

## Model Question Paper-1/2 with effect from 2022-23 (CBCS Scheme)

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Course **BEE401**  
Code

### Fourth Semester B.E. Degree Examination ELECTRIC MOTORS

TIME: 03 Hours

Max. Marks: 100

**Note:** Answer any **FIVE** full questions,  
Choosing at least **ONE** question from each **MODULE**.

Module -1			L	CO	PO	Marks
<b>Q.01</b>	<b>a</b>	With usual notation, derive an expression for torque equation of a D C motor.	<b>L2</b>	<b>CO1</b>	<b>1</b>	<b>06</b>
	<b>b</b>	Analyze how to control the speed of DC shunt motor using Armature and field control methods.	<b>L4</b>	<b>CO1</b>	<b>2</b>	<b>08</b>
	<b>c</b>	A 4- pole DC Shunt motor takes 22 amps from 220 V supply. The armature and shunt field resistances are 0.5 ohm and 100 ohm respectively. The armature is lap connected with 300 conductors. If flux per pole is 20 m wb. Calculate speed and the developed torque	<b>L3</b>	<b>CO1</b>	<b>2</b>	<b>06</b>
OR						
<b>Q.02</b>	<b>a</b>	With usual notations Derive an expression, that gives variable losses is equal to constant losses of DC Motor	<b>L2</b>	<b>CO1</b>	<b>1</b>	<b>06</b>
	<b>b</b>	With a neat circuit diagram, experimental testing procedure for conducting Swinburne's test on a dc motor. Show how the efficiency as i) Motor and ii) Generator can be predetermined.	<b>L4</b>	<b>CO1</b>	<b>2</b>	<b>08</b>
	<b>c</b>	A 220 V DC shunt motor at no load takes a current of 2.5 A. The resistance of armature and shunt field are 0.8 ohm and 200 ohm respectively. Estimate the efficiency of the motor when the input current is 32A.	<b>L3</b>	<b>CO1</b>	<b>2</b>	<b>06</b>
Module-2						
<b>Q.03</b>	<b>a</b>	With a neat diagram, Explain the construction and working principle of three phase Squirrel cage Induction motor.	<b>L2</b>	<b>CO2</b>	<b>1</b>	<b>08</b>
	<b>b</b>	What is Slip? Explain its significance.	<b>L2</b>	<b>CO2</b>	<b>1</b>	<b>06</b>
	<b>c</b>	A 8 pole, 50 Hz, induction motor has an emf in the rotor of frequency 1.5 Hz. Determine the slip and speed of the motor.	<b>L3</b>	<b>CO2</b>	<b>2</b>	<b>06</b>
OR						

<b>Q.04</b>	<b>a</b>	Derive an expression for torque equation of an Induction Motor under starting condition.	<b>L2</b>	<b>CO2</b>	<b>1</b>	<b>06</b>
	<b>b</b>	Discus the Torque slip characteristics of a three phase Induction motor including Motoring, Generating and Braking modes of operation.	<b>L2</b>	<b>CO2</b>	<b>1</b>	<b>08</b>
	<b>c</b>	A 400 V , 4 pole 3 phase , 50Hz , star connected induction motor has a rotor resistance and reactance per phase equal to 0.01 ohm and 0.1 ohm respectively. Determine: i) Starting torque ii) Slip at which maximum torque will occur iii) Speed at which maximum torque will occur iv) Maximum torque	<b>L3</b>	<b>CO2</b>	<b>2</b>	<b>06</b>
<b>Module-3</b>						
<b>Q. 05</b>	<b>a</b>	Draw and Explain, the approximate equivalent circuit referred to stator of three phase Induction motor.	<b>L2</b>	<b>CO3</b>	<b>1</b>	<b>06</b>
	<b>b</b>	With a neat circuit diagram, explain the experimental testing of conducting No load and Blocked rotor tests on Three phase Induction motor.	<b>L4</b>	<b>CO3</b>	<b>1</b>	<b>08</b>
	<b>c</b>	A 10KW, 400V, 4 pole delta connected squirrel cage induction motor gave the following test results. No load test: 400V, 8A, 250W. Blocked rotor test: 90V, 35A, 1350W. DC resistance per phase of stator is 0.6 ohm. Calculate equivalent circuit parameters.	<b>L3</b>	<b>CO3</b>	<b>2</b>	<b>06</b>
<b>OR</b>						
<b>Q. 06</b>	<b>a</b>	Draw and Explain, the Phasor diagram of three phase Induction motor.	<b>L2</b>	<b>CO3</b>	<b>1</b>	<b>06</b>
	<b>b</b>	Explain clearly, the phenomenon of cogging and crawling in a three phase induction motor.	<b>L2</b>	<b>CO3</b>	<b>1</b>	<b>08</b>
	<b>c</b>	Explain with a neat diagram, the construction and operation of Double cage rotor induction motor and draw its torque slip characteristics	<b>L2</b>	<b>CO3</b>	<b>1</b>	<b>06</b>
<b>Module-4</b>						
<b>Q. 07</b>	<b>a</b>	Why starter is necessary for an Induction motor? With a neat diagram, explain the operation of a Star Delta starter.	<b>L2</b>	<b>CO4</b>	<b>1</b>	<b>08</b>
	<b>b</b>	With a neat diagram, explain the construction and operation of a Rotor rheostat starter of an induction motor.	<b>L2</b>	<b>CO4</b>	<b>1</b>	<b>06</b>

