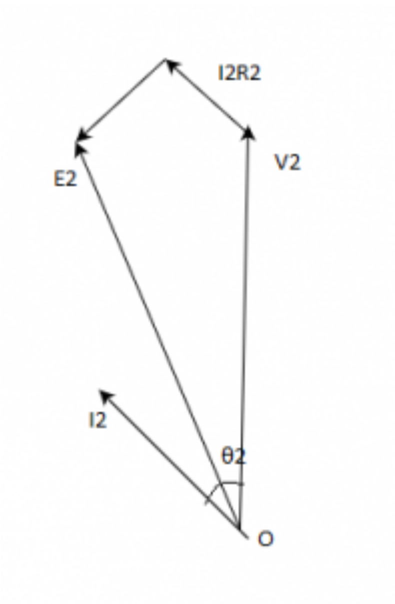
d)



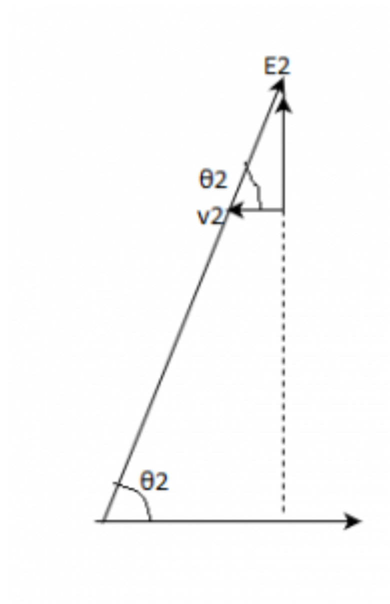
Answer: a
Explanation: Maximum voltage regulation occurs when load power factor angle and leakage impedance angle are equal.

11. The transformer phasor diagram under the short circuit can be identified by?

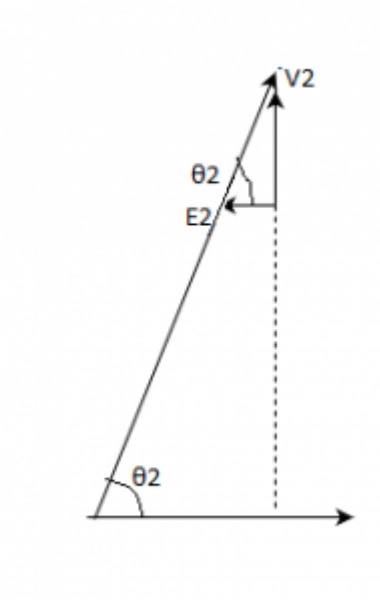
a) 



b)



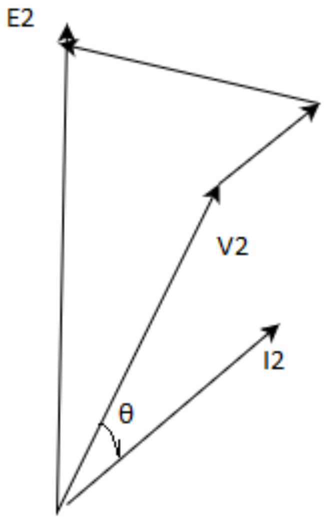
c)

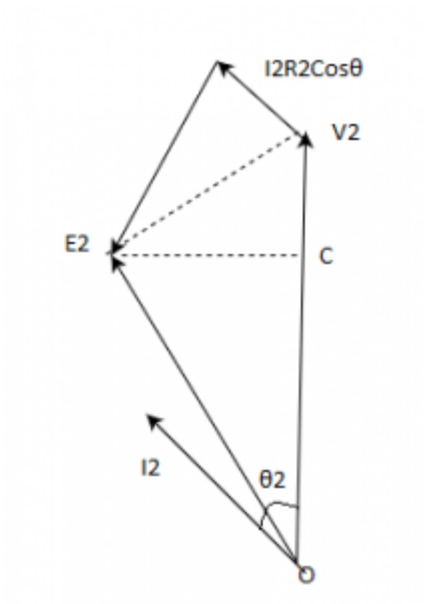


d)

Answer: a
Explanation: For the short-circuit condition of a transformer, voltage across the secondary will be voltage drop across winding only.

