BEEE MCQs

1. When the phase difference between current and voltage is exactly 90 degrees, then the zero power occurs. It may be a

Leading power factor (depends on load)	Current leads	Voltage lags	Capacitive load
Lagging power factor	Current lags	Voltage leads	Inductive load

Lagging PF can be improved by capacitors, synchronous motors, etc.

Leading PF can be improved by inductors.

2. No load condition

60 Hz system → $60 \times 60 \times 2 = 7200$

No-load rpm Ã . No. of poles

50 Hz system → $50 \times 60 \times 2 = 6000$

No-load rpm Ã . No. of poles

What is no load speed?

No load speed is the RPM at which DC Motor's shaft rotate when there is no load attached to it. (No torque applied to the output shaft).

⇒ It is the maximum output speed of the motor.

In series motor, when there is ~~not~~ no load, armature current $= 0$

$\Rightarrow$ flux $= 0$.

Speed $\propto \frac{1}{flux}$ $\Rightarrow$ Speed $= \infty$

Thus no load speed of DC motor is highest.

DC Shunt motor → Slowest
→ constant speed.

Differentially compound DC motor
→ Maximum self loading property.
↓
flux reduces sharply at small increase in load at higher values.

⇒ Hence we should not use it above some load, as it may damage itself by self-loading.

High starting torque ⟶ DC series motor

which power is mentioned on the name plate of a motor? ⟶ HP
Horse power

Which Motor should never be started on no load? ⟶ DC series motor.

Speed of DC motor – increases
Back emf – increases
Armature current – decreases.

In series $I_a = I_L$.

3. Economical : Capacitor start method
* high starting torque * high power factor

Lowest cost : Split-phase method.

Single phase motor.

4. Power factor [-1, 1].

$$PF = \frac{\text{Real Power}}{\text{Apparent Power}}$$

Pure Resistive circuit PF = 1.

Pure inductive circuit PF = 0. (lagging)

Pure capacitive circuit PF = 0 (leading)

8.

$$\text{Motor speed (RPM)} = \frac{60 f}{\text{pair of poles}}$$

$$= \frac{60 \times f}{\text{Poles}/2} = \frac{120 f}{\text{Poles}}.$$

12. Analogous.

Magnetic flux → electric current

mmf → emf.

reluctance → resistance.

14. $\frac{V_2}{V_1} = \frac{N_2}{N_1} \Rightarrow \frac{V_2}{110} = 8$

$\Rightarrow V_2 = 880V.$

15. Single - winding, Single - phase $\Big\}$ motor → zero starting torque

Starting torque → is also called Standstill torque.

Dc series motor → high starting torque.

DC motor needs a load to start.

Induction motor, synchronous motor cannot start ~~with a~~ on load.

Low inrush current $\Big\}$ → Low starting torque. (15 - 50hp)

Methods to increase torque.

⇒ adjust input voltage or amount of excitation current.

⇒ Adjust speed reducer.

18. In a differential compound motor, series field flux (ϕ_{se}) opposses shunt field flux

(ϕ_{sh}) $$\omega_m = \frac{V_t - I_a(r_a + r_{se})}{K_a(\phi_{sh} - \phi_{se})}$$

as the load increases, I_a increases.

ϕ_{se} increases $\Rightarrow$ numerator decreases

denominator decreases faster

$\Rightarrow$ Motor speed increases. This cumulative process makes the motor speed dangerously high. This is similar to series motor characteristics.

4. 3 point starter → Shunt motor & compound motor

4 point starter → DC shunt motor with armature resistance control

Used to start & control speed of.

Pg. 6 (6) ⇒

$$\text{Speed of rotation} = \frac{E}{k\phi}$$

Speed of dc motor

$\propto \sqrt{T} \longleftarrow \bullet \longrightarrow \propto \frac{1}{\sqrt{T}}$

$\downarrow$

$\propto \frac{1}{I_a} \longrightarrow$ armature current.