Register No.: ....   Name: ....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (S), FEBRUARY 2023
ELECTRICAL AND ELECTRONICS ENGINEERING
(2020 SCHEME)

Course Code :   **20EET307**

Course Name: **Synchronous and Induction Machines**

Max. Marks :   100   **Duration: 3 Hours**

Provide graph sheets (two numbers) along with answer booklet.

PART A
(Answer all questions. Each question carries 3 marks)

1. Name different types of armature windings of alternators.
2. Explain the basic operation of turbo alternator.
3. Why MMF method is known as the optimistic method to determine voltage regulation?
4. What do you mean by slip test? Briefly explain its procedure.
5. What is the effect of excitation on armature current in synchronous motor, explain with a neat graph?
6. Explain the principle of operation of three phase induction motor.
7. What are the advantages of constructing circle diagram over equivalent circuit?
8. What are the different braking methods adopted in induction motor and write down the differences among them in terms of operation?
9. Explain the principle of operation of grid connected induction generator.
10. Write down the principle of operation of split phase induction motor with neat diagram.

PART B
(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Derive the EMF equation of alternator considering pith and distribution factor.   (7)

     b) Calculate the speed and open circuit line and phase voltages of a 4 pole 3 phase 50Hz, star connected alternator with 36 slots and 30 conductors per slot. The flux per pole is 0.05Wb sinusoidally distributed.   (7)

OR

12. a) Why do stationary armature in alternators have an advantage over rotating armature?   (4)

b) What are the different types of alternators based on the application? Briefly explain its constructional features with neat cross-sectional diagrams. (10)

MODULE II

13. Determine the regulation by ZPF method of 5000kVA, 6600V, 3 phase, and 50Hz star connected alternator at full load unity power factor having the following test data. Neglect armature resistance. (14)

Filed current, If (A)	32	50	75	100	140
Open circuit terminal voltage (V)	3100	4900	6600	7500	8300
Full load current ZPF test line potential difference (V)	0	1850	4250	5800	7000

OR

14. a) What are the conditions for synchronizing an alternator to bus bar? (6)

b) Explain bright lamp method of synchronization of an alternator with necessary diagrams (8)

MODULE III

15. a) Draw and explain the power flow diagram of a synchronous motor with equations representing different power stages. (6)

b) A star connected synchronous motor rated at 187kVA, 3phase, 2300V, 47A, 50Hz, 187.5rpm has an effective resistance of 1.5 ohm and synchronous reactance of 20 ohm per phase. Determine the internal power developed by the motor when it is operating at rated current and 0.8 power factor leading. (8)

OR

16. a) Draw the torque slip characteristic of a three phase induction motor and mark the following parameters on the graph: (5)
stable region, unstable region, pull out torque, starting torque

b) The power input to a 6 pole, 50 Hz, 3 phase induction motor is 700W at no load and 10kW at full load. The no load copper losses may be assumed negligible while the full load stator and rotor copper losses are 295W and 310W respectively. Find the full load speed, shaft torque and efficiency of the motor assuming rotational and core losses to be equal. (9)

MODULE IV

17.   Draw the circle diagram of a 3 phase delta connected, 30hp, 500V, 4 pole, 50 Hz cage induction motor. The Table 1 given below give the measurements of line voltage, current and readings of two wattmeters connected to measure the input power. Find i) full load current ii) power factor iii) efficiency and iv) maximum power output from the circle diagram.   (14)

Table 1

No load	500V	8.3A	+2.85kW	-1.35kW
Short circuit (Blocked rotor)	100V	32A	-0.75kW	+2.35kW

OR

18. a) How star delta starter operates during the starting of a three phase induction motor? Derive the expression for starting torque in terms of full load torque.   (7)

     b) What are the practical importance of speed control of three phase induction motor? Explain any two speed control techniques used in three phase induction motor.   (7)

MODULE V

19. a) What are the applications of induction generators and what are its main disadvantages?   (6)

     b) Draw the equivalent circuit of a single phase induction motor after calculating the parameters from no-load and blocked rotor tests.   (8)

OR

20. a) Draw the equivalent circuit of a single phase induction motor and explain each parameters.   (6)

     b) Explain the principle of operation of a single phase induction motor by double field revolving theory. Derive the expressions of forward slip and backward slip.   (8)

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