ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009
ELECTRICAL MACHINES – I
SEMESTER – 4

Time : 3 Hours]   [Full Marks : 70

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :   10 x 1 = 10

   i) The number of parallel paths in a 8-pole D.C. machine, wave wound is

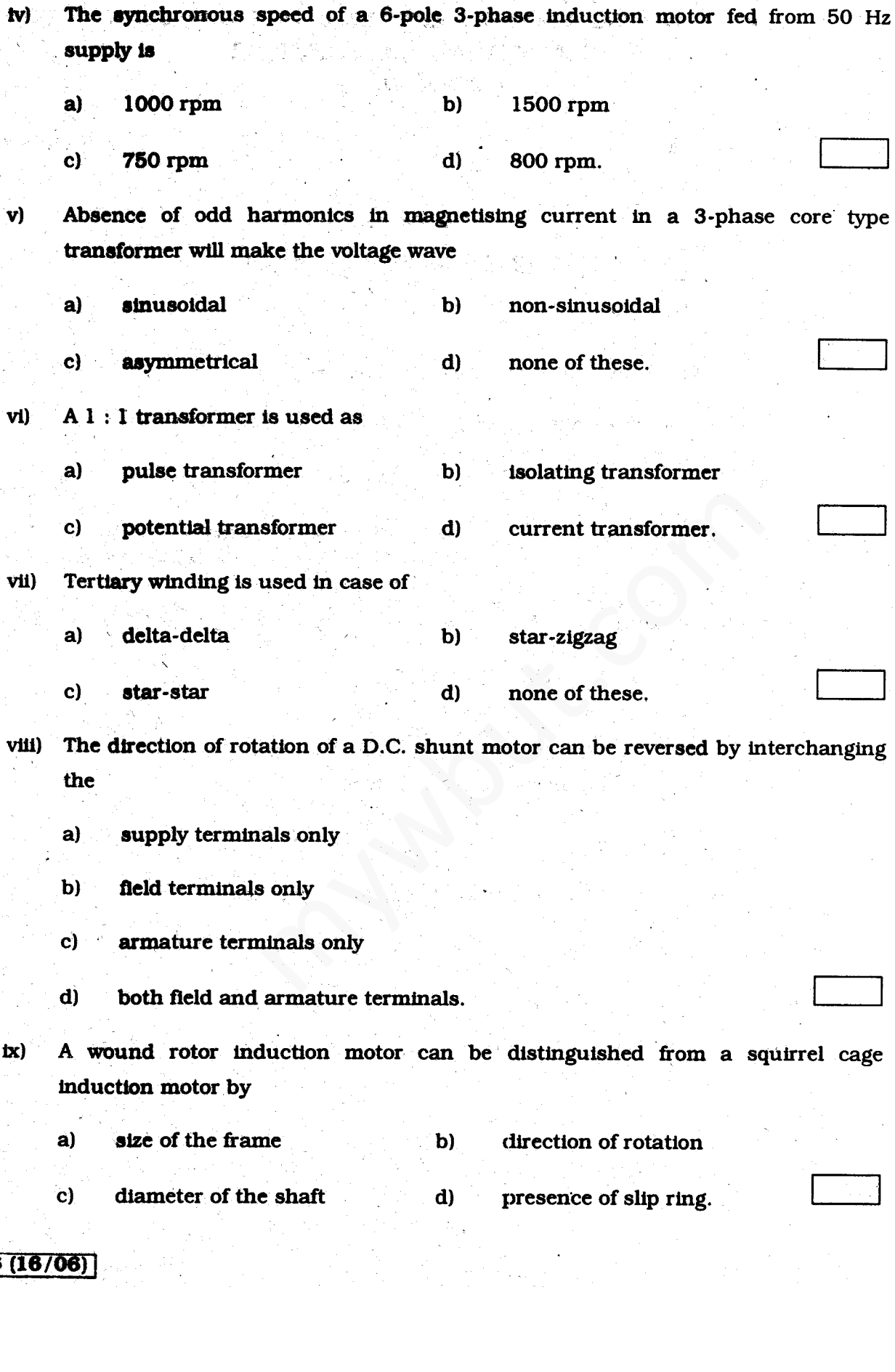   a)   8   b)   4

   c)   2   d)   none of these.

   ii) A D.C. series motor is never switched on without load connected at rated voltage source because

   a)   the field current initially zero

   b)   the motor does not accelerated

   c)   the speed becomes dangerously high

   d)   none of these.