12. With the reference of the diagram below, Choose the most appropriate.

A: 

B: 

a) A-lagging pf, B-leading pf
b) B-lagging pf, A-leading pf
c) A-lagging pf, B-lagging pf
d) A-leading pf, B-leading pf

Answer: a
Explanation: Maximum voltage regulation occurs at lagging pf while zero or minimum V.R. occurs at leading pf.

13. A 200/400 V single phase transformer has leakage impedance z= r+jx. Then we can expect zero voltage regulation at power factor of ____________
a) x/r leading
b) x/r lagging
c) r/x leading
d) r/x lagging

Answer: a
Explanation: ZVR occurs at the leading pf of load at x/r.

14. A 200/400 V single phase transformer has leakage impedance z= r+jx. Then we can expect magnitude of load pf of ____ at zero voltage regulation.
a) cosθ = x/z
b) cosθ = r/z
c) cosθ = x/r
d) cosθ = r/x

Answer: a
Explanation: Cosθ = x/z for the transformer at zero V.R.

15. If the pu impedance of a single phase transformer is 0.01+j0.05, then its regulation at p.f. of 0.8 lagging will be?
a) 3.8%
b) 2.2%
c) -3.8%
d) -2.2%

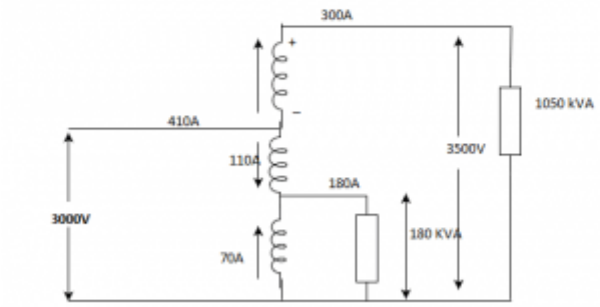
Answer: a
Explanation: V.R. = (r(pu)*cosθ+x(pu)*sinθ)*100 % = (0.01*0.8 + 0.05*0.6)*100 = 3.8%.

16. If the pu impedance of a single phase transformer is 0.01+j0.05, then its regulation at p.f. of 0.8 leading will be?
a) 3.8%
b) 2.2%
c) -3.8%
d) -2.2%

Answer: d
Explanation: V.R. = (r(pu)*cosθ-x(pu)*sinθ)*100 % = (0.01*0.8 – 0.05*0.6)*100 = -2.2%.

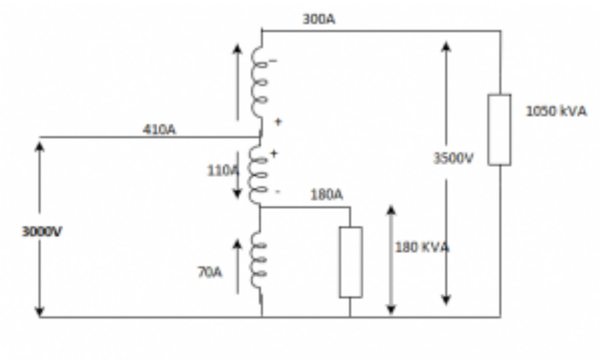
This set of Electrical Machines Problems focuses on “Parallel Operation of Single Phase Transformers”.

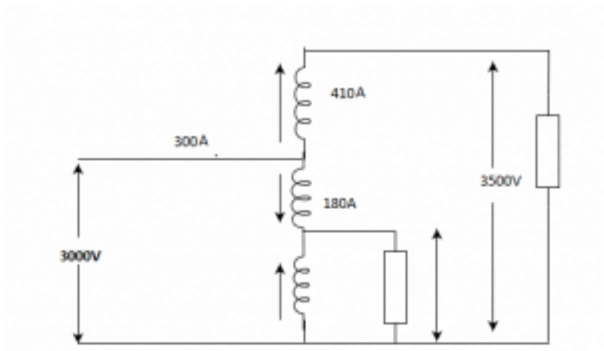
1. A 2000/1000/500 three winding transformer is to be used as auto transformer with supply of 3000 V. Two loads of 1050 kVA at 3500V, and other one at 180 kVA at 1000V. The circuit representing the mentioned application is?



a)

b)



c) 

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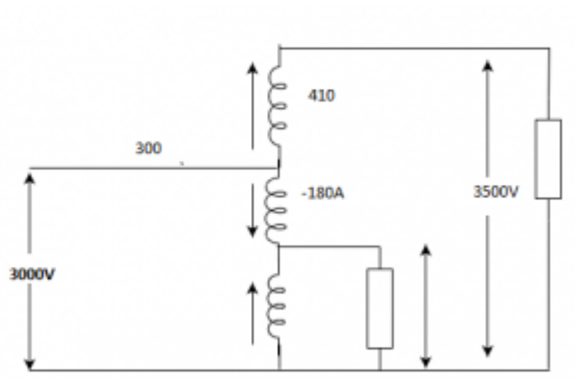
d) 

Answer: a
Explanation: Current due to load of 1050 kVA = 1050*1000/3500 = 300A
Current due to 180 kVA = 180*1000/1000 = 180A.

