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Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2008

EE 04 505—ELECTRICAL MACHINES—II

(2004 admissions)

Time : Three Hours

Maximum : 100 Marks

Answer **all** *questions.*

1. (a) Explain the term "Reluctance Power".

   (b) Explain distribution factor and chording factor related to three-phase winding.

   (c) Explain the effect of change in excitation of a 3-phase alternator connected to infinite bus.

   (d) What is bunting ; How its effect is eliminated ?

   (e) Why do induction motor run at low power factors ?

   (f) Explain cogging and crawling in induction motors.

   (g) Compare the performance of a "Capacitor start capacitor run" and "Capacitor start induction run" type single phase induction motors.

   (h) Explain a static Voltage control method for speed control of induction motor.

(8 × 5 = 40 marks)

2. (a) Explain the constructional details of a 3ϕ alternator. (7 marks)

   (b) A 1MVA, 11kV, 3-phase star-connected synchronous machine has the following OCC test data : —

I_f (A)	:	50	110	140	180
Voc (V) (Line)	:	7000	12500	13750	15000

The short circuit test gave full -load current at a field current of 40 A. The ZPF test gave rated terminal voltage for a field current of 150 A. The armature resistance is negligible. Calculate the field current needed for the machine to draw full-load 0.8 p.f. leading current when operated as motor connected to 11 kV supply.

(8 marks)

Or

Turn over

3 (a) Explain the steps, tests involved in the calculation of voltage regulation by MMF method. (5 marks)

(b) What is potier triangle method of voltage regulation ? Compare with MMF method. (5 marks)

(c) Why X_d is greater than Xq for a salient pole machine ? (5 marks)

4. (a) Explain any *one* method of synchornisation of alternation to an infinite bus. Explain how the various conditions for synchronisation are verified in this method. (7 marks)

(b) The excitation of a 415 V, 3 phase, Δ -connected synchronous motor is such that the induced e.m.f. is 520 V. The impedance per phase is $0.5 + j\,4\ \Omega$. If the friction and iron losses are constant and is 1000 W, calculate the power output, Line Current, Power factor and efficiency for :

(i) Maximum power input.

(ii) Maximum power output. (8 marks)

Or

5. (a) Derive from basic principles an expression for power developed by a synchronous motor. (4 marks)

(b) Explain the V and Λ – curves of a synchronous generator. (4 marks)

(c) A 600 V, 6-pole, 3-phase, 50 Hz star-connected synchronous motor has a resistance of $0.4\ \Omega$/ phase and reactance of $7\ \Omega$/phase. It takes a current of 15 A at upf. When operating with certain field current with the field current remaining the same the load torque is increased until the motor draws 50A. Find the gross torque developed and new power factor. (7 marks)

6. (a) Explain with circuit diagrams the no-load and blocked rotor test on a three-phase induction motor. (6 marks)

(b) A 60 kW, 400 V, 3-phase, 50 Hz wound rotor induction motor has a full-load slip of 0.04 when operating at rated voltage and frequency with rotor winding shorted at the slip rings. The slip at the maximum torque is 0.2. Neglecting the rotational and stator resistance losses find the maximum torque and full-load rotor resistance losses. (9 marks)

Or

7. (a) Explain the principle of operation of a linear induction motor. (4 marks)

(b) Explain the Double cage induction motor and its applications. (4 marks)

(c) With the help of current locus diagrams explain the working of induction generator. (4 marks)

(d) Prove that Rotor input : Rotor Cu loss : Rotor O/P = 1 : S : (1–S). (3 marks)

8. (a) Explain the circuit diagram of a star-delta starter for a 3-phase induction motor. Compare its merits over autotransformer starter. (6 marks)

(b) Determine the approximate starting torque of an induction motor in terms of the full-load torque when started by means of :

(i) Star-Delta Starter.

(ii) Auto transformer starter with 50% tapping. Ignore magnetization current. The short circuit current of the motor at normal voltage is 5 times the full-load current, and the full-load slip is 5%. (9 marks)

Or

9. (a) Calculate the steps in a 4 slip starter for a 3-phase slip ring induction motor, from the following data : —

Maximum starting current = full-load current; full-load slip = 2.5%; Rotor resistance per phase = 0.02 Ω. (8 marks)

(b) Explain, with the help of a circuit diagram, the slip power recovery scheme. Can we use it for speed control. Explain in detail. (7 marks)

[4 × 15 = 60 marks]