

**FOURTH SEMESTER B.Tech. (ENGINEERING) DEGREE EXAMINATION  
DECEMBER 2006**

**EE04 405—ELECTRICAL MACHINES—I**

(2004 admissions)

Time : Three Hours

Maximum : 100 Marks

*Answer all questions.*

*Assume missing data.*

- I. (a) Enumerate and explain the methods to overcome the adverse effect of the armature reaction.
- (b) Give the advantages and uses of lap and wave windings.
- (c) A separately excited generator, when running at 1000 r.p.m. supplied 200 A at 125 V. What will be the load current when the speed drops to 800 r.p.m. if the field current is unchanged ? Given that the armature resistance =  $0.04 \Omega$  and brush drop = 2 V.
- (d) Mention some applications of the following :—
- (i) Series generator.
- (ii) Compound generator.
- (e) A d.c. motor takes an armature current of 110 A at 480 V. The armature circuit resistance is  $0.2 \Omega$ . The machine has 6 poles and the armature is lap-connected with 864 conductors. The flux per pole is 0.05 Wb. Calculate (i) the speed and (ii) the gross torque developed by the motor.
- (f) Explain the working principle of a D.C. motor.
- (g) What is a transformer ? Explain the working principle of a transformer.
- (h) A 40 kVA, single-phase transformer has 400 turns on the primary and 100 turns on the secondary. The primary is connected to 2000 V, 50 Hz supply. Determine :
- (i) The secondary voltage on open circuit.
- (ii) The current flowing through the two windings on full-load.
- (iii) The maximum value of flux.

(8 × 5 = 40 marks)

II. A Explain the following methods of improving commutation :—

- (i) Resistance commutation.
- (ii) E.m.f. commutation.

(15 marks)

Or

B Explain the constructional details of a D.C. machine with neat diagram.

(15 marks)

**Turn over**

III. A The magnetisation characteristic of a separately excited generator running at 750 r.p.m. is as follows :

|                  |   |     |     |     |     |     |     |
|------------------|---|-----|-----|-----|-----|-----|-----|
| Field current, A | : | 3.5 | 5   | 6   | 8   | 10  | 12  |
| E.m.f., V        | : | 270 | 390 | 445 | 535 | 600 | 640 |

Calculate :

- The voltage developed (a) at 750 r.p.m., ; (b) 600 r.p.m., if the field resistance is 55 ohms.
- The additional resistance to be inserted in the field circuit to reduce the voltage to 400 V at 750 r.p.m.

(15 marks)

Or

B (i) Enumerate the three most important characteristics of D.C. generators and also explain with neat sketch the characteristics of a shunt generator.

(13 marks)

(ii) What is meant by critical resistance ? (2 marks)

IV. A (i) Why is d.c. series motor used to start heavy loads ? (2 marks)

(ii) Mention the applications of Shunt and Compound motors. (4 marks)

(iii) Write the advantages and disadvantages of flux control method. (4 marks)

(iv) A 500 V shunt motor runs at its normal speed of 250 r.p.m. when the armature current is 200 A. The resistance of the armature is  $0.12 \Omega$ . Calculate the speed when a resistance is inserted in the field reducing the shunt field to 80 % of normal value and armature current is 100 A.

(5 marks)

Or

B (i) Explain the construction and operation of a 3-point starter of a D.C. motor with the neat sketch. Also mention the difference between a 3-point starter and 4-point starter of a d.c. motor.

(12 marks)

(ii) Mention the advantages of Swinburnes test. (3 marks)

V. A (i) Define All-Day efficiency. (2 marks)

(ii) What is Sumpner's test ? Draw a circuit diagram to conduct this test and explain its principle.

(13 marks)

Or

B List the four possible ways of connecting a bank of three transformers for three-phase service with a neat diagrams. State the applications of each of the connections listed above.

(15 marks)

[4 × 15 = 60 marks]