2. Transformer operating in parallel will share a common load in the best possible manner if ____________
a) leakage impedances are proportional to their kVA rating
b) pu leakage impedances are equal
c) leakage impedances are equal
d) any of the mentioned

Answer: b
Explanation: For same pu leakage impedance, parallel operation of transformers become feasible.

3. A 2000/1000/500 three winding transformer is to be used as auto transformer with supply of 3000 V. Two loads of 1050 kVA at 3500V and other one at 180 kVA at 1000V. The total kVA supplied will be?
a) 1230 kVA
b) 1440 kVA
c) 1680 kVA
d) 1150 kVA

Answer: a
Explanation: Total kVA = 1050+180 = 1230 kVA.

4. Which if the conditions is must be fulfilled for satisfactory parallel operation of transformers?
a) Same voltage ratio
b) Leakage impedances should be inversely proportional to kVA of the transformer
c) Same pu impedance
d) Correct polarity

Answer: d
Explanation: out of all, polarity must be correct for the connected transformers.

5. Which of the following is the correct matching made for the harmonics and the associated harmonic component?

```
A. Positive sequence components - 5th harmonic component
B. Negative sequence components - 7th harmonic component
C. Zero sequence components - 3rd harmonic component
```

a) A, B, C
b) C
c) A, B
d) B, C

Answer: b
Explanation: 3m-1 phases are displaced 120° in opposite and (3m+1) in the same direction as the fundamental. Here 'm' is even integer. So 5th harmonic is in negative sequence and 7th harmonic component in positive sequence.

6. Two single phase transformers A and B are operating in parallel having same impedance. But the x/r ratio of them are not equal. Then total kVA output of the output will be ____________
a) less than sum of kVA of A and B
b) more than sum of kVA of A and B
c) equal to sum of kVA of A and B
d) any of the mentioned

Answer: a
Explanation: As the leakage reactances are not same for both the transformers, then Ia < I2 and Ib < I/2.
So the kVA will also be less than sum of individual A and B.

7. Two single phase transformers A and B are operating in parallel having same impedance. But the x/r ratio of them are not equal and xa > xb. Then?
a) A has poorer pf than B
b) B has poorer pf than B
c) lesser power factor angle
d) both operate at same power factor

Answer: a
Explanation: As xa > xb, leakage impedance angle of A will be more than that of B, so lesser power factor.

8. Two single phase transformers A and B are operating in parallel having different impedance and identical x/r ratio. Then?
a) A has poorer pf than B
b) B has poorer pf than B
c) lesser power factor angle
d) both operate at same power factor

Answer: d
Explanation: As the x/r is same, this supports that they should have same leakage impedance angles.

9. Two single phase transformers A and B are operating in parallel having different impedance and identical x/r ratio. Also impedance of A is more than that of B, then A ____________
a) shares lesser kVA
b) share more kVA
c) equal kVA as of B
d) total kVA

Answer: a
Explanation: Given that, za is more than zb, so Ia will be lesser than Ib, With Ea = Eb, kVA(A) shared by A will more than kVA(B).

10. Two single phase transformers A and B are operating in parallel having different impedance and identical x/r ratio. Also impedance of A is more than that of B, then?
a) Za/Zb = Sb/Sa
b) Za/Zb = Sa/Sb
c) Za/Zb = 1
d) Za/Zb = $(Sb/Sa)^2$

Answer: a
Explanation: Leakage impedance in ‘ohms’ are inverse ratio of their respective kVA ratings.

