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D 42175 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2007

EE 04 505—ELECTRICAL MACHINES—II

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Write short notes on three phase self-excited alternator with neat sketch.

(b) Derive the e.m.f. equation of a three phase alternator.

(c) Discuss the load sharing between two alternators operating in parallel.

(d) Explain the operation of a synchronous motor as a phase modifier.

(e) Derive an expression for starting torque in a three phase induction motor and obtain the condition for maximum starting torque.

(f) A 3.3 kV, 20 pole, 50 Hz three phase induction motor has rotor resistance and standstill reactance of 0.014 Ω and 0.113 Ω per phase respectively. Calculate (i) the speed at which the torque developed is maximum and (ii) the ratio of full-load torque to maximum torque, if the full load torque is delivered at 288 r.p.m. speed.

(g) Write short notes on plugging.

(h) Explain the method of speed control by injection of e.m.f. in the rotor circuit of a 3-ϕ induction motor.

II. (a) Explain in detail the method of pre-determination of voltage regulation of an alternator by m.m.f. method.

(8 marks)

(b) Write short notes on winding resistance and armature leakage reactance. (7 marks)

Or

(c) What is 'Two reaction theory' ? (5 marks)

(d) A 3.3 kV alternator gave the following results :—

Field at(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 18 A is found to cause the full-load current to flow through the winding during short-circuit test. Pre-determine the full-load voltage regulation at (i) 0.8 lag pf and (ii) 0.8 lead pf by (a) M.m.f. method (b) E.m.f. method.

(10 marks)

Turn over

III. (a) Two alternators operating in parallel supply a lighting load of 2000 kW and motor loads aggregating 6000 kW at 0.707 power factor. One alternator is loaded to 3600 kW at 0.8 pf lagging. Find the power delivered and the power factor of the second alternator.

(b) A 25 kVA, 415 V, 3-ϕ synchronous generator delivers full-load output at rated voltage at 0.8 pf lagging to the infinite bus-bars. Determine the voltage generated at this excitation condition if the per phase synchronous impedance is $0.33 + j\ 3.5\ \Omega$.

Or

(c) A six-pole three phase star connected synchronous motor has a synchronous impedance of $0.5 + j\ 8\ \Omega$ per phase. When operating on 2.2kV 50 H_z bus bars, its field current is such that the e.m.f induced is 18 kV. Calculate the maximum torque that can be developed at this excitation condition.

(d) A 415 V, 3-ϕ star connected synchronous motor gives a net output mechanical power of 7.5 kW and operates at 0.8 pf leading. Its effective resistance per phase is 0.9 Ω. If the iron, friction and field copper looses are 125 W, 75 W and 100 W respectively, estimate the current drawn by the motor and over all efficiency.

(10 marks)

IV. (a) Discuss about the rotor and stator current frequencies in a three phase induction motor.

(5 marks)

(b) A 400 V, 50 Hz, delta-connected 30-ϕ Inducting motor gave the following test results :—

No-load test	:	400 V	8.6 A	1120 W
Blocked rotor test	:	130 V	17.9 V	1640 W

Stator resistance per phase = 2 .45 Ω .

Find the parameters of equivalent circuit.

Or

(c) Explain the operation of separately excited induction generator. Also mention the advantages and disadvantages.

(10 marks)

(d) Write short notes on Harmonic synchronous torques. (5 marks)

V. (a) Explain the method of speed control in a three phase induction motor by changing the no. of poles.

(15 marks)

Or

(b) Explain Auto-transformer starter. (4 marks)

(c) A 3.7 kW 3-ϕ Induction motor has a locked rotor current of 5 times the full-load current and full-load slip is 5%. Find the starting torque as a percentage of full-load torque if the motor is started by

(i) Dot starter. (ii) Star-delta starter.

(iii) Auto-starter and (iv) Stator resistance starter.

($4 \times 15 = 60$ marks)