MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : PC-EE 401/PC-EEE 401 Electric machine-I

UPID : 004420

Time Allotted : 3 Hours   *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :   [1 x 10 = 10]
   (I)   A transformer transforms which parameter of electricity?
   (II)   Scott-connections are used for the transformation of _____
   (III) Transformer cores are laminated in order to _____
   (IV)   In a 4-pole, 25 KW, 200V wave wound D.C. shunt generator the current in each parallel path will be _____
   (V)   The number of parallel paths for a simplex lap winding is equal to _____
   (VI)   D.C. generator works on the principle of Fleming's_____ hand rule.
   (VII) In a transformer, the leakage flux of each winding is proportional to the current in that winding because leakage paths do not saturate. State true or false.
   (VIII)   The essential condition for parallel operation of two 1-ϕ transformers is that they should have the same _____
   (IX)   The developed electromagnetic force and/or torque in electro-mechanical energy conversion system act in a direction tends to increase the stored energy at constant flux. Is it true or false?
   (X)   In a DC series motor torque is approximately proportional to _____
   (XI)   What conversion commutator does in dc machines?
   (XII) A delta-zigzag three-phase transformer can be designated as _____

Group-B (Short Answer Type Question)

Answer any three of the following :   [5 x 3 = 15]

2. Draw and explain the method of speed control of a DC motor by flux control method. Discuss the ranges of speed control by the flux control method.   [5]

3. What is commutation? Briefly explain the factors that enable sparkless commutation in a dc machine   [5]

4. Explain three point starter with neat diagram.   [5]

5. For any DC machine, prove that E =PΦZN/60A [all the parameters bear the usual meaning]   [5]

6. A 50 kVA, 1000/100 V single phase two-winding transformer is to be connected as an auto-transformer as shown. Find kVA rating of the auto-transformer.   [5]

Group-C (Long Answer Type Question)

Answer any three of the following :   [15 x 3 = 45]

7. a) Under what condition can a transformer have zero voltage regulation?   [15]
    b) In a given transformer, without changing its constructional features, how can you reduce its eddy current and hysteresis losses?
    c) A 10 kVA, 400/200 V single phase transformer with a percentage resistance of 3% and percentage reactance of 6% is supplying a current of 50 A to a resistive load. Find the value of the load voltage.

8. Write short notes in i) armature reaction (ii) back-emf iii) Commutation in DC machines   [15]

9. a) What do you mean by neutral shifting of a 3-phase transformer?   [15]
    b) Explain the use of tertiary winding in a star-star transformer.
    c) One of the windings of a 3phase transformer shall be delta connected. Explain why.

10. a) State the essential and desirable conditions to be fulfilled for successful parallel operation of transformers.   [15]
    b) A transformer is working under rated condition on a 200 V, 50 Hz supply. Find the percentage change in hysteresis and eddy current losses when the same transformer is operated on a 160 V, 40 Hz supply.
    c) The primary of a transformer is rated at 10A and 1000V.
    On open-circuit the readings are: V1=1000V, V2 =500V. I=0.42 A and Poc =100W.

On short circuit the readings are I1=10A, V1=126V and Psc=400W.

Draw the equivalent circuit for the transformer and determine the parameters.

11. a) Three single phase transformers are connected in delta. If one of the transformers is found faulty and removed, Derive the reduction in kVA supplied.   [15]

b) Two single-phase transformers A and B have the following parameters:

Transformer A: 5 kVA , 400V/200V, percentage resistance and percentage reactance 3% and 4% respectively.

Transformer B: 5 kVA, 400V/200V, percentage resistance and percentage reactance 4% and 3% respectively.

These two transformers are connected in parallel and they share a common load of 12 kW at a power factor of 0.8 lagging. Determine the (i) active power delivered by transformer A and (ii) reactive power delivered by transformer A.

<center>*** END OF PAPER ***</center>