



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## ELECTRICAL AND ELECTRONICS ENGINEERING

### DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	ELECTRICAL MACHINES - II
Course Code	:	AEEB15
Program	:	B.Tech
Semester	:	IV
Branch	:	Electrical and Electronics Engineering
Section	:	A & B
Academic Year	:	2019 – 2020
Course Faculty	:	Mr. K Devender Reddy, Assistant Professor Mr. A Satish Kumar, Assistant Professor

#### OBJECTIVES:

I	To help students to consider in depth the terminology and nomenclature used in the syllabus.
II	To focus on the meaning of new words / terminology / nomenclature

#### DEFINITIONS AND TERMINOLOGY QUESTION BANK:

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
<b>MODULE – I</b> <b>PULSATING AND REVOLVING MAGNETIC FIELDS</b>						
1	Define magnetic flux.	Magnetic flux is a measurement of the total magnetic lines of force which passes through a given area	Remember	CO1	CLO 1	AEEB15.01
2	Define magnetic flux density.	The flux per unit area is called as magnetic flux density.	Remember	CO1	CLO 1	AEEB15.01
3	State Faradays first law of electromagnetic induction.	The first law of Faraday's electromagnetic induction states that whenever a conductor is placed in a varying magnetic field emf is induced which is called induced emf, if the conductor circuit is closed current is also induced which is called induced current	Understand	CO1	CLO 1	AEEB15.01
4	State Faradays second law of electromagnetic induction.	Faraday's second law of electromagnetic induction states that the magnitude of induced emf is equal to the rate of change of flux linkages with the coil.	Understand	CO1	CLO 1	AEEB15.01
5	State Lenz's law	Lenz's law states that the current induced in a circuit due to a change or a motion in a magnetic field is so directed as to oppose the change in flux and to exert a mechanical force opposing the motion	Understand	CO1	CLO 1	AEEB15.01
6	State Fleming's left hand rule	Fleming's left hand rule states that when the thumb, forefinger and the	Understand	CO1	CLO 1	AEEB15.01

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		middle finger are stretched mutually perpendicular to each other such that the forefinger is in the direction of magnetic field and the middle finger is in the direction induced current, then thumb represents the direction of force.				
7	State Fleming's right hand rule	Fleming's right hand rule states that when the thumb, forefinger and the middle finger are stretched mutually perpendicular to each other such that the forefinger is in the direction of magnetic field and the thumb is in the direction force, then middle finger represents the direction of induced emf or current.	Understand		CLO 1	AEEB15.01
8	What are the other names for induction motor?	The induction motor is also called as a rotating transformer or an asynchronous motor.	Remember	CO1	CLO 1	AEEB15.01
9	Why an induction motor is called a rotating transformer?	An induction motor is sometimes called a rotating transformer because the stator (stationary part) is essentially the primary side of the transformer and the rotor (rotating part) is the secondary side.	Understand	CO1	CLO 1	AEEB15.01
10	Why an induction motor is also called an asynchronous motor?	An induction motor is also called as an asynchronous motor because the speed of induction motor is always less than the synchronous speed.	Remember	CO1	CLO 1	AEEB15.01
11	How the synchronous speed of a machine be calculated?	If the machine has 'P' number of poles, and is supplied with the frequency of 'f' then the synchronous speed is expressed as $N_s = 120f/P$	Remember	CO1	CLO 1	AEEB15.01
12	Define is RMF?	RMF (Rotating Magnetic Field) is the field produced in the stator of a three phase induction motor when supplied with a three phase balanced supply. The RMF has constant magnitude and rotate in space at synchronous speed.	Remember	CO1	CLO 1	AEEB15.01
13	What is the direction of RMF?	The direction of rotating magnetic field (RMF) is from the axis of the leading phase of the three phase winding towards the lagging phase of the winding.	Remember	CO1	CLO 1	AEEB15.01
14	How the direction of RMF be reversed?	The direction of RMF is reversed by interchanging the any two terminals of three phase winding while connecting it to a three phase AC supply.	Understand	CO1	CLO 1	AEEB15.01
15	What is a stator?	The stator consists of wound 'poles' that carry the supply current that induces a magnetic field in the conductor. The number of 'poles' can vary between motor types but the poles are always in pairs (i.e. 2, 4, 6, etc.).	Understand	CO1	CLO 1	AEEB15.01