   iii) Transformer core are made up of laminated sheet to reduce

   a)   hysteresis loss

   b)   eddy current loss

   c)   copper loss

   d)   none of these

   e)   all of these.

iv) The synchronous speed of a 6-pole 3-phase induction motor fed from 50 Hz supply is

    a)   1000 rpm   b)   1500 rpm

    c)   750 rpm   d)   800 rpm.

v) Absence of odd harmonics in magnetising current in a 3-phase core type transformer will make the voltage wave

    a)   sinusoidal   b)   non-sinusoidal

    c)   asymmetrical   d)   none of these.

vi) A 1 : 1 transformer is used as

    a)   pulse transformer   b)   isolating transformer

    c)   potential transformer   d)   current transformer.

vii) Tertiary winding is used in case of

    a)   delta-delta   b)   star-zigzag

    c)   star-star   d)   none of these.

viii) The direction of rotation of a D.C. shunt motor can be reversed by interchanging the

    a)   supply terminals only

    b)   field terminals only

    c)   armature terminals only

    d)   both field and armature terminals.

ix) A wound rotor induction motor can be distinguished from a squirrel cage induction motor by

    a)   size of the frame   b)   direction of rotation

    c)   diameter of the shaft   d)   presence of slip ring.

x) A D.C. shunt generator when driven without any excitation shows an open circuit voltage of 10 volts. When the field winding is excited, the voltage dropped to zero. The reason is

a) there is not residual magnetism

b) field resistance is greater than the critical resistance

c) field winding is wrongly connected

d) none of these.

xi) For a slip ring induction motor, if the rotor resistance is increased, then

a) starting torque and efficiency increases

b) starting torque and efficiency decreases

c) starting torque decreases but efficiency increases

d) starting torque increases but efficiency decreases.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following questions.   3 × 5 = 15

2. Show how there is saving in conductor material in an auto-transformer compared to a two winding transformer having same kVA rating.

3. Determine the steps of the resistance for a shunt motor starter using resistance control method.

4. Derive the expression for developed torque in a 3-phase induction motor and state the conditions for maximum torque.

5. What is armature reaction ? Describe the effects of armature reaction on the operation of a D.C. machine. How is the armature reaction minimised ?   1 + 2 + 2

6. Explain the tests to be conducted on three isolated secondary windings of a 3-phase transformer for connecting them

   i) in star

   ii) in delta.   3 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following questions.   3 × 15 = 45

7. a) What is the advantage of V-V connection of transformer ?

   b) Three single-phase transformers are connected in delta. If one of the transformers is found faulty and removed, what will be the reduction in kVA supplied ?

   c) Three single-phase transformers, connected in Δ/Δ supply a balanced 3-phase load of 1500 kW at 4400 V at 0·8 power factor lagging. The transformers are supplied from 3-phase mains at 11000 V. Find the current in the windings of each transformer. If one of the transformers is found faulty and is removed and the supply is maintained in V-V connection, determine the currents in the windings and the power supplied by each of the transformers. 2 + 5 + (2 + 2 + 4)

8. a) What are different phasor groups ? Why are phasor groups mentioned in the name plate of a transformer ?

   b) Draw the phasor and connection diagrams of transformers connected

      i) *Yd* 11

      ii) *Dz* 6

      iii) *Dy* 11

      iv) *Dd* 6.   (2 + 1) + 12

9. a) Describe the different types of excitation of D.C. machines. Explain the build up process of voltage of a D.C. shunt generator. Mention the different reasons of failure to building up process of D.C. shunt generator.

   b) A 10 kW, 250 V shunt generator having an armature resistance of 0·1 Ω and field resistance of 250 Ω delivers full load at rated speed of 800 rpm and at rated voltage of 250 volt. Machine now runs as motor while taking 10 kW at 250 volt. Find the speed of the machine as motor. Neglect brush contact drop.　　3 + 5 + 7

10. a) Bring out the difference between an autotransformer and induction regulator.

    b) Explain with circuit diagram the principle of operation of a single-phase induction regulator.

    c) Draw the circuit diagram of a 3-phase induction regulator and explain.

    d) Why is compensating winding necessary for single phase induction regulator but not necessary for 3-phase ?　　2 + 6 + 3 + 4

11. Write short notes on any *three* of the following :　　3 × 5

    a) On-load tap changer of a transformer

    b) Three-phase to two-phase conversion

    c) Cogging and Crawling in induction motors

    d) Determination of external characteristics of separately excited D.C. generator from its open circuit characteristics.

    e) Different methods of starting of induction motors.

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