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EE 131402

Roll No. of candidate | | | | | | | | | | |

2019

B.Tech. 4th Semester End-Term Examination

Electrical Engineering

ELECTRICAL MACHINES – II

(New Regulation)

(w.e.f. 2017-2018)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *four* from the rest.

1. (A) Choose the correct option for the following questions : (5 × 1 = 5)

(i) The speed of a 8-pole, 50 Hz induction motor with slip 5% is

(a) 712.5 rpm (b) 725.5 rpm

(c) 750 rpm (d) 500 rpm

(ii) The speed of a synchronous motor can be changed by varying

(a) Mechanical load

(b) Field excitation

(c) Supply frequency

(d) None of the above

(iii) The ac synchronous generators have

(a) revolving ac armature winding

(b) stationary field type construction

(c) revolving field type construction

(d) none of the above

(vi) For low speed, which type of alternators are used?

(a) Salient pole type

(b) Non-salient pole type

(c) Both of these

(d) None of these

(v) In single phase inducting motors, when the rotor is under running conditions, the slip with respect to the backward flux is

(a) Greater than unity

(b) Less than unity

(c) Equal to one

(d) Equal to zero

(B) Fill in the blanks with the most appropriate answer : $(5 \times 1 = 5)$

(i) An over excited synchronous motor running on no-load is known as a ————————.

(ii) External resistance can be inserted in the rotor circuit of ———————— rotor in case of a three phase induction motor.

(iii) The field circuit of an alternator is excited with ———————— current.

(iv) In split phase induction motors the auxiliary winding is displaced from the main winding by ————————.

(v) When the rotor is stationary, the slip of an induction motor is ————————.

2. (a) Describe slip of an induction motor. (2)

(b) Why is the starting torque of a squirrel cage induction motor low? (3)

(c) Draw and describe the slip-torque characteristics of a three phase induction motor. (5)

(d) An 8-pole, 3 phase, 50 Hz induction motor is running at a speed of 710 r.p.m. with an input power of 35 kW. The stator losses at this operating condition are known to be 1200 W while the rotational losses are 600 W. Find (i) the rotor Cu loss (ii) the gross mechanical power developed (iii) the gross torque developed (iv) mechanical power output (v) the net torque. (5)

3. (a) Derive the e.m.f. equation of an alternator. (5)

(b) A 1200 kVA, 3300 V, 50 Hz, three phase, star connected alternator has an armature resistance of 0.25 Ohm per phase. A field current of 40 A produces a short circuit current of 200 A and an open circuit e.m.f. of 1100 V line-to-line. Find the voltage regulation on (i) unity power factor (ii) full load 0.8 pf leading (iii) full load 0.8 pf lagging. (10)

4. (a) Explain the operating principle of a synchronous motor. (5)

(b) Draw the V curves of a synchronous motor. (4)

(c) What is hunting in a synchronous machine and how can it be reduced? (3)

(d) Calculate the value of distribution factor for a 3-phase winding of a 4-phole alternator having 36 slots. (3)

5. (a) Why are single phase induction motors not self starting? (2)

(b) Draw and explain the construction, working principle and applications of a split phase induction motor. (7)

(c) An 8-pole, 50 Hz, 3 phase, slip-ring motor has an effective rotor resistance of 0.07 Ohm/phase. Its stalling speed is 630 r.p.m. How much resistance must be inserted per phase to obtain the maximum torque at starting? (6)

6. (a) A 400 V, 40 h.p., 50 Hz, 4 pole delta connected induction motor gave the following test data.

No load test : 400V 20A 1200W

Blocked rotor test : 100V 45A 2800W

Draw the circle diagram and determine (i) full-load line current and power factor (ii) maximum output power (iii) maximum torque (iv) full-load efficiency and (v) full-load rotor speed. Assume stator and rotor Cu losses to be equal at standstill. (10)

(b) Briefly explain the two-reaction theory of salient pole synchronous machines. (5)

7. Write short notes on (any *three*) : (3×5=15)

(a) Reluctance motors.

(b) Universal motors.

(c) Schrage motors.

(d) Repulsion motors.

(e) Starting methods of a three phase induction motor.