	<b>c</b>	With a neat sketch, explain how to control the speed of an induction motor by frequency of supply mains.	<b>L2</b>	<b>CO4</b>	<b>1</b>	<b>06</b>
<b>OR</b>						
<b>Q. 08</b>	<b>a</b>	Explain double field revolving theory as applied to a single phase induction motor and prove that it is not self-starting motor.	<b>L2</b>	<b>CO4</b>	<b>1</b>	<b>06</b>
	<b>b</b>	With a neat schematic sketch, explain the construction and operation of Capacitor start induction motor and Draw its torque slip characteristics.	<b>L2</b>	<b>CO4</b>	<b>1</b>	<b>08</b>
	<b>c</b>	Explain what happens when the load on a synchronous motor is changed.	<b>L2</b>	<b>CO4</b>	<b>1</b>	<b>06</b>
<b>Module-5</b>						
<b>Q. 09</b>	<b>a</b>	Explain, with a neat diagram the working principle of Synchronous motor.	<b>L2</b>	<b>CO5</b>	<b>1</b>	<b>06</b>
	<b>b</b>	Explain , the V and Inverted V curves of Synchronous motor	<b>L2</b>	<b>CO5</b>	<b>1</b>	<b>08</b>
	<b>c</b>	Illustrate the working of Synchronous condenser	<b>L2</b>	<b>CO5</b>	<b>1</b>	<b>06</b>
<b>OR</b>						
<b>Q. 10</b>	<b>a</b>	With a neat schematic diagram, explain the construction and operation of A C Servo motor. List out applications, Advantages and Disadvantages.	<b>L2</b>	<b>CO5</b>	<b>1</b>	<b>06</b>
	<b>b</b>	With a neat schematic diagram, explain the construction and operation of BLDC motor. List out Advantages and Disadvantages	<b>L2</b>	<b>CO5</b>	<b>1</b>	<b>08</b>
	<b>c</b>	With a neat diagram, explain the construction and operation of a Universal motor.	<b>L2</b>	<b>CO5</b>	<b>1</b>	<b>06</b>

\*Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.

**Model Question Paper-1/2 with effect from 2023-24  
(CBCS Scheme)**

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**Fourth Semester B.E. Degree Examination  
Electric Motors**

