

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 0.5Ω 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 $R_1 = 0.3 \Omega$, $X_1 = 1.1 \Omega$, $R_2 = 0.01 \Omega$ and $X_2 = 0.035 \Omega$. 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 : $7 \times 2 = 14$
- (a) Advantage of d.c. series motor
- (b) Autotransformer
- (c) Synchronous speed of a 3-phase induction motor
