Squirrel Cage Induction Motors

SECTION A

In the following statements one of the suggested answers is best. Place the identifying letter on your answer sheet.

1. The rotor current in a three phase induction motor is:-

   a) zero, since no supply is connected to the rotor circuit;

   b) supplied by the d.c. connected to the rotor terminals;

   c) supplied by the a.c. connected to the rotor terminals;

   d) induced by the stator field cutting the rotor conductors.

2. A three phase winding will produce an electromagnetic field which:-

   a) rotates at a constant speed;

   b) reverses direction each cycle;

   c) reverses direction each half cycle;

   d) is stationary and constant in strength.

3. Increasing the frequency of supply to a three phase stator winding will:-

   a) cause the magnetic field to rotate faster;

   b) cause the magnetic field to rotate slower;

   c) increase the strength of the magnetic field;

   d) increase the number of poles in the stator winding.

4. To reverse the direction of rotation of a rotating magnetic field you must:-

   a) reverse the connections to alternate pole windings;

   b) reverse the phase sequence of the supply;

   c) reverse the connections to the rotor winding;

   d) reverse the connections to all pole windings.

5. The rotor current in an induction motor is:-

   a) supplied from the separate rotor supply;

   b) induced by the rotating magnetic field;

   c) supplied from the stator supply terminals;

   d) always the same frequency as the stator supply.

6. The rotor speed of an induction motor is:-
   a) always slightly higher than the speed of the rotating magnetic field;
   b) always slightly lower than the speed of the rotating magnetic field;
   c) always the same as the speed of the rotating magnetic field;
   d) dependant only on the size of the load the motor is driving.

7. A six pole three phase motor on a 50 hertz supply will have a rated speed of about:-
   a) 2,800 r.p.m.;
   b) 1440 r.p.m.;
   c) 960 r.p.m.;
   d) 720 r.p.m.

8. The motor in question 7 will have a slip speed of:-
   a) 200 r.p.m.;
   b) 60 r.p.m.;
   c) 40 r.p.m.;
   a) 30 r.p.m.

9. When a three phase motor is running on no load and one supply conductor is open circuited:-
   a) the motor will stop and then start in the opposite direction;
   b) the motor will continue to run in the same direction;
   c) the motor will overload and burn out;
   d) the motor will stop due to loss of the RMF.

10. When a three phase motor is started with one supply conductor open circuited it will:-
   a) start and run normally;
   b) not start and may burn out;
   c) not start, but not burn out;
   d) start, but the direction of rotation will be random.

SECTION B

1. A six pole three phase induction motor is connected to a 60Hz supply and runs atfull load at 1050r.p.m. Determine:-

a) the synchronous speed of the motor; (1 200 r.p.m.)

b) the slip speed of the motor. (150 r.p.m.)

SECTION D

1. The rotor and stator windings of a slip ring induction motor must have the same:-
   a) number of phases;
   b) number of poles;
   c) number of poles and phases;
   d) connection method (star or delta).
2. The rotor windings of a slip ring induction motor are connected to an external:-
   a) source of a.c. supply;
   b) source of d.c. supply;
   c) variable resistance;
   d) star delta starter.
3. The rotor and stator windings of a slip ring induction motor are normally connected:-
   a) rotor in star and stator in delta;
   b) rotor in delta and stator in delta;
   c) rotor in star and stator in star;
   d) rotor in delta and stator in star.

4. In a squirrel cage induction motor with dual cage rotor:-
   a) the inner cage has the higher resistance and carries the greater current at starting;
   b) the outer cage has the higher resistance and carries the greater current at starting;
   c) the inner cage has the higher resistance and carries the least current at starting;
   d) the outer cage has the higher resistance and carries the least current at starting.

1. The mechanical losses on no load in an induction motor include:-
   a) hysteresis in the stator and rotor cores;
   b) eddy currents in the stator and rotor core;
   c) resistance of the stator and rotor windings;
   d) friction and windage loss in the motor.

2. Most induction motors are designed to have maximum efficiency:-
   a) when rotor resistance equals rotor inductive reactance;
   b) close to full load as most motors run at this load;
   c) at starting to give increased starting torque;
   d) at about half of full load as a compromise.

1. A 415V squirrel cage induction motor delivers 116 Nm of torque when started on full voltage. The voltage to the motor must be reduced to 320 volts to limit starting current in line with supply authority requirements. Determine the starting torque at the reduced voltage. (69Nm.)

1. The problem with starting squirrel cage motors with any of the voltage reduction starters is:-
   a) the motor must have all six winding ends brought out to the terminal block;
   b) six wires must be run between the switchboard and the starter;
   c) reducing the voltage causes an even greater reduction in starting torque;
   d) the increased starting torque may damage the load or couplings.

2. The thermal overload used on motor protection:-
   a) interrupts all overloads very quickly;
   b) only isolates short circuits instantly;
   c) allows slight overloads for longer periods;
   d) takes several minutes to isolate any overload.

3. A motor started with a star-delta starter with overloads fitted between the motor and starter would:-
   a) require a thermal overload with six bimetallic elements;
   b) require an overload current rating equal to rated current times $\frac{1}{\sqrt{3}}$
   c) require an overload current rating equal to rated motor current;
   d) require an overload current rating equal to rated current times $\sqrt{3}$

4. An advantage of differential thermal overloads over normal overloads is:-
   a) they can detect the difference between a short circuit and overload fault;
   b) they will protect the motor from loss of one phase of the supply;
   c) they can be used on single, two or three phase motors;
   d) they can also protect against loss of load (ie underload);.

5. Stop buttons and thermal overloads use normally closed contacts because:-
   a) if they get dirty and will not close the machine will not start (fail safe);
   b) normally closed contacts operate quicker than normally open contacts;
   c) normally open contacts would need to be connected in parallel;
   d) normally closed contacts stay cleaner as the dirt cannot get in.

6. AS/NZS 3000 Clause 4.2.1.2 would be satisfied if:-
   a) an automatic reclosing overload device protects the motor under all conditions;
   b) the isolating switch can be locked in the off position if not located next to the motor;
   c) the motor on a saw bench was controlled by a DOL starter operated by pushbuttons;
   d) copper losses vary as the square of the load while other losses are almost constant.

SECTION B