Department of Electrical Engineering
Assignment
Date: 14/04/2020

Course Details

Course Title:	AC Machines	**Module:**	B-Tech
Instructor:	Eng Rashid Aleem	**Total Marks:**	30

Student Details

Name:	Salman Farooq	**Student ID:**	15276

(Q1) Fill in the blanks?(5 Marks)

(1)Induction motor was invented by ……. In ……..

(2)The Stator of the induction motor is ,in principle ,the same as that of ……

(3)Greater the no of poles in induction machine ……..the speed.

(4)The stator winding when supplied with three phase currents,produce a magnetic flux which has ……..magnitude.

(5)Motors employing wound rotor are known as ……. Motors.

(Q2) Multiple choice questions?(5 Marks)

(1)Regarding skewing of motor bars in squirrel cage induction motor ,which statement is false?

(a)it prevents cogging (b)it increases starting torque (c)it produces more uniform torque (d)it reduces motor 'hum' during its operation

(2)The principle of operation of a 3-phase induction motor is most similar to that of a

(a)synchronous motor (b)repulsion start induction motor (c)transformer with a shorted secondary (d)capacitor –start ,induction run motors

(3)The magnetizing current drawn by transformers and induction motors is the cause of their …….. power factor

(a)zero (b)unity (c)lagging (d)leading

(4)The effect of increasing the length of air-gap in an induction motor will be to increase the

(a)power factor (b)speed (c)magnetizing current (d)air gap flux

(5)In a three phase induction motor,the relative speed of stator flux with respect to …… is zero.

(a)stator winding (b)rotor (c)rotor flux (d)space

(Q3) In case of AC generator the input domain is mechanical,identify the potential and kinetic variable for input and output and explain the relationship of input and output?(5 Marks)

(Q4) Is it true that conduction takes place in ac machines.Back your reason with valid facts?Explain the working of synchrounous machines and give solid reason why it uses separate dc source?(5 Marks)

(Q5) The stator of a three Phase induction motor has 6 slots per pole per phase.If supply frequency is 60Hz.Calculate the number of stator poles produced and total number of slots on the stator.Calculate the speed of the rotating stator flux?(5 Marks)

(Q6)3-Phase ,50Hz ,8 pole ,induction motor has full load slip of 2%.The rotor resistance and stand still rotor –reactance per phase are 0.001 ohm and 0.005 ohm respectively.Find the ratio of

the maximum to full load torque and the speed at which the maximum torque occurs? (5 Marks)

Q:-1 Fill in the blanks. Page:- (1)

(i) Induction motor was invented by Nikola tesla In 1887

(ii) The Startor of the Induction motor is, in Principle, the Same as that of Synchronous motor or genrator

(iii) Greater the no of poles in induction machine Lesser the Speed.

(iv) The Startor winding when Supplied with three phase Currents, Produce a megnetic flux which has Constant magnitude.

(v) Motors employing wound rotor are Known as wound motors, slip ring motors Motors.

Q:-2 Multiple choice questions :-

(i) Regarding Skewing of motor bars in Squirrel cage Induction motor, Which Statment is false?

(a) it prevents cogging (b) ✓ it increases Starting torque
(c) it Produces more uniform torque (D) it reduce motor "hum" during its operation.

(ii) The Principle of operation of Three 3-phase Induction motor is most similar to that of a.

(a) synchronous motor (b) repulsion start Induction motor (c) ~~Transformer with a shorted Secondary~~ (D) capacitor-start, Induction run motors.

(iii) The magnetizing current drawn by transformer and Induction motors is the cause of their ..... power factor.

(a) Zero (B) Unity (c) Lagging (d) Leading

(iv) The effect of Increasing the Length of air-gap in an induction motor will be to Increase the.

(a) ~~The effect of Increasing the Length of air-gap in an~~

(a) power factor (B) speed (c) magnetizing current (D) air gap flux

(v) In a three phase induction motor, the relative speed of stator flux with respect to ..... is zero.

(A) Startor winding (B) rotor (C) rotor flux

(D) space

Q:3 In case of AC generator the input domain is mechanical. Identify the Potential and Kinetic variable for input and output and Explain the relationship of input and output.