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
16	What is a rotor?	The rotor is the non-stationary part of a rotary electric motor or alternator, which rotates because the wires and magnetic field of the motor are arranged so that a torque is developed about the rotor's axis. In some designs, the rotor can act to serve as the motor's armature, across which the input voltage is supplied. The stationary part of an electric motor is the stator.	Understand	CO1	CLO 1	AEEB15.01
<b>MODULE – II INDUCTION MOTORS</b>						
1	What are the equivalent circuit parameters of an induction motor?	The equivalent circuit parameters of an induction motor are No load resistance ( $R_0$ ) No load Reactance ( $X_0$ ) Stator and rotor resistances ( $R_1, R_2$ ) Stator and rotor reactances ( $X_1, X_2$ )	Remember	CO2	CLO4	AEEB15.04
2	What is the rotor reactance under running condition?	The rotor reactance ( $X_r$ ) of an induction motor under running condition is the slip ( $S$ ) times the Reactance of rotor under standstill condition ( $X_2$ ). i.e. $X_r = S * X_2$	Understand	CO2	CLO4	AEEB15.04
3	How the mechanical power developed is expressed in equivalent circuit of induction motor?	The mechanical power developed is expressed in equivalent circuit of induction motor as $R_L = R_2 * (1-S)/S$	Remember	CO2	CLO4	AEEB15.04
4	What is no load test?	It is a test conducted on three phase induction motor under no-load condition. This test is used to find the shunt branch equivalent circuit parameters.	Understand	CO2	CLO 4	AEEB15.04
5	What is blocked rotor test?	A blocked rotor test is conducted on an induction motor. It is also known as locked rotor test or stalled torque test. From this test, short circuit current at normal voltage, power factor on short circuit, total leakage reactance, and starting torque of the motor can be found.	Understand	CO2	CLO 4	AEEB15.04
6	Classify the losses in induction motor?	The losses of an induction motor are classified into three types. 1. Iron/core losses 2. Copper losses 3. Mechanical Losses	Understand	CO2	CLO 4	AEEB15.04
7	What are the constant losses?	The core losses together with the mechanical losses are called the constant losses because as the motor is loading from no-load to full load these losses are constant.	Understand	CO2	CLO 4	AEEB15.04
8	What are the variable losses?	The copper losses of an induction motor is also called as variable losses because as the motor is loading from no-load to full load these losses will increase and vary.	Understand	CO2	CLO 4	AEEB15.04

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9	Define efficiency.	The ratio of output power to input power is called the efficiency.	Remember	CO2	CLO 4	AEEB15.04
10	What is the condition for getting maximum efficiency?	The efficiency of induction motor is maximum when the variable losses (copper losses) equal to the constant losses (iron / core losses) of the machine.	Remember	CO2	CLO 4	AEEB15.04
11	Define speed regulation	The change in speed of the motor from no load to full load expressed as a percentage of full load is called the speed regulation of the motor.	Remember	CO2	CLO 4	AEEB15.04
12	What is a self starting motor?	Motors which start by themselves by switching in, without additional help, are called self-starting motors.	Understand	CO2	CLO 5	AEEB15.05
13	Is induction motor is a self starting motor?	Yes, the induction motor is a self starting motor as when it is connected to the supply it will start running by itself.	Remember	CO2	CLO 5	AEEB15.05
14	Why does an induction motor need a starter?	In an induction motor, when supply is given to the stator windings, the rotating magnetic field flux and the produced flux in the rotor windings due to the back emf, causes the motor torque to increase, causing a high rotor current. During the time between the application of electric supply to the motor and the actual acceleration of the motor to its full speed, a large amount of current is drawn by the stator from the supply. This starting current is about 5 to 6 times more than the full load current. This time duration can be for few seconds or longer. This causes the electrical equipments to damage because of the increasing voltage drop in electrical systems due to flow of larger currents across the cable. For this reason, an induction motor needs a starter at start to reduce the high starting currents.	Understand	CO2	CLO 5	AEEB15.05
15	List the different starting methods used for an induction motor.	1. Direct Online (DOL) starter 2. Star-delta starter 3. Auto transformer starter	Remember	CO2	CLO 5	AEEB15.05
16	What is a DOL starter?	The simplest form of motor starter for the induction motor is the direct on line starter. The direct on line motor starter (DOL) consist a MCCB or Circuit Breaker, Contactor and an overload relay for protection. Electromagnetic contactor which can be opened by the thermal overload relay under fault conditions	Remember	CO2	CLO 5	AEEB15.05
17	What is star delta starter?	The Star Delta Starter is a very common type of starter and is used extensively as compared to the other type of starting methods of the induction motor. A star delta is used for a cage motor designed to run	Understand	CO2	CLO 5	AEEB15.05

