SINGLE PHASE SPLIT PHASE MOTOR

SECTION A

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

1. A single phase winding produces:-
   a) a stationary magnetic field;
   b) a rotating magnetic field;
   c) a steady magnetic field;
   d) an alternating magnetic field.

2. To develop a rotating magnetic field a split phase induction motor simulates a:-
   a) two phase motor;
   b) three phase motor;
   c) series universal motor;
   d) shaded pole motor.

3. If motor load is reduced from full load to three quarters of full load you wouldexpect that:-
   a) speed would increase and current would increase;
   b) speed would decrease and current would decrease;
   c) speed would increase and current would decrease;
   d) speed would decrease and current would increase;

4. The angle of phase displacement between the start and run winding currents of asplit phase induction motor is approximately:-
   a) 10 degrees;
   b) 30 degrees;
   c) 90 degrees;
   d) 120 degrees.

5. The single phase split phase motor is reversed by:-
   a) reversing the supply connections;
   b) reversing the auxiliary winding connection;
   c) reversing the armature connection;
   d) reversing both the auxiliary winding and armature connections.

6. If the centrifugal switch on a split phase motor goes permanently open circuit:-
   a) the motor will not start;
   b) the start winding will burn out;
   c) the start capacitor will burn out;
   d) starting torque will drop to about half of normal value.

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7. The auxiliary winding switch should open when:-

a) rotor speed is about 25 percent of rated speed;
b) rated speed is about 25 percent of synchronous speed;
c) rotor speed is about 75 percent of synchronous speed;
d) slip speed is about 75 percent of synchronous speed.

8. The run winding in a split phase induction motor is placed in:-

a) the top of the slot to increase inductance;
b) the top of the slot to decrease inductance;
c) the bottom of the slot to decrease inductance;
d) the bottom of the slot to increase inductance.

9. Variable frequency speed control of split phase motors is not generally usedbecause:-

a) the capacitor start motor has higher torque;
b) the starting switch might not operate;
c) voltage speed control in more efficient;
d) pole changing gives smoother speed changes.

10. The auxiliary winding of a split phase motor always has:-

a) a lower power factor than the main winding;
b) a higher resistance than the main winding;
c) a lower resistance than the main winding;
d) a higher power factor than the main winding.

1. A single phase 240 volt 50 hertz 4 pole split phase motor runs at rated speed of1425 r.p.m. For full load determine:-

a) the synchronous speed of the motor; (1 500 r.p.m.)
b) the slip speed; (75 r.p.m..)
c) the slip percent; (5%.)
d) the rotor frequency. (2.5Hz)

1. The single phase induction motor that is commonly used to drive cooling fans insmall appliances is the:-

a) permanently split capacitor motor;
b) shaded pole motor;
c) series universal motor;
d) split phase induction motor.

2. A capacitor start induction motor has an open circuited capacitor. The motor will:-

a) start with reduced torque;
b) fail to start;
c) start normally but stop when the centrifugal switch operates;
d) start in the reverse direction.

3. Impedance protection of shaded pole motors:-
    a) reduces overheating when stalled;
    b) reduces the starting current;
    c) reduces unwanted tripping of overload devices;
    d) limits motor current on no load.
4. Electrolytic capacitors are used in starting circuits:-
    a) because of their low leakage current;
    b) because of their small size;
    c) because they are continuously rated;
    d) because of their high dielectric strength.

5. On a capacitor start, capacitor run induction motor the start capacitor may beidentified as having:-
    a) the lower capacitance and a continuous rating;
    b) the higher capacitance and a continuous rating;
    c) the lower capacitance and a short term rating;
    d) the higher capacitance and a short term rating.

1. A single phase 240 volt 50 hertz capacitor start induction motor has a run windingwhich takes 4 amperes at 0.6 lag power factor at start while the start winding/capacitor takes 3 amperes at 0.8 lead power factor. Determine:-
    a) the phase angle of each current and the angle between them; (53.1^{O}lag,36.9^{O}lead, 90^{O})
    b) the total current taken by the motor at starting. (5A.)
    c) the voltage across the 35uF capacitor. (273V.)

1. The series universal motor is reversed by:-
    a) reversing the supply connections;
    b) reversing the armature and field connections;
    c) physically reversing the rotor in the field;
    d) reversing the armature connections.
2. A series universal motor driving a constant torque load has its armature voltagereduced from 200 volts to 100 volts using a series resistor. The result will be:-
    a) motor speed will remain unchanged;
    b) motor speed will double;
    c) motor speed will drop to half rated speed;
    d) motor current will decrease to half rated current.

3. For a given load the constant speed of a motor occurs when:-

a) the input power is equal to the output power;
b) the efficiency of the motor is at a maximum;
c) the motor output torque equals the load input torque;
d) the motor slip is at a maximum.