11. Two single phase transformers A and B are operating in parallel having different impedance and identical x/r ratio. Impedance of A is Za and impedance of B is Zb, both sharing a load of Sl. Then the load shared by transformer A is?
a) Sl*(Zb/(Za+Zb))
b) Sl*(Za/(Za+Zb))
c) Sl*(Zb*Za/(Za+Zb))
d) Sl*(Zb+Za/Zb))

Answer: a
Explanation: The load sharing is based on the inverse of the kVA rating.

12. Two single phase transformers A and B are operating in parallel having different impedance and identical x/r ratio. Impedance of A is Za and impedance of B is Zb, both sharing a load of Sl. Then the load shared by transformer B is?
a) Sl*(Zb/(Za+Zb))
b) Sl*(Za/(Za+Zb))
c) Sl*(Zb*Za/(Za+Zb))
d) Sl*(Zb+Za/Zb))

Answer: b
Explanation: The load sharing is based on the inverse of the kVA rating.

13. Operating transformers in parallel gives the advantage of ____________
a) reliable loading
b) increased capacity of power system
c) reducing the capacity of substation
d) all of the mentioned

Answer: d
Explanation: All are advantages of having parallel connection of transformers.

14. Which of the following is a shortcoming for using parallel connected transformers?

```
I. Reliable loading
II. Increased capacity of power system
III. Reducing the capacity of substation
```

a) I, II, III
b) I, II
c) I, III
d) None of the mentioned

Answer: d
Explanation: All of the mentioned are advantages for using parallel connected transformers.

15. In three phase supply, the voltage phases are displaced by _________ and in two phase by ____________
a) 120°, 90°
b) 180°, 90°
c) 120, 120°
d) 120°, 180°

Answer: a
Explanation: Displacement angle for m-phase system is 2*pi/m.

16. For a delta-star three phase transformer, if the transformation ratio is ‘x:1’, then how much percent of output will be improved?
a) 73%
b) 57%
c) 173%
d) 157%

Answer: a
Explanation: Line voltage in the output will be (1.73*V/x), so the additional voltage will be (173-100/100)*100% = 73%.

17. For a star-delta three phase transformer, if the transformation ratio is ‘x:1’, then how much percent of output will be?
a) 73%
b) 57%
c) 173%
d) 157%

Answer: c
Explanation: Line voltage in the output will be (V/1.73*x).

18. Identify the correct order for the voltage transformation for the three-phase transformers.
a) D-Y > D-D = Y-Y > Y-D
b) D-Y > D-D > Y-Y > Y-D
c) D-Y > D-D = Y-Y < Y-D
d) D-Y > D-D < Y-Y < Y-D

Answer: a
Explanation: Delta to star has maximum(173%) voltage transformation while star to delta is least(57%). Y-Y and D-D have deviation of voltage levels.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Transformer as a Magnetically Coupled Circuit”.

1. In power transformers, it is found that the iron or core losses practically varies very less, this is because _____________
a) constant core flux
b) constant leakage flux
c) constant leakage and core flux
d) constant load current

Answer: a
Explanation: Due to the constant core flux, the iron losses also remain constant.

2. It is advised to coat the laminations of the core with some enamel, to ensure ___________
a) insulation
b) adhesion of laminations
c) reduction in humming sound
d) all of the mentioned

Answer: a
Explanation: It is done to provide insulation.

3. Primary and the secondary winding of the transformer are interlaced mainly for ___________
a) reducing leakage flux
b) reducing cost
c) reducing heating
d) saving the copper of the winding

Answer: a
Explanation: Interlacing is done to provide less air gaps and improved efficiency by reduction of leakage fluxes around the core.

4. Transients currents are maximum in the transformer when it is switched on with secondary _______ and when input voltage wave is passing through _________
a) open, zero
b) open, peak
c) closed, zero
d) closed, peak

Answer: a
Explanation: At t=0, the current flowing will be very high as emf is very high due to t = 0.

5. Identify the matching which is not matched correctly?

```
I. Silicon steel - Power transformer
II. Ferrite  - High frequency transformers
III.  Alnico - permanent magnet
```

a) I, II, III
b) I, III
c) II, I
d) None of the mentioned

Answer: d
Explanation: All are matched correct. High frequency transformer uses ferrites as the magnetic domains reverse very fastly.

6. Identify the matching which is not matched correctly?

```
I. Silicon steel - Power transformer
II. Ferrite  - High frequency transformers
III. Alnico - permanent magnet
```

a) I, II, III
b) I, III
c) II, I
d) I

Answer: a
Explanation: All are matched correct. High frequency transformer uses ferrites as the magnetic domains reverse very fastly.