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		normally on the delta connected stator winding.				
<b>MODULE – III ALTERNATORS</b>						
1	Define concentrated winding	In these windings the coils are not distributed rather than they are concentrated at one particular slot. That is, the armature poles are equal to the number of armature slots	Remember	CO3	CLO 8	AEEB15.08
2	Define distributed winding	The distributed winding is the distribution of conductors each slot equally. The conductors are placed under several slots. The distributed winding reduces the armature reaction and helps in better cooling. In these windings, the induced emf is less, but it is more sinusoidal in nature than concentrated windings	Remember	CO3	CLO 8	AEEB15.08
3	Define single layer winding	When each side of a coil occupies a slot completely without any other coil lying on top of it and the number of coils equals half the number of slots, the winding is known as single layer winding.	Remember	CO3	CLO 8	AEEB15.08
4	Define double layer winding	When each side of a coil occupies two coil-sides such a winding is known as a two layer Winding. All the coils of a two-layer winding are of similar shape so that these can be wound separately and then placed in the slots.	Remember	CO3	CLO 8	AEEB15.08
5	Define pole pitch	The distance between the centres of two adjacent poles is called pole pitch. One pole pitch is equal to 180 electrical degrees. It is also defined as the number of slots per pole.	Remember	CO3	CLO 8	AEEB15.08
6	Define coil span.?	The distance between the two coil sides of a coil is called as coil span. It may be expressed in electrical degrees or in number of slots.	Remember	CO3	CLO 8	AEEB15.08
7	What is meant by full pitched winding?	If the coil span is equal to pole pitch, the winding is called as full pitched winding.	Remember	CO3	CLO 8	AEEB15.08
8	What is meant by short pitched winding?	If the coil span is less than the pole pitch, the winding is called as short pitched winding. It is also known as short chording winding.	Remember	CO3	CLO 8	AEEB15.08
9	What is balanced winding?	If under each pole face, there are an equal number of coils of different phases, then the winding is said to be balanced winding. In balanced winding, coil group should be an even number.	Remember	CO3	CLO 8	AEEB15.08

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
10	What is unbalanced winding?	If the number of coils per coil group is not a whole number, the winding is known as unbalanced winding. In such case, each pole face contains unequal of coils of different phase. In two-phase alternator, two single-phase windings are placed on the armature by 90 electrical degrees apart from each other.	Remember	CO3	CLO 8	AEEB15.08
11	Define coil group.	It is product of number of phases and number of poles in a rotating machine. coil group = number of poles × the number of phases.	Remember	CO3	CLO 8	AEEB15.08
12	Define integral slot winding.	When the number of slots per pole per phase is an integer, the winding is the integer slot winding but when the number slots per pole per phase is fractional number the winding we refer as fractional slot winding.	Remember	CO3	CLO 8	AEEB15.08
13	Define fractional slot winding.	Fractional slot winding is practicable only with the double layered winding. It limits the number of parallel circuits available because phase group under several poles must be connected in series before a unit is formed and the widening respects the pattern to give the second unit that can be put in parallel with the first.	Remember	CO3	CLO 8	AEEB15.08
14	Define infinite bus	The bus whose voltage and frequency remains constant even after the variation in the load is known as the infinite bus.	Understand	CO3	CLO 10	AEEB15.10
15	Why EMF method for calculation voltage regulation is also called as pessimistic method	The EMF method is also called pessimistic method as the value of regulation obtained is much more than the actual value	Understand	CO3	CLO 9	AEEB15.09
<b>MODULE – IV</b>						
<b>SYNCHRONOUS MOTORS</b>						
1	What do you mean by the term synchronous?”	Existing or occurring at the same time.	Remember	CO4	CLO 11	AEEB15.11
2	What is an electric motor?	An electric motor is an electrical machine that converts electrical energy into mechanical energy	Remember	CO4	CLO 11	AEEB15.11
3	What is meant by “excitation” in synchronous motor?	Synchronous motor excitation refers to the dc supply given to rotor which is used to produce the required magnetic flux	Remember	CO4	CLO 12	AEEB15.12
4	What is power factor?	The ratio of the actual electrical power dissipated by an ac circuit to the product of the r.m.s. values of current and voltage. The difference between the two is caused by reactance in the circuit and represents power that does no useful work.	Remember	CO4	CLO 12	AEEB15.12

