[5869]-237

S.E. (Electrical Engineering)

Electrical Machines - I

(Semester - IV) (2019 Pattern)

Time : 2 ½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Assume suitable data, if necessary.*
5) *Use of non-programmable calculator is allowed.*

Q1) a) State two features each of LAP winding and WAVE winding for DC machine. **[4]**

b) Draw the diagram showing constructional details of a DC machine, clearly mark all parts, State the details of any two parts (name of part, material used for it ,its function) **[6]**

c) With suitable diagrams explain armature reaction in DC machine. Clearly elaborate the demagnetising and cross magnetising effect with suitable diagrams. **[8]**

OR

Q2) a) Derive the torque equation of DC motor with usual notations. **[4]**

b) A 6pole DC motor with wave connected armature has 87 slots with 6 conductors per slot.The flux per pole is 20 milliweber and armature resistance is 0.13 Ohm. Calculate the speed when motor runs on 240 volt supply taking armature current of 80 Ampere. Also find the torque developed by motor in Newton meter. **[6]**

c) Draw the connection diagram of shunt, series DC motors. State their current & voltage distribution equations. **[8]**

P.T.O.

Q3) a) State any one application of- (i) DC shunt (ii) Series & (iii) Cumulative compound motor. **[3]**

b) Sketch & explain the Torque- Armature current characteristics of (i) DC shunt motor & (ii) Series motor. **[6]**

c) A 250 V DC Shunt motor takes a current of 6 Ampere and runs at 1200 rpm. The armature resistance is 0.05 Ohm and shunt filed resistance is 250 Ohm. Determine the speed of motor when it is loaded and taking a current of 31 Ampere. **[8]**

OR

Q4) a) What is meant by reactance voltage in case of commutation in DC machine? **[3]**

b) Draw the circuit diagram & explain the speed control of DC shunt motor by flux control also draw the nature of graph (Field current Vs. Speed). **[6]**

c) Draw the connection diagram of 4 point starter used for DC shunt motor & explain the function of (i) Hold on coil & (ii) Over load coil. **[8]**

Q5) a) Draw the power flow diagram of 3-ph Induction motor. **[4]**

b) A 6 pole, 3 phase induction motor is connected to 400 volt, 50 Hz ac supply. **[6]**

Calculate :

i) the speed of rotating magnetic field of the motor

ii) speed of motor at 3% slip

iii) the rotor emf frequency at 3% slip

c) A 12 pole, 3phase, 50 Hz slip ring induction motor has rotor resistance of 1 Ohm per phase and stand still reactance of 3 Ohm per phase. At stand still condition, the rotor induced emf is 100 volt across the slip-rings.

Calculate the rotor current per phase and rotor power factor when -

i) slip-rings are short circuited

ii) when external resistance of 3 Ohm/phase is added in the rotor circuit **[8]**

OR

Q6) a) Derive the condition for maximum torque under running of 3 phase induction motors with usual notations. **[4]**

b) With suitable diagram explain constructional details of 3 phase squirrel cage induction motor. **[6]**

c) The input to 3 phase, 6 pole, 50 Hz, induction motor is 47 kWatt at certain load. The stator losses are 1.5 kWatt and mechanical losses are 1kWatt. Determine the HP output power of motor when it runs at 970 rpm. (Take 1HP = 746 watt) **[8]**

Q7) a) State the necessity of starter for 3 phase induction motor. **[3]**

b) Why 3 phase induction is also called as generalised transformer? State clearly the similarities between the two. **[6]**

c) With suitable circuit diagram explain no load and blocked rotor test on 3 phase induction motor. Also write respective formulae involved in calculation part for determining the respective parameters. **[8]**

OR

Q8) a) Obtain the approximate equivalent circuit diagrams of 3-ph induction motor step by step. Also draw the phasor diagram of 3 phase induction motor. **[7]**

b) Using data from No load & Blocked rotor test on 3-ph induction motor; Draw the circle diagram & write the procedure to find full load slip, locate the points for slip = 0, 1 **[10]**

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[5925]-231
S.E. (Electrical Engineering)
ELECTRICAL MACHINES-I
(2019 Pattern) (Semester-IV) (203146)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*
5) *Use of non-programmable calculator is allowed.*

