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B.TECH.
SEM V THEORY EXAMINATION 2022-23
ELECTRICAL MACHINE-II

Time: 3 Hours

Total Marks: 100

Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. Attempt all questions in brief. 2x10 = 20

- (a) What are two main types of synchronous generators based on their rotor construction?
- (b) Why are Alternators rated in kVA and not in kW?
- (c) What is the function of synchronous condenser?
- (d) What are the effects of hunting in synchronous motor?
- (e) Define slip in Induction motor
- (f) Discuss the advantages of squirrel cage induction motor
- (g) What do you mean by crawling in an induction motor?
- (h) List two methods of speed control in 3-phase induction motor
- (i) What are the different types of single-phase induction motors?
- (j) What is a universal motor?

SECTION B

2. Attempt any three of the following: 10x3 = 30

- (a) Explain Potier's Triangle method of determining voltage regulation in cylindrical rotor machine.
- (b) With the help of suitable diagrams discuss why synchronous motors are not self-starting? Also, explain starting of synchronous motor by using damper winding.
- (c) Discuss the working principle of 3-phase induction motor. Also, with neat sketches discuss the construction of squirrel cage and wound rotor 3-phase induction motor.
- (d) What is the need of the starter in 3-Phase induction motor? With a neat sketch describe autotransformer method of starting.
- (e) The following data shown result on a 230V, 50 Hz capacitor start single phase induction motor at standstill:
 Main winding : 100V, 2A, 40W
 Auxiliary winding: 80V, 1A, 50W
 Determine the value of capacitance for obtaining the maximum starting torque

SECTION C

3. Attempt any one part of the following: 10x1 = 10

- (a) A 230V, 3-phase, 5kVA star connected salient pole alternator with $X_d=12$ ohm and $X_q=7$ ohm delivers full load current at unity power factor. Calculate the excitation voltage neglecting resistance.
- (b) With the help of phasor diagrams explain the operation of synchronous motor at constant load and variable excitation. Also, draw the V-curves and state its significance.

4. Attempt any *one* part of the following: **10 x1 = 10**

- (a) Derive emf equation of alternator. Also, define and derive pitch factor and distribution factor.
- (b) A 3-phase, 1500 kVA, star connected 50Hz, 2300 V alternator has dc resistance of $0.08 \Omega/\text{phase}$. Assume that effective resistance/phase is 1.5 times the dc resistance. A field current of 70A produces a short circuit current equal to full load current of 376A in each line. The same field current produces an emf of 700V on open circuit. Determine the synchronous reactance of the machine and its full load regulation at 0.8 pf lagging.

5. Attempt any *one* part of the following: **10x1 = 10**

- (a) Sketch and derive the Torque-Slip characteristics of a 3-phase induction motor indicating starting, maximum torque and the operating region. Also, derive the conditions of maximum torque and maximum starting torque.
- (b) An 18.650 kW, 4 pole, 50 Hz, 3-phase induction motor has friction and windage loss of 2.5 percent of the output. The full load slip is 4 %. Compute for full load
 - (i) The rotor copper loss
 - (ii) The rotor input and
 - (iii) The shaft torque.

6. Attempt any *one* part of the following: **10x1 = 10**

- (a) What is the purpose of using deep bar cage rotors. Also, describe the construction and working of deep bar cage rotors.
- (b) With a suitable circuit diagram explain cascade operation of 3-phase induction motor. Derive the relation of speed for cumulative cascading and differential cascading.

7. Attempt any *one* part of the following: **10x1 = 10**

- (a) What is double revolving field theory? Explain the operation of a single-phase induction motor using double revolving field theory?
- (b) Discuss the working of
 - (i) Shaded pole motor and
 - (ii) Capacitor-start capacitor-run motor