Ans

In case of Ac genrator.

We know that genrator Convert mechanical energy into Electrical energy or power.

Mechanical Power → [Genrator] → Eelectrical Power

The output of Genrator is Electrical Power OR Alternating cycle Electrical Power.

Genrator

page (5)

When the input ~~and~~ domain is mechanical in case of genrator. So Therefore the potential vareiable and Kinatic vareiable are Torque (T) & (W)

$\Rightarrow$ T, W

Let us => we know that the genrator out put domain is Ac Electrical Power. which will Potential vareiable is E (Induced emf) and the Second Kinatic variable is represent will be Current.

Potential vareiable is E (Indueed Emf)

Kinatic variable is i (Current)

Page (6)

Relationship of input and output.

T = Torque

E = Induced Emf

i = Current

Let Suppose

In This case the relationship b/w Torque & Current and Emf and w.

Q:- It is true that conduction takes Place in ac machines. Back your reason with valid facts? Explain the working of Synchronous machines and give solid reason why it uses Separate dc source?

Ans:- NO, It is false that Conduction takes place in AC machine.

The main reason of ac machine that

Permeant magnent Synchronous uses permeant magnent in the Steel rotor to Create a Constant magnetic field. The Stator Carries winding Connected to an ac Supply to produce to rotating magnetic field. At Synchronous Speed the rotor poles lock to the rotating field.

Working Synchronous machines

Synchronous motor depends on the interaction of the magnetic field of the stator with the magnetic field of the rotor. the stator contains 3 phase windings and is supplied with 3-phase power. This stator winding produces a 3 phased rotating magnetic-Field.

and Synchronous genrator is electromagnetic induction. If there exits araltive motion between the flux and Conductors, then an emf is induced in the conductors. To understand The Synchronous genrator working Principale Let us Consider two oppositemagnetic poles in between them a rectangular coil or turn is placed.

Q:5

The Stator of a Three phase Induction motor has 6 slots Per Pole Per phase. If supply frequency is 60 Hz. Calculate the Number of stator poles produced and Total number of slots on the stator. Calculate the speed of the rotating stator flux ?

Solution

given data: No slot Per pole = 6

⇒ Frequency = 60 Hz

Required

(i) Total No. of slot on the stator

(ii) speed of the rotating stator flux

So $P = 2n$

$\Rightarrow \quad P = 2n$

$\Rightarrow \quad P = 2 \times 3 = 6$ poles

(a) Total No. of slots

= 6 slots pole phase × 6 poles × 3 phase

= 108

Total No. of slot = 108

(b) speed of the rotating stator flux.

Let => we know that

$$N_s = \frac{120f}{P} \longrightarrow (1)$$

putting value in above equation (1)

$$N_s = \frac{120 \times 60}{6} = 1200 \text{ rpm}$$

Example (2) Question NO: 6

3-phase, 50 Hz, 8 Pole, Induction motor has full Load slip of 2%. The rotor resistance and stand still rotor-reactance Per Phase are 0.001 ohm and 0.005 ohm respectivily. Find the ratio of the maximum to full Load torque and the Speed at which the maximum torque occurs?

Solution

First of all we Find Synchronous Speed

So Synchronous speed $N_s = 120 \times 50/8 = 750$ rpm

=> we know that

slip at maximum torque $S_{mT} = \frac{I_2}{X_2}$

Let a => $= \frac{I_2}{X_2} = \frac{0.001}{0.005} = 0.2$

Corresponding speed =

$= (1 - 0.2) \times 750 = 600$ rpm

$\Rightarrow$ Full-Load torque / maximum Torque =

$$= \frac{2 s_{mT} s_1^2}{s_{mT}^2 + s_1^2} \therefore \frac{T_1}{T_{max}} = \frac{2 \times 0.2 \times 0.02^2}{0.20^2 + 0.02}$$

$$= \frac{1.6 \times 10^{-4}}{0.0404}$$

$$\frac{T_{max}}{T_1} = 252.5 = 3.96 \times 10^{-3}$$