NOTE

1. A 240 volt series universal motor drives a constant torque load at rated load and rated current of 7 amperes at 4 000 r.p.m. If speed is to be reduced to 2 500 r.p.m.determine:-
   a) the voltage required (hint: at constant torque, speed is proportional tovoltage);(150V)
   b) the value of series resistance required to drop motor voltage to thisvalue.(12.86Ω)

1. Alternators are generally run at a constant speed to maintain:-
   a) a constant output voltage;
   b) a constant load current;
   c) maximum efficiency;
   d) a constant output frequency.

2. Low speed rotating field alternators use:-
   a) salient pole rotors with many poles;
   b) cylindrical rotors with many poles
   c) salient poles rotors with two poles
   d) cylindrical rotors with two poles

3. The armature winding in a rotating field alternator is placed:-
   a) in slots in the laminated stator core;
   b) in slots in the solid stator core;
   c) in slots in the laminated rotor core;
   d) around the poles on the solid rotor core.

4. Most three phase alternators have their armature windings:-
   a) connected to a d.c. supply for excitation;
   b) connected to an a.c. supply for excitation.
   c) connected in star to allow earthing of the star point;
   d) connected in delta to increase the generated output voltage.

5. Cylindrical rotors are used in 50 Hz alternators with:-
   a) many poles driven at high speed;
   b) few poles driven at high speed;
   c) many poles driven at low speed;
   d) few poles driven at low speed.

SECTION C

1. At what speed must a 24 pole 50Hz alternator in a Hydro-electric power station bedriven? (250 r.p.m.)
2. How many poles would be required on a 25Hz alternator running at 375r.p.m.?
   (8poles)

1. The efficiency of an alternator is the ratio of:-
   a) kVA output to kVA input;
   b) kW output to kW input;
   c) kVA output to kW input;
   d) kW output to kVA input;

2. The terminal potential difference of a three phase 50 hertz alternator is adjusted tothe required value by means of:-
   a) altering the field excitation;
   b) changing the speed

c) using a tapped winding;
d) adjusting the number of poles.

3. Modern large alternators use hydrogen cooling. This is done to:-

e) prevent the windings from oxidising;
f) reduce the rotational losses in the machine;
g) reduce the load on the alternator bearings;
h) reduce air pollution caused by arcing.

4. Alternators are connected in parallel to:-

a) increase the output voltage supplied to the load;
b) increase the output current supplied to the load;
c) allow two alternators to be driven by one prime mover;
d) because two small alternators are more efficient than one large one.

5. As the power factor of a constant current load with a lagging power factor isimproved towards unity power factor the t.p.d. of the alternator will:-

a) increase;
b) decrease;
c) remain unchanged;
d) depend on load frequency.

6. Alternators are rated in terms of:-

a) speed and voltage;
b) current and voltage;
c) voltage and kVA;
d) voltage and kW.

1. An alternator with a full load t.p.d. of 415 volts has the terminal voltage increase to 499 volts on no load. Determine the percentage voltage regulation for the alternator.(20.24%)
2. The terminal voltage of a 70MVA, three phase, 50 hertz, star connected alternator is11.7kV. If the armature winding has a breadth factor (k) of 0.956 and the armature winding has 16 turns per phase determine:-
   a) the maximum flux per pole; (1.98Wb)
   b) the full load current rating of the alternator. (3 454A.)
3. The 70MVA alternator in the previous question has an efficiency of 92 percent when operating at full load and 0.8 power factor. Determine the power output of theprime mover at this load. (60.87MW)

1. "Normal excitation" of a synchronous motor at full load:-
   a) is the rated field current on the nameplate;
   b) gives minimum power factor and maximum current;
   c) gives minimum power factor and minimum current;
   d) gives unity power factor and minimum current.

2. Synchronous motors develop a torque by:-
   a) electromagnetic induction between stator and rotor;
   b) mutual induction between stator and rotor;
   c) attraction between stator and rotor fields;
   d) stator field hunting the rotor field.

3. An "under excited" synchronous motor would operate with:-
   a) a leading power factor at more than synchronous speed;
   b) a leading power factor at synchronous speed;
   c) a lagging power factor at synchronous speed;
   d) a lagging power factor at less than synchronous speed.

4. Synchronous motors are:-
   a) all self starting and produce high starting torque;
   b) started as induction motors or with a pony motor;
   c) started as a d.c. motor by connecting d.c. to the stator;
   d) started as a slip ring motor by connecting a.c. to the rotor.

1. A three phase four pole 415 volt synchronous motor takes a current of 75 amperes atfull load with normal excitation while driving a 50kW load. Determine:-
   a) the input power to the motor; (53.91kW)
   b) the efficiency of the motor under these conditions; (92.75%)
   c) the speed of the motor; (1 500r.p.m.)
   d) the torque delivered to the load at normal excitation; (318.3Nm)
   e) the current taken if excitation is reduced until power factor is 0.8 lagging.(93.75A)

SECTION D