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Question Paper Code : 71779

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Fifth Semester

Electrical and Electronics Engineering

EE 6504 — ELECTRICAL MACHINES — II

(Regulations 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What do you mean by single layer and double layer winding?
2. Define voltage regulation.
3. What are V – curves?
4. What is synchronous condenser?
5. Why are the slots on the cage rotor of induction motor usually skewed?
6. A 3-phase, 4-pole induction motor operates from a supply whose frequency is 50Hz. Calculate the frequency of the rotor current at standstill and the speed at which the magnetic field of the stator is rotating.
7. What is the effect of change in input voltage on starting torque of induction motor?
8. State two advantages of speed control of induction motor by injecting an e.m.f in the rotor circuit.
9. Define double field revolving theory.
10. Why single phase induction motor is not self starting? Mention any one method of starting.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain step by step method of potier triangle method of determining the regulation of an alternator. (8)

(ii) A 30MVA, 15KV, 60Hz ac generator has a synchronous reactance of 1.2pu and a resistance of 0.02 pu. Calculate

(1) the base voltage, base power and base impedance of the generator,

(2) the actual value of the synchronous reactance,

(3) the actual winding resistance, per phase

(4) the total full-load copper losses. (8)

Or

(b) A 3 phase Y-connected, 1000 KVA, 2000 V, 50 Hz alternator gave the following open-circuit and short circuit test readings :

Field current (A) :	10	20	25	30	40	50
O.C. Voltage (V) :	800	1500	1760	2000	2350	2600
S.C. armature current (A) :	–	200	250	300	–	–

The armature effective resistance per phase is 0.2Ω. Draw the characteristic curves and determine the full load percentage regulation at

(i) 0.8 p.f lagging,

(ii) 0.8 p.f leading by MMF method. (16)

12. (a) (i) Explain V – curve and inverted V curve. (8)

(ii) A 500 hp, 720 rpm synchronous motor connected to a 3980V, 3phase line generates an excitation voltage E_o of 1790V (line to neutral) when the dc exciting current is 25A. The synchronous reactance is 22Ω and the torque angle between E_o and E is 30°, calculate

(1) The value of E_x

(2) The ac line current

(3) The power factor of the motor

(4) The approximate horsepower developed by the motor

(5) The approximate torque developed at the shaft. (8)

Or

(b) (i) A 1000 KVA, 11000 V, 3–phase star-connected synchronous motor has an armature resistance and reactance per phase of 3.5Ω and 40Ω respectively. Determine the induced emf and angular retardation of the rotor when fully loaded at 0.8 p.f. lagging and 0.8 p.f. leading. (8)

(ii) Derive the expression for power delivered by a synchronous motor in terms of load angle (α). (8)

13. (a) Explain in detail the construction of circle diagram of an induction motor. (16)

Or

(b) (i) Sketch and explain the torque slip characteristics of the 3 phase cage and slip-ring induction motors. Show the stable region in the graph. (8)

(ii) A 3 phase, 25 KW, 400 V, 50 Hz, 8-pole induction motor has rotor resistance of 0.08 ohm and standstill resistance of 0.4 ohm. The effective stator/ rotor turn ratio is 2.5/1. The motor is to drive a constant-torque load of 250N-m. Neglect stator impedance

(1) Calculate the minimum resistance to be added in rotor circuit for the motor to start up on load.

(2) At what speed would the motor run, if the added rotor resistance is (A) left in the circuit, and (B) subsequently short circuited. (8)

14. (a) The results of the no-load and blocked rotor tests on a 3-phase, Y-connected 10KW, 400V, 17A, 50Hz, 8-pole induction motor with a squirrel-cage rotor are given below.

No- load test :	Line-line voltage	=	400V
	Total input power	=	467W
	Line current	=	6.8A
Blocked rotor tests :	Line-line voltage	=	180V
	Total input power	=	1200W
	Line current	=	17A

The dc resistance of the stator measured immediately after the blocked rotor test is found to have an average value of 0.68 ohm/phase. Calculate the parameters of the circuit model of the induction motor. Draw circuit model. Calculate

(i) Torque (net),

(ii) Stator current,

(iii) Power factor,

(iv) Efficiency. (16)

Or

(b) Explain the speed control of 3 phase induction motor with slip power recovery scheme. (16)

15. (a) Using double field revolving theory, explain why a single phase induction motor is not self starting. Also obtain the equivalent circuit of single phase induction motor with necessary equations. (16)

Or

(b) Describe the constructional features and principle of operation of hysteresis motor and AC series motor. (16)
