C 15221

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Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2010

EE 04 405—ELECTRICAL MACHINES—I

(2004 Admissions)

Time : Three Hours

Maximum : 100 Marks

Answer **all** *questions.*

Part A

I. (a) Explain the constructional details of a D.C. machine.

(b) Explain the different methods to improve commutation.

(c) Derive the EMF equation of a D.C. Machine.

(d) Explain the magnetisation characteristics of a D.C. shunt generator.

(e) Explain the necessity of a starter for starting a D.C. motor.

(f) Explain Swinburn's test.

(g) Explain O.C. and S.C. test in a transformer.

(h) Derive the expression for saving of copper in an autotransformer as compared to a two winding transformer.

(8 × 5 = 40 marks)

Part B

II. (a) (i) With the help of neat diagram, explain what is armature reaction. (10 marks)

(ii) Explain the difference between Lap and wave winding. (5 marks)

Or

(b) (i) Explain the principle of operation of a D.C. Machine. (7 marks)

(ii) Derive the expressions for demagnetising and cross magnetising ampere - turns. (8 marks)

III. (a) (i) Explain the process of voltage build up of a d.c. shunt generator. (5 marks)

(ii) A shunt generator delivers 450 A at 230 V and the resistance of the shunt field and armature are 50 Ω and 0.03 Ω respectively. Calculate the generated e.m.f.

(10 marks)

Or

Turn over

(b) (i) Explain the load characteristics of a D.C. Shunt generator. (5 marks)

(ii) A 4 pole lap wound d.c. shunt generator has a useful flux per pole of 0.07 Wb. The armature winding consists of 220 turns each of 0.004 Ω resistance. Calculate the terminal voltage when running at 900 r.p.m. if its armature currents 50 A.

(10 marks)

IV. (a) (i) Explain what is back e.m.f. (5 marks)

(ii) A 4 pole 240 V, wave connected D. C. Shunt motor gives 11.19 kW when running at 1,000 r.p.m. and drawing armature and field currents of 50 A and 1 A respectively. It has 540 conductors. It's armature resistance is 0.1 Ω. Assuming a drop of 1 volt / brush find.

(1) Total Torque.

(2) Useful Torque.

(3) Rotational losses.

(4) Efficiency.

(5) Flux per pole.

(10 marks)

Or

(b) (i) Explain the mechanical and electrical characteristics of a d.c. series motor. (5 marks)

(ii) A 500 V d.c. shunt motor takes a current of 5 A on no - load. The resistance of armature and field circuit are 0.22 Ω and 250Ω respectively. Find (a) The efficiency when loaded and taking a current of 100 A. (b) The change inspeed when loaded.

(10 marks)

V. (a) (i) Derive the condition for maximum efficiency of a single-phase transformer. (5 marks)

(ii) Obtain the equivalent circuit referred to LV side of a 200/400 V, 50 H_2, 1-phase transformer from the following test data :

O.C. test : 200 V, 0.7 A, 70 W on l.v. side.

S.C. test : 15 V, 10 A, 85 W on h.v. side.

Calculate the secondary voltage when delivering 5 kW at 0.8 p.f. lagging ; the primary voltage being 200 V.

(10 marks)

Or

(b) (i) Explain Scott connection of a three-phase transformer. (5 marks)

(ii) A 11,000 / 230 V, 150 kVA, 1-phase transformer has a corel loss of 1.4 kW and F.L. cu loss of 1.6 kW. Determine.

(1) The kVA load for maximum efficiency and value of maximum efficiency at unity p.f.

(2) The efficiency at half full-load 0.8 p.f. leading.

(10 marks)

[4 × 15 = 60 marks]