TIME: 03 Hours

Max. Marks: 100

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

Module -1			*Bloom's Taxonomy Level	COs	Marks
Q.01	a	With neat sketch, explain the constructional details of DC Motor.	L2	CO1	8
	b	What is Back emf? Explain its significance in D.C. motor operation.	L2	CO1	6
	c	A 4 pole D.C. shunt motor takes 22 A from 220 V supply. The armature and shunt field resistances are 0.5 $\Omega$ and 100 $\Omega$ respectively. The armature is lap connected with 300 conductors. If the flux per pole is 20 mWb. Calculate the speed and the torque developed.	L3	CO1	6
OR					
Q.02	a	Derive the torque equation of D.C. Motor.	L3	CO1	8
	b	Explain any two characteristics of D.C. shunt motor.	L2	CO1	6
	c	The no load test on a 60 HP, 220 V d.c. shunt motor gave the following resultson no load test. Input current = 13.25 amps, Field current = 2.55 amps, resistance of the armature = 0.032 $\Omega$ , Brush drop = 2 volts. Determine the full load current and full load efficiency.	L3	CO1	6
Module-2					
Q. 03	a	With necessary diagrams, explain the concept of generation of rotating magnetic field with respect to three phase induction motor.	L2	CO2	8
	b	Define slip of an Induction Motor and derive the relation between the supply frequency and rotor current frequency.	L2	CO2	6
	c	Derive the torque equation of a 3 phase induction motor.	L3	CO2	6
OR					
Q.04	a	Discuss the torque- slip characteristics of a three phase induction motor including motoring, generating and braking regions.	L2	CO2	8
	b	A 400 V. 4 pole 3 phase, 50 Hz star connected induction motor has a rotor resistance and reactance per phase equal to 0.01 $\Omega$ and 0.1 $\Omega$ respectively. Determine i) Starting torque ii) Slip at which maximum torque occurs iii) Speed at which maximum torque occurs	L3	CO2	6
	c	With relevant diagrams, explain the construction of squirrel cage and slip ring induction motor.	L2	CO2	6

## Module-3

Q. 05	a	With neat circuit diagram, explain no load and blocked rotor test of a 3- phase induction motor. How are the parameters of equivalent circuit determined from test results?	L2	CO3	6
	b	Discuss the various losses that take place in 3 phase induction motor.	L2	CO3	6
	c	A 10 KW, 400V, 4 pole delta connected squirrel cage induction motor gave the following test results No load test: 400V, 8A, 250 W Blocked rotor test: 90V, 35A, 1350 W DC resistance per phase of the stator is 0.6 $\Omega$ . Calculate equivalent circuit parameters.	L3	CO3	8

OR

Q. 06	a	Starting from the fundamentals, develop the equivalent circuit of three phase induction motor.	L2	CO3	8
	b	With neat diagram, explain construction and working of doubly fed induction generator.	L2	CO3	6
	c	Write short note on Crawling and cogging of three phase induction motor.	L2	CO3	6

## Module-4

Q. 07	a	Justify the need of a starter to start three phase Induction Motor. With neat diagram, explain the operation of Star-Delta starter.	L2	CO4	8
	b	Explain the construction and operation of capacitor start, capacitor run single phase induction motor.	L2	CO4	6
	c	Discuss supply frequency control method for speed control of 3-phase induction motor.	L3	CO4	6

OR

Q. 08	a	Explain the construction and operation of split phase single phase induction motor.	L2	CO4	6
	b	A 250W, 230 V, 50 Hz single phase capacitor start induction motor has the following constants for main winding and auxiliary windings. Main winding $Z_m = (4.5 + j3.7)\Omega$ , auxiliary winding $Z_a = (9.5 + j3.5)\Omega$ . Determine the value of capacitor that will place the main winding and auxiliary winding currents in quadrature at starting.	L3	CO4	8
	c	With necessary diagrams, explain double revolving field theory applied to single phase induction motor.	L2	CO4	6

## Module-5

Q. 09	a	With neat phasor diagram, discuss the operation of synchronous motor at constant load variable excitation condition.	L3	CO5	8
	b	Explain construction and operation of linear induction motor.	L2	CO5	6
	c	Explain construction and operation of universal motor.	L2	CO5	6

OR

Q. 10	a	Discuss 'V' and inverted 'V' curves of synchronous motor.	L3	CO5	8
	b	Explain how synchronous motor can be operated as a synchronous condenser with change in excitation.	L2	CO5	6
	c	Explain construction and operation of AC servomotor.	L2	CO5	6