Code : 031342

B.Tech 3rd Semester Exam., 2014

ELECTRICAL MACHINE—I

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose and write the correct option (any *seven*) : 2×7=14

(a) The armature of a d.c. machine is made of

(i) silicon steel

(ii) wrought iron

(iii) cast steel

(iv) soft iron

(b) Eddy current loss occurs in the —— of a d.c. machine.

(i) armature

(ii) commutating poles

(iii) field poles

(iv) yoke

(c) DC machines, which are subjected to abrupt changes of load, are provided with

(i) interpole windings

(ii) compensating windings

(iii) equalizers

(iv) copper brushes

(d) The open circuit characteristic of a d.c. generator is also called its —— characteristic.

(i) magnetic

(ii) internal

(iii) external

(iv) performance

(e) A transformer will work on

(i) a.c. only

(ii) d.c. only

(iii) a.c. as well as d.c.

(iv) None of the above

(f) The primary and secondary of a transformer are —— coupled.

(i) electrically

(ii) magnetically

(iii) electrically and magnetically

(iv) None of the above

(g) The approximate efficiency of a large transformer is

(i) 65%

(ii) 50%

(iii) 80%

(iv) 95%

(h) The stator of a 3-phase induction motor produces —— magnetic field.

(i) steady

(ii) rotating

(iii) alternating

(iv) None of the above

(i) When a 3-phase induction motor is at no-load, the slip is

(i) 1

(ii) 0·5

(iii) practically zero

(iv) 0·2

(j) For high efficiency of a 3-phase induction motor, the slip should be

(i) as small as possible

(ii) large

(iii) very large

(iv) 1

2. (a) What are the advantages and disadvantages of carbon brushes in a d.c. machine? 6

(b) A shunt generator delivers 195 A at a terminal p.d. of 250 V. The armature resistance and shunt field resistance are 0·02 Ω and 50 Ω respectively. The iron and friction losses equal 950 W. Find—

(i) e.m.f. generated;

(ii) Cu losses;

(iii) output of the prime mover;

(iv) mechanical, electrical and commercial efficiencies. 8

3. (a) Write down the names of losses which occur in a d.c. machine. 6

(b) A d.c. shunt machine when runs as a motor on no-load takes 440 W and runs at 1000 r.p.m. The field current and armature resistance are 1 A and 0·5 Ω respectively. Calculate the efficiency of the machine, when running *(i)* as a generator delivering 40 A at 220 V and *(ii)* as a motor taking 40 A from a 220-V supply. 8

4. (a) List few applications of transformers. 6

(b) The efficiency of a 400-kVA, single-phase transformer is 98·77% when delivering full-load at 0·8 p.f. lagging and 99·13% at half full-load at unity p.f. Calculate *(i)* iron loss and *(ii)* full-load copper loss. 8

5. (a) What are the advantages of back-to-back test in determining the efficiency of a transformer? 6

(b) What are the advantages and disadvantages of a 3-phase transformer over three single-phase bank of transformers? 8

6. (a) Why is transformer rating in kVA? 6

(b) A 100-kVA, 2200/440 V transformer has $R_1 = 0 \cdot 3\ \Omega$, $X_1 = 1 \cdot 1\ \Omega$, $R_2 = 0 \cdot 01\ \Omega$ and $X_2 = 0 \cdot 035\ \Omega$. Calculate *(i)* the equivalent impedance of the transformer referred to the primary and *(ii)* total copper losses. 8

7. (a) What is the importance of slip in a 3-phase induction motor? 6

(b) A 3-phase induction motor is wound for 4 poles and is supplied from 50 Hz system. Calculate *(i)* the synchronous speed, *(ii)* the speed of the motor when slip is 4% and *(iii)* the rotor current frequency when the motor runs at 600 r.p.m. 8

8. (a) What are the advantages of skewed slots in the rotor of a squirrel-cage motor? 7

(b) Why is maximum torque of a squirrel-cage induction motor called pull-out torque? 7

9. Write short notes on any *two* of the following : 7×2=14

(a) Advantage of d.c. series motor

(b) Autotransformer

(c) Synchronous speed of a 3-phase induction motor

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