Q. Code:286057

Reg. No. | | | | | | | | | | | | | |

B.E./B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fourth Semester

EE22403 – ELECTRICAL MACHINES II

(Electrical and Electronics Engineering)

(Regulation 2022)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Determine the performance parameters of a Three phase Induction Motor by suitable tests	**3**
CO 2	Evaluate different types of Starters and classify the Speed control schemes of Three phase Induction Motors	**3**
CO 3	Characterize different types of Single phase Induction Motors and special machines	**3**
CO 4	Predict the Regulation of an Alternator by different methods	**3**
CO 5	Describe the Operation and Characteristics of Synchronous Motors	**3**

PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Classify the types of three phase induction motor.	**1**	**2**
2.	Why an induction motor will never run at its synchronous speed?	**1**	**2**
3.	Draw the torque-slip characteristics of double cage induction motor.	**1**	**2**
4.	Write a short note on induction generator.	**1**	**2**
5.	Express the relationship between starting torque and full load torque of DOL starter.	**2**	**2**
6.	Summarize the different methods of speed control on stator side of induction motor.	**2**	**2**
7.	Generalize how is super-synchronous speed achieved, while controlling the speed of an induction motor?	**2**	**2**
8.	What type of braking is employed during deceleration of an induction motor?	**2**	**2**
9.	Distinguish the terms rotating and pulsating magnetic fields.	**3**	**2**
10.	Examine why centrifugal switches are provided in single phase induction motor.	**3**	**2**
11.	State the limitations of shaded pole induction motor.	**3**	**2**
12.	Mention the applications of stepper motor.	**3**	**2**
13.	What are the advantages of salient pole type construction used for synchronous machines?	**4**	**2**
14.	Differentiate single layer and double layer winding.	**4**	**2**

15.	Calculate the pitch factor a synchronous generator which contains its windings has 36 stator slots, 4 poles and a coil span of 1 to 8.	**4**	**3**
16.	Why the concept of two reaction theory is applied only to salient pole machines?	**4**	**2**
17.	Point out why synchronous motor is not self-starting.	**5**	**2**
18.	How the synchronous motor can be used as synchronous condenser?	**5**	**2**
19.	Express the causes of hunting.	**5**	**2**
20.	How does a change of excitation affect its power factor?	**5**	**2**

PART- B (5 x 10 = 50 Marks)

		Marks	CO	RBT LEVEL
21. (a)	A 40 kW, three phase slip ring induction motor of negligible stator impedance runs at a speed of 0.96 times synchronous speed at rated torque. The slip at maximum torque is four times the full load value. If the rotor resistance of the motor is increased by 5 times, determine (i) speed, power output and rotor copper loss at rated torque, (ii) the speed corresponding to maximum torque.	**(10)**	**1**	**4**
	(OR)			
(b)	The test readings of a 3 phase 14.71 kW, 400V, 50Hz star connected induction motor is given below: No load test :400V, 9A, 0.2 p.f Short Circuit test : 200V, 50A, 0.4 p.f From the circle diagram, estimate (i) line current, (ii) power factor, (iii) slip and (iv) efficiency at full load.	**(10)**	**1**	**4**
22. (a)	With neat diagram, explain the working of any two types of starters used for squirrel cage type 3 phase induction motor.	**(10)**	**2**	**3**
	(OR)			
(b)	Explain the following methods of speed control scheme (i) cascade connection and (ii) v/f control.	**(10)**	**2**	**3**
23. (a)	Using double field revolving theory, compose why a single phase induction motor is not self-starting. Also obtain the equivalent circuit of single phase induction motor with necessary equations.	**(10)**	**3**	**3**
	(OR)			
(b)	Describe the construction and working principle of (i) stepper motor and (ii)	**(10)**	**3**	**3**

shaded pole induction motor.

24. (a) A 3.3 kW alternator gave the following results: **(10) 4 4**

Field current (A)	16	25	37.5	50	70
O.C voltage (kV)	1.55	2.45	3.3	3.75	4.15

A field current of 18A is found to cause the full load current to flow through the winding during short circuit test. Predetermine the full load voltage regulation at (i) 0.8 p.f lag and (ii) 0.8 p.f lead by MMF method.

(OR)

(b) A 3-phase 50 Hz star connection alternator with 2-layer winding is running at 600 rpm. It has 12 turns/coil, 4 slots/pole/phase and a coil pitch of 10 slots. If the flux/pole is 35mWb sinusoidally distributed, find the phase and line emf's induced. Assume that the total turns/phase are series connected. **(10) 4 4**

25. (a) Derive the mechanical power developed per phase and maximum torque developed per phase of a synchronous motor. **(10) 5 3**

(OR)

(b) Examine in detail the effect of varying excitation on armature current and power factor of synchronous motor. **(10) 5 3**

PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

Marks CO RBT LEVEL

26. A 1.1 MVA, 2.2kV, 3-phase star connected alternator gave the following test results during OC and SC tests: **(10)** 4 **5**

Field current (A)	10	20	30	40	50
Open circuit voltage (kV)	0.88	1.65	2.20	2.585	2.86
Short circuit current (A)	200	400	-	-	-

The effective resistance of the 3-phase winding is 0.22Ω / phase. Estimate the full-load voltage regulation at 0.8 p.f lagging by synchronous impedance method.

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