Q1) a) Give any two points of comparison between LAP winding and WAVE winding for DC machine. **[4]**

b) Draw the power stage diagram of DC motor. Clearly indicate various losses along with respective formulae for the losses. **[6]**

c) A DC Shunt motor develops output power of 7355 watt and runs at 700 rpm. It is connected across 400 volt DC supply and draws a current of 23 Ampere. The mechanical and iron losses are 735.5 Watt. **[8]**

Determine-

i) Efficiency of Motor

ii) Armature resistance of motor

OR

Q2) a) The armature of 4 pole DC shunt motor has LAP winding which is accommodated in 60 slots, each slot carries 20 conductors. **[4]**

If the useful flux per pole is 23 milli Weber, determine the total torque developed by motor in Newton meter. The armature current is 50 Ampere. **[6]**

b) What is meant by back emf in DC motor? State the equation of back emf. Also explain how back emf acts as a regulating mechanism when load on DC motor changes. **[8]**

c) Draw the connection diagram of shunt, series DC motors. State their current & voltage distrubution equations.

P.T.O.

Q3) a) State any one application of- **[3]**
  i) DC shunt
  ii) Series &
  iii) Cumulative compound motor

  b) Sketch & explain the Torque- Armature current characteristics of **[6]**
  i) DC shunt motor
  ii) Series motor.

  c) A 250 V DC Shunt motor takes a current of 6 Ampere and runs at 1200 rpm. The armature resistance is 0.05 Ohm and shunt filed resistance is 250 Ohm. Determine the speed of motor when it is loaded and taking a current of 31 Ampere. **[8]**

OR

Q4) a) What is meant by reactance voltage in case of commutation in DC machine? **[3]**

  b) Draw the circuit diagram & explain the speed control of DC shunt motor by armature voltage control also draw the nature of graph (Armature voltage Vs. speed). **[6]**

  c) Draw the connection diagram of 3 point starter used for DC shunt motor & explain the function of **[8]**
  i) Hold on coil &
  ii) Over load coil

Q5) a) Draw the power flow diagram of 3-ph Induction motor. **[4]**

  b) A 6 pole, 3 phase induction motor is connected to 400 volt, 50 Hz ac supply. Calculate-
  i) the speed of rotating magnetic field of the motor
  ii) Speed of motor at 3% slip
  iii) the rotor emf frequency at 3% slip **[6]**

  c) Draw and explain torque-Slip characteristics of 3 phase induction motor with respective mathematical expressions. Clearly mark the two regions and point of maximum torque and starting torque **[8]**

OR

Q6) a) Derive the condition for maximum starting torque of 3 phase induction motors with usual notations. **[4]**

b) With suitable diagram explain constructional details of 3 phase slipring induction motor **[6]**

c) The input to 3 phase, 6 pole, 50 Hz, induction motor is 47 kWatt at certain load. The stator losses are 1.5 kWatt and mechanical losses are 1k Watt. Determine the HPoutput power of motor when it runs at 970 rpm. (Take 1 HP = 746 watt) **[8]**

Q7) a) State the types of starters used for induction motors. **[3]**

b) With suitable circuit diagram explain no load and blocked rotor test on 3 phase induction motor. Also write respective formulae involved in calculation part for determining the respective parameters **[6]**

c) Draw the connection diagram of star-delta starter used for 3-ph induction motor & explain its working **[8]**

OR

Q8) a) Obtain the approximate equivalent circuit diagrams fo 3-ph induction motor step by step. Label it & state the meaning of each nomenclature used. **[7]**

b) Using data from No load & Blocked rotor test on 3-ph induction motor; Draw the circle diagram & write the procedure to find full load slip, locate the points for slip = 0, 1 **[10]**

[5925]-231   3

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[6179]-212
S.E. (Electrical Engineering)
ELECTRICAL MACHINES - I
(2019 Pattern) (Semester - IV) (203146)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagram must be drawn wherever necessary.*
4) *Assume suitable data, if necessary.*
5) *Use of Non-Programmable calculator is allowed.*