7. Choose the matching which is not matched correctly?

```
I. Silicon steel - High frequency transformers
II. Ferrite  - Power transformer
III.  Alnico - permanent magnet
```

a) I, II, III
b) I, III
c) II, I
d) III

Answer: c
Explanation: High frequency transformer uses ferrites as the magnetic domains reverse very fastly. And power transformer uses CRGO steel.

8. Which of the following matches are matched correctly?

```
I. OC test - Copper and iron losses
II. SC test - Copper losses
III. Load Test  - Total losses
IV. Sumpner's Test - Iron losses
```

a) II, III
b) II, III, IV
c) I, IV
d) II, IV

Answer: a
Explanation: OC test gives iron losses. Sumpner’s test gives iron and core losses.

9. In a transformer,eddy-current loss is 1000 watts which is half of the total core loss. If thickness of lamination and frequency are increased by 10%, What is the new core-losses?
a) 3200W
b) 3300W
c) 2200W
d) 3100W

Answer: a
Explanation: Pe = 1000W, Pi = 2000W
Here, V/f = constant
Pe will be same 1000W, Pi = 200+2000 = 2200W
Total core losses = 1000+2200 = 3200W.

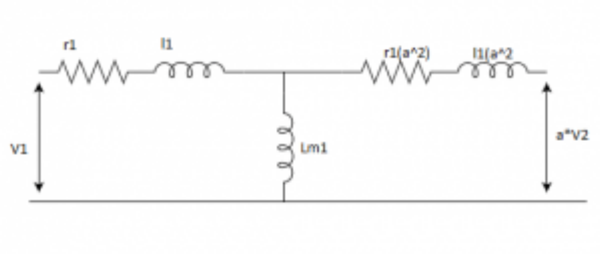
10. The voltage conversion ratio of the transformer is inverse of the current transformation.
a) True
b) False

Answer: a
Explanation: It is true because, V1/V2 = N2/N1; I2/I1=1/N.

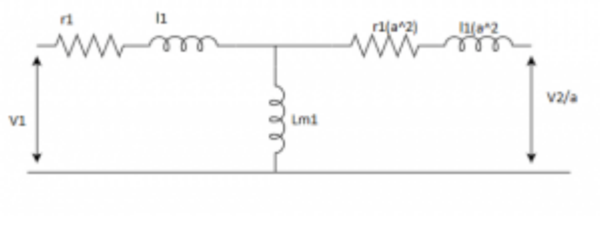
11. The voltage regulation of a transformer at full-load 0.8 p.f lagging is 2%. Its voltage regulation at full load 0.8 p.f leading ______________
a) will be positive
b) will be negative
c) may be positive
d) may be negative

Answer: b
Explanation: The leading p.f. has negative v.r.

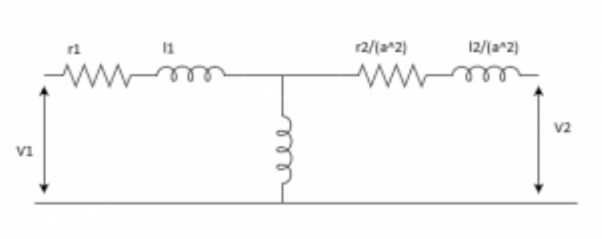
12. The Transformer equivalent circuit referred to primary with converting two winding transformer in impedance forms is?



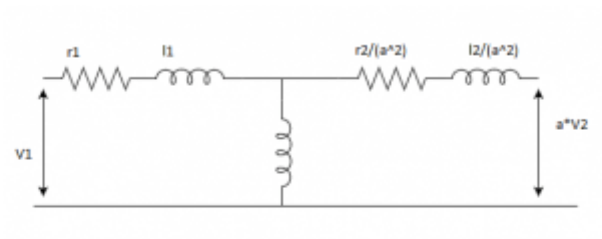
a)



b)



c)



d)

Answer: a
Explanation: When referred to primary, secondary inductance winding will be turns ratio squared.

13. Consider a 10 KVA, 2000/200 V, single phase transformer having below following parameters are r1=10Ω, r2=0.1Ω, l1 = 40mH, l2=0.4 mH, M = 10H. Then the expected primary self inductance will be?
a) 100.04H
b) 99.06H
c) 1.0004H
d) 10.04H

Answer: a
Explanation: Primary self inductance = L1 = Lm1 + l1
= (N1/N2)*M + l1
= 2000/200*10 + 0.04
=100.04 H.