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
5	What is a damper winding?	The bars are connected to each other at both ends of the rotor by so called end-rings. Damper windings are used to counteract an asynchronous air-gap flux which can be caused by electrical and mechanical transients. They are also used to bring the machine to synchronous speed in direct-online applications.	Understand	CO4	CLO 11	AEEB15.11
6	Why do we give DC excitation to AC synchronous motor?	The DC excitation provides a steady (constant) magnetic field in the rotor. As the rotor spins, the steady field becomes a rotating output. Steady rotor electromagnetic field (from DC excitation) becomes rotating (or AC) output voltage	Understand	CO4	CLO 11	AEEB15.11
7	Why synchronous motor is not self starting?	This is because the speed with which rotating magnetic field is rotating is so high that it is unable to rotate the rotor from its initial position, due to the inertia of the rotor. So under any case, whatever may be the starting position of the rotor, synchronous motor is not self starting.	Understand	CO4	CLO 11	AEEB15.11
8	How to make synchronous motor self starting?	The synchronous motor is made self starting by providing a special winding on the rotor poles, known as damper winding or squirrel cage winding. AC supply given to the stator produces a rotating magnetic field which causes the rotor to rotate, therefore, in the beginning synchronous motor provided with damper winding starts as a squirrel cage induction motor. The exciter moves along the rotor. When the motor attains about 95% of synchronous speed, the rotor winding is connected to exciter terminals and the rotor is magnetically locked by the rotating field of the stator and the motor runs as a synchronous motor.	Remember	CO4	CLO 11	AEEB15.11
9	What methods are generally used to start the synchronous motor?	1. Using pony motors. In this method, the rotor is brought to the synchronous speed with the help of some external device like small induction motor 2. Using Damper Winding 3. As a Slip Ring Induction Motor 4. Using Small D.C. Machine	Remember	CO4	CLO 11	AEEB15.11
10	What is the difference between synchronous motor and induction motor?	An induction motor runs a little slower than the applied frequency. The speed of asynchronous motor is fixed by the frequency of the AC system. In induction motor magnetic fields of rotor and stator are rotating in different frequencies. In a synchronous motor, stator field and rotor field are synchronous	Understand	CO4	CLO 11	AEEB15.11



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11	Why synchronous motor has no starting torque?	The stator carries windings connected to an AC supply to produce a rotating magnetic field at synchronous speed. The rotor poles lock to the rotating magnetic field, because of the constant magnetic field in the rotor these cannot use induction windings for starting.	Remember	CO4	CLO 11	AEEB15.11
12	How does synchronous motor improve power factor?	An over-excited synchronous motor has a leading power factor. This makes it useful for power factor correction of industrial loads. Both transformers and induction motors draw lagging (magnetising) currents from the line. This improves the plant power factor and reduces the reactive current required from the grid.	Understand	CO4	CLO 11	AEEB15.11
13	Why there is no slip in synchronous motor?	Because the rotor turns at the same speed as synchronous speed (speed of the rotating magnetic field), there is no slip. The speed of rotation of the motor is constant in a synchronous motor, and does not vary with load, as in an induction motor.	Understand	CO4	CLO 11	AEEB15.11
14	Why synchronous motors are known as synchronous capacitors?	In electrical engineering, asynchronous condenser (sometimes called asynchronous capacitor or synchronous compensator) is a DC-excited synchronous motor, whose shaft is not connected to anything but spins freely.	Understand	CO4	CLO 13	AEEB15.13
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<b>MODULE – V</b>						
<b>SINGLE PHASE INDUCTION MOTOR</b>						
1	Why is it called a split phase motor?	Split Phase Induction Motor. The Split Phase Motor is also known as a resistance start motor. It has a single cage rotor, and its stator has two windings known as main winding and starting winding. At the starting of the motor both the windings are connected in parallel.	Understand	CO5	CLO 14	AEEB15.14



