Course Details

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

Student Details

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

(1)Induction motor was invented by …**Nikola tesla**…. In …**1887**…

(2)The Stator of the induction motor is, in principle, the same as that of
………...….**synchronous motor or Generator**…

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

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

(5)Motors employing wound rotor are known as …**phase wound motor or slip ring**…. 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 synchronous 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)
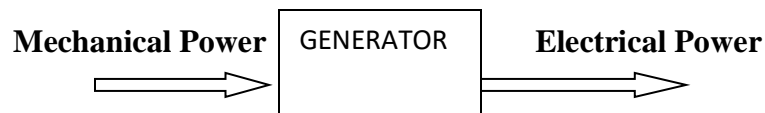
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(Q3) In case of AC generator the input domain is mechanical, identify the potential and kinetic variable for input and output and explain the relationship of input and output?(5 Marks)

ANS: Ac generator converts mechanical power into electrical power.

Mechanical Power | GENERATOR | **Electrical Power**

Input domain in case of AC generator :

The input domain is mechanical domain

Variable for potential and kinetic:

Input and output:

Input is mechanical power so therefore potential variable is torque which is represented by T and kinetic variable is angular velocity which is represented by W .

Output is Ac electrical power so therefore potential variable is emf which is represented by E

And kinetic variable is Current which is represented by i .

E which means emf induced → potential variable

i means current → kinetic variable

Relationship of input and output:

The torque of a input is proportional to the current flowing through it ($T \propto i$).

And output emf is proportional to the angular velocity W

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(Q4) Is it 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?(5 Marks)

ANS: NO, in ac machine we use induction instead of conduction because conduction is the supply of current when parts are directly in contact while in induction parts are not connected to each other but it produce emf

Working of synchronous machine:

Working of synchronous machine depends on the interaction of magnetic field of the stator with the magnetic field of the rotor.

- The stator contain three phase winding and is supported with 3 phase power
- The stator winding produces a three phase rotating magnetic field
- Dc supply is given to the rotor
- The rotor enter into the rotating magnetic field produced by stator
- Speed of motor depends on the frequency of supplied current

In synchronous motor dc power supply is separately used because it use in field winding. it has both stator winding as well as rotor winding. The direct current DC can be supplied by separate DC source.

(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)

ANS:

Solution:

(i) $P = 2n$

$P = 2 \times 3 = 6 \; poles$

Total no. of slots

$= 6slots/pole/phase \times 6 \; poles \times 3 \; phase$

$= 108$

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ii)   We know that

$$Ns = \frac{120\ f}{p}$$

Now putting values we get

$$= \frac{120 \times 60}{6} = 1200 \text{ r.p.m}$$

(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)

ANS:

 Solution:

Synchronous speed Ns = 120×50/8 = 750 r.p.m

Slip at maximum torque. $S_m t = r_2/x_2$

$$= \frac{r_2}{x_2} = \frac{0.001}{0.005} = 0.2$$

Corresponding speed = (1-0.2) × 750 = 600 r.p.m

$$\frac{full\ load\ torque}{maximum\ torque} = \frac{2s_{mt}\ \pi}{s^2 m^{t} + s^2\ \pi} = \frac{2 \times 0.2 \times 0.2^2}{0.2^2 + 0.2^2}$$

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

$$\frac{Tt_{max}}{T_f} = 252.5$$

$$= 3.96 \times 10^{-3}$$