14. There is a 10 KVA, 2000/200 V, single phase transformer having below following parameters are r1=10Ω, r2=0.1Ω, l1 = 40mH, l2=0.4 mH, M = 10H. Then the expected secondary self inductance will be?
a) 100.04H
b) 99.06H
c) 1.0004H
d) 10.04H

Answer: c
Explanation: Secondary self inductance = L2 = Lm2 + l2
= (N2/N1)*M + l2
= 200/2000*10 + 0.0004H
= 0.0004 H.

15. There is a 10 KVA, 2000/200 V, single phase transformer operating at 50 Hz. Maximum flux linkages in secondary will be?
a) 0.9 AT
b) 9 AT
c) 1 AT
d) 0.09 AT

Answer: a
Explanation: Flux linkages on secondary = N*φ = E/(4.44*f)
= 200/(4.44*50) = 0.9 AT

16. A 10 KVA, 2000/200 V, single phase transformer operating at 50 Hz with a current of 50 A flowing through the l.v. winding. Then the Self inductance of l.v. winding is?
a) 12.7mH
b) 1.27 mH

c) 12.7H
d) 0.127 H

Answer: a
Explanation: Flux linkages on l.v. = N*φ = E/(4.44*f)
= 200/(4.44*50) = 0.9 AT
Self inductance = mutual flux linkage/peak current
= 0.9/(1.414*50)
= 0.0127 H.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on "Three Phase Transformers".

1. A V-V connected transformer can be connected in parallel to delta-delta connected transformer but not to ____________
a) delta-star
b) star-delta
c) star-V
d) all of the mentioned

Answer: a
Explanation: The V-V connected transformer and D-D connected transformers have same phase displacement, so they only can be connected in parallel to each other.

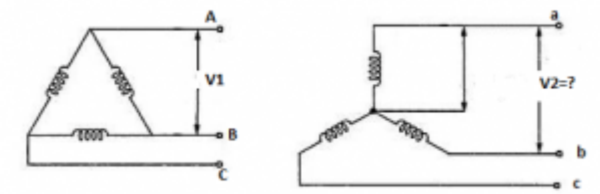
2. Three units of single phase transformers and one single three-phase transformer rating ____________
a) will be same for one rating
b) can never be made same
c) may be same
d) none of the mentioned

Answer: a
Explanation: Three single phase transformers and one single unit of three phase transformer will be same only. this is done to reduce the cost and spacing.

3. The transformer which is more feasible to use in the distribution ends should be ____________
a) star-delta
b) delta-star
c) scott
d) delta-delta

Answer: a
Explanation: Star-delta will have lower voltage at delta end.

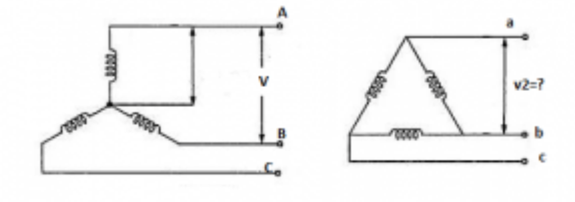
4. For the given circuit below, the voltage across the terminal 'a' and 'b' is?



a) 1.73*V
b) V/1.73
c) V
d) 3*V

Answer: a
Explanation: From delta to star, the voltage between the lines will increase by 1.73.

5. The voltage across the terminal ‘r’ and ‘y’ is?



a) 1.73*V
b) V/1.73
c) V
d) 3*V

Answer: b
Explanation: From star to delta, the line voltage will reduce by 1.73.

6. The delta-delta connections are used in applications of ____________
a) large l.v. transformers
b) small h.v. transformers
c) large h.v. transformers
d) small l.v. transformers

Answer: a
Explanation: Delta connected winding handle line voltages so it needs more turns in the winding but thin wires.

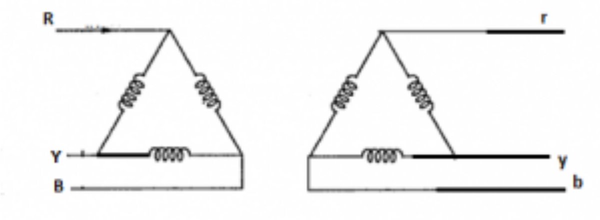
7. Open delta transformers can be obtained from ____________
a) delta-delta
b) star-delta
c) delta-star
d) any of the mentioned

Answer: a
Explanation: If one of the transformers is removed from the bank of only delta-delta, then it behaves with 58% power delivery.