S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
2	What happens when a motor capacitor goes bad?	The most common problem that bad capacitors can cause is "hard starting." This is when the compressor of an AC has difficulty starting up, stutters trying to turn on, and then shuts off a short while later. In most cases of capacitor problems, such as damage or a loss of charge, the capacitor will need to be replaced.	Understand	CO5	CLO 14	AEEB15.14
3	What is the use of shading ring in a pole motor?	The shading coil causes the flux in the shaded portion to lag behind the flux in unshaded portion of pole. This gives in effect a rotation of flux across the pole face and under the influence of this moving flux a starting torque is developed.	Remember	CO5	CLO 14	AEEB15.14
4	In which direction does a shaded pole motor run?	The rotor starts rotation in the direction from unshaded part to the shaded part.	Remember	CO5	CLO 14	AEEB15.14
5	What is size of shaded-pole motor?	These are usually built in small fractional H.P, not exceed 1/4 H.P	Remember	CO5	CLO 14	AEEB15.14
6	Differentiate between "capacitor start" and "capacitor start capacitor run" induction motor?	In capacitor start motor, capacitor is connected in series with the starting winding. But it will be disconnected from the supply, when the motor picks up its speed. But in capacitor start capacitor run motor starting winding and capacitor are not disconnected, but always connected in the supply so it has high starting and running torque.	Remember	CO5	CLO 14	AEEB15.14
7	What is auxiliary winding?	The winding which is included in the circuit at starting makes the single phase induction motor a self starting motor.	Remember	CO5	CLO 14	AEEB15.14
8	Why single phase induction motor does not self start?	The single-phase stator winding produces a magnetic field that pulsates in strength in a sinusoidal manner. The field polarity reverses after each half cycle but the field does not rotate. Consequently, the alternating flux cannot produce rotation in a stationary squirrel-cage rotor.	Remember	CO5	CLO 14	AEEB15.14
9	How to produce rotating magnetic field from 2-phase supply?	As with a 3-phase supply, a 2-phase balanced supply also produces a rotating magnetic field of constant magnitude. With the exception of the shaded-pole motor, all single-phase induction motors are started as 2-phase machine. Once so started, the motor will continue to run on single-phase supply.	Remember	CO5	CLO 14	AEEB15.14
10	What is speed variation of split phase induction motor from no load to full load?	An important characteristic of these motors is that they are essentially constant-speed motors. The speed variation is 2-5% from no-load to full-load.	Remember	CO5	CLO 14	AEEB15.14

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
11	Which type of capacitor is used in single phase motor?	A capacitor-start induction motor only has a capacitor in series with the auxiliary winding during starting. A capacitor-run motor typically has a large non polarized electrolytic capacitor in series with the auxiliary winding for starting, then a smaller non-electrolytic capacitor during running.	Remember	CO5	CLO 14	AEEB15.14
12	What happens if capacitor is too small?	Motor will not run properly with a weak capacitor. This is not to imply bigger is better, because a capacitor that is too large can cause energy consumption to rise. In both instances, be it too large or too small, the life of the motor will be shortened due to overheated motor windings.	Remember	CO5	CLO 14	AEEB15.14
13	What happens when a capacitor fails?	Depending on where the capacitor is connected This will cause the circuit to stop working, it may burn out components and blow a fuse. When capacitor fails due to open circuit nothing happens but when it fails due to short circuit there might be changes in currents and voltages in the circuit.	Understand	CO5	CLO 14	AEEB15.14
14	Why do you need a run capacitor?	Run capacitors some single-phase AC electric motors require a "run capacitor" to energize the second-phase winding (auxiliary coil) to create a rotating magnetic field while the motor is running. If a wrong capacitance value is installed, it will cause an uneven magnetic field around the rotor.	Understand	CO5	CLO 14	AEEB15.14
15	Can I use a bigger capacitor than needed?	Much the same way, a motor will not run properly with a weak capacitor. This is not to imply bigger is better, because a capacitor that is too large can cause energy consumption to rise. There is a maximum of +10% tolerance in microfarad rating on replacement start capacitors, but exact run capacitors must be replaced.	Understand	CO5	CLO 14	AEEB15.14

**Signature of the Faculty**

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