8. If one of the transformers is removed from the bank of only delta-delta, then it behaves with 58% power delivery.
a) True
b) False

Answer: a
Explanation: It is true as the circuit will still be closed and the transformer will operate will lesser operating point.

9. Below is the circuit diagram for delta-delta transformer have a transformation ratio 'k'. The current flowing in the windings of phase r-y in the below diagrams is?



a) k*I/1.73
b) I/k*1.73
c) 1.73*k*I
d) 3*k*I

Answer: a
Explanation: The phase current will be reduced by 1/1.73.

10. If para magnetic core is used in the place of the ferromagnetic core of the transformer, then magnetostriction will ____________
a) be vanished
b) reduce
c) increase
d) not be affected

Answer: a
Explanation: If the core is not ferromagnetic then the transformer will not operate at all so no humming sound.

11. When we magnetize the ferromagnetic core of the transformer, core length________ and it _______ when demagnetized.
a) decreases, increases
b) decreases, decreases
c) increases,increases
d) none of the mentioned

Answer: a
Explanation: Due to aligned magnetic dipoles in the material, the size will reduce by a small margin and vice versa while demagnetization.

12. A 400 V, 10 KVA transformer at 50 Hz, is operated at the frequency of 40 Hz, then the humming ____________
a) increases
b) decreases
c) remains same
d) increases to very high

Answer: a
Explanation: If the frequency is reduced, the core flux density increases, so the noise also will increase.

13. While using three phase transformers, it is taken care about the third harmonics current in the system. This is present when transformer set is delta on either side.
a) True
b) False

Answer: a
Explanation: Third harmonic current are co-phase in nature and require closed path which is present in delta connected only.

14. A recording of the output of the emf induced for star and delta are recorded. Then shape of the emf induced in Y-connected 3-phase transformer is non sinusoidal in nature due to ____________
a) 3rd harmonic component of currents is absent
b) 3rd harmonic component of currents is present
c) negative sequence component of current is present
d) none of the mentioned

Answer: a
Explanation: In a star connected transformer, closed path to generate 3rd harmonic is not there. So the emf shape will be peaky in nature.

15. Shape of emf generated by delta connected transformer is not always sinusoidal.
a) True
b) False

Answer: b
Explanation: No, for a delta transformer, closed path is present to generate 3rd harmonics current and so the emf will be sinusoidal always.

This set of Electrical Machines Multiple Choice Questions & Answers (MCQs) focuses on “Autotransformers”.

1. While comparing potential transformer to an auto transformer, a potential transformer transfers power _________
a) conductively
b) inductively
c) both conductively as well as inductively
d) electromagnetic induction

Answer: a
Explanation: Potential divider is resistance division and it does not take part in induction processes.

2. The statements which support the points that auto transformers are advantageous?

```
I. Weight of conductor reduces
II. Ohmic losses reduces
III. Leakage reactance reduces
IV. Lower short-circuit current
```

a) I, II, III
b) II, III, IV
c) I, II, III, IV
d) I, IV

Answer: a
Explanation: Short circuit current of the auto transformer is higher than the corresponding 2-winding transformer.

3. The statements which support the points that auto transformers are advantageous?

```
I. Weight of conductor reduces
II. Direct electrical contacts
III. Leakage reactance reduces
IV. Lower short-circuit current
```

a) I, III
b) II, III
c) I, II, III, IV
d) I, IV

Answer: a
Explanation: Direct electrical contacts is a disadvantage to the auto transformer.
Short circuit current of the auto transformer is higher than the corresponding 2-winding transformer.

4. The statements which support the points that auto transformers are disadvantageous as compared to 2-winding transformer?

```
I. Weight of conductor reduces
II. Direct electrical contacts
III. Leakage reactance reduces
IV. Lower short-circuit current
```

a) I, III
b) II, III
c) II, IV
d) I, II, IV

Answer: c
Explanation: Direct electrical contacts is a disadvantage to the auto transformer.
Short circuit current of the auto transformer is higher than the corresponding 2-winding transformer.

5. Which of the above are correct for an auto transformer when compared to the identical rating two winding transformer?

```
I. KVA rating : 1/(1-k)
II. Losses : (1-k)
III. Impedance drop = 1/(1-k)
```

a) I, II
b) II, III
c) 1, III
d) I, II, III, IV

Answer: a
Explanation: KVA(auto)/KVA(2-W) = V2*I2/V2*(I2-I1)
= 1/(1-I1/I2)
= 1/(1-k)

Losses(auto) = (1-k) *Losses(2-W)
Impedance drop(auto) = (1-k)*Impedance drop(2-W).

6. The voltage regulation of a transformer at full-load 0.8 p.f leading is -2%. Its voltage regulation at full load 0.8 p.f lagging _______________
a) will be positive
b) will be negative
c) may be positive
d) may be negative

Answer: a
Explanation: The leading p.f. has negative v.r. and lagging p.f. has major portion of positive voltage regulation.

7. The voltage regulation of a transformer depends on its ___________

```
(A) Equivalent reactance
(B) Equivalent resistance
(C) Load power factor
(D) Transformer size
(E) Load current
```

a) A, B, C, E
b) A, B, C, D, E
c) A, B, D, E
d) A, B, C, D

Answer: a
Explanation: Voltage regulation is independent of the size of the transformer.

8. Three transformers having identical dimensions but with core of iron, aluminium and wood are wound with same number of turns and have same supply. Then choose the order for hysteresis losses.
a) wood > aluminium > iron
b) aluminium > iron > wood
c) iron > wood > aluminium
d) iron > aluminium > wood

Answer: d
Explanation: Hysteresis losses occur maximum in the ferromagnetic material.

9. Three transformers having identical dimensions but with core of iron, aluminium and wood are wound with same number of turns and have same supply. Then choose the order for eddy current losses.
a) wood > aluminium > iron
b) aluminium > iron > wood
c) iron > wood > aluminium
d) iron > aluminium > wood

Answer: a
Explanation: The eddy current losses are dependent on resistance offered to the currents. Wood is an insulator so it will get heated up most.

10. Maximum efficiency of a transformer for a constant load current, occurs at ___________
a) at any p.f
b) zero p.f leading
c) zero p.f lagging
d) unity p.f

Answer: d
Explanation: Efficiency = KVA*p.f/(KVA*p.f + Losses); So the efficiency is maximum at unity power factor.

11. A 1-phase tranformer has a leakage impedance of 1+ j4 Ω for primary and 3+ j11 Ω for secondary windings. This transformer has ___________
a) H.V primary

b) Medium voltage primary
c) L.V primary
d) L.V secondary

Answer: c
Explanation: The side which has lower impedance will have lower number of turns and so the low voltage side.

12. If a transformer is at no load, then it will act like ___________
a) a resistor at p.f = 0
b) an inductive reactor at 0.2 lagging
c) a capacitive reactor at0.2 leading
d) an inductive reactor at 0.8 lagging

Answer: b
Explanation: Transformer is nothing but the arranged windings which are magnetically coupled. The windings will inductive predominantly with very low resistance.

13. The tappings on the transformers is provided on ___________
a) h.v side at one end of the winding
b) l.v. side at one end of the winding
c) h.v side at middle
d) l.v side at middle

Answer: c
Explanation: High voltage side winding has more voltage so the variation of the voltage will be more and better applicable. And it is better to place at the middle because it gives uniform voltage distribution by eliminating axial forces.

14. In a transformer, we place the tapping windings at the middle because ___________
a) of radial forces on the windings
b) axial forces on the windings
c) insulation level of the winding
d) to provide a mechanical balance to the windings

Answer: b
Explanation: Due to two different voltages, different currents will flow in the windings and it will cause the axial forces due to currents interaction appear causing damage.

15. When a transformer winding suffers a short circuit, then inter turns of the same winding experience _______ forces.
a) an attractive
b) a repulsive
c) no force
d) may be attractive or repulsive type

Answer: a
Explanation: As the current will flow in one direction, attractive force will appear across the inter turns as per Biot-savart’s law.

16. Two tranformer having same voltage but different KVA are operating in parallel. For a good load sharing ___________
a) impedance must be equal
b) pu impedances must be equal
c) pu impedance and X/R ratios must be equal
d) impedance and X/R ratios must be equal

Answer: c
Explanation: Both the conditions are to be met in order to have an efficient operation while in parallel condition.