Q1) a) Related to DC machine winding define the following terms. **[4]**
     i) Pole Pitch
     ii) Coil Pitch
     iii) Conductor
     iv) Back Pitch

   b) An 8-pole armature has 96 slots with 8 conductors per slot. It is driven at 600 rpm. **[6]**
     The useful flux per pole is 10mWb. Calculate the induced e.m.f. in the armature winding when
     i) Lap connected and
     ii) Wave connected.

   c) Draw and explain the connection diagram of DC shunt, and DC series motors. Write their current and voltage equations. **[8]**

OR

Q2) a) State the significance of back emf. Write down its equation. **[4]**

   b) Derive the EMF equation of the DC generator by usual notations. State clearly the meaning of each term used in derivation. Write the EMF equation for LAP winding and WAVE winding. **[6]**

   c) A 200V, 4 pole, lap wound, DC shunt motor has 800 conductors of armature winding. Armature and field winding resistances are 0.5ohm and 200ohm respectively. The motors take 21Amp & flux per pole is 30mWb. Find the speed and torque developed. **[8]**

Q3) a) Draw the following characteristics of a series motor- **[3]**
- i) Torque Vs. armature current
- ii) Speed Vs armature current
- iii) Speed Vs Torque

b) A 500V, 6 pole, DC shunt motor has armature and field winding resistance of 0.5ohm and 250ohm respectively. It draws a full load current 20 A from the supply. If rotational losses are 900W calculate the efficiency motor. **[6]**

c) Draw and explain the three-point starter used for the DC motor. Write the function of the HOLD ON coil and OVERLOAD coil. **[8]**

OR

Q4) a) Write a short note on the functions of interpoles in DC machines. **[3]**

b) List the various speed control methods of the DC shunt motor. Explain any one with a suitable diagram. **[6]**

c) A 250V DC shunt motor has an armature resistance of 0.5ohm and field resistance of l25ohm. It drives a load at 1000 rpm and draws a current of 25Amp. Calculate the armature current drawn and speed of the motor if field resistance is increased up to 150ohms and load is kept constant. **[8]**

Q5) a) Draw the power flow diagram of the 3-ph Induction motor. **[4]**

b) Compare squirrel cage induction motor with slip ring induction motor (6 points). **[6]**

c) Derive Torque equation of 3 3-phase induction motor by usual notations. Also find. Full load torque, Starting torque, and Condition for maximum torque. **[8]**

OR

Q6) a) With a suitable diagram explain the constructional details of the 3-phase slip ring induction motor. **[4]**

b) Draw and explain the torque slip characteristics of the 3-phase induction motor. Mark the starting torque, pull-out torque, maximum torque, and full load torque in the same. **[6]**

c) A 3-phase induction motor having 6 pole star connected stator winding runs on 240V, 50Hz supply. The rotor resistance and standstill reactance are 0.12 ohms and 0.85 ohms per phase. The ratio of the stator to rotor turns is 1:8. Full load slip is 4%.Calculate the developed torque at full load, maximum torque, and speed at maximum torque. **[8]**

Q7) a) Draw the phasor diagram of a 3-phase induction motor. **[3]**

b) State the types of starters used for induction motors. Explain the rotor resistance starter with a suitable diagram. **[6]**

c) What data is required to plot the circle diagram of the 3-phase induction motor? Plot the circle diagram of the 3-phase induction motor and indicate the following quantities in it. **[8]**

    i) No Load Current,

    ii) No load Power Factor angle,

    iii) Constant loss,

    iv) Stator copper loss,

    v) Rotor copper Loss,

    vi) Torque line,

    vii) Output line,

    viii) Full load current

OR

Q8) a) Name the various tests carried out on 3-phase induction motors as per IS 325 and IS 4029. **[3]**

b) Compare a three-phase induction motor with a three-phase transformer. **[6]**

c) With a suitable circuit diagram explain the No load and Blocked rotor test carried out on a 3-phase induction motor. What information is obtained from these tests? **[8]**

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[6002]-131

S.E. (Electrical Engineering)
ELECTRICAL MACHINES - I
(2019 Pattern) (Semester - IV) (203146)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagram must be drawn wherever necessary.*
4) *Assume suitable data, if necessary.*
5) *Use of non-programmable calculator is allowed.*

Q1) a)   State four features of LAP winding of DC machine.   **[4]**

b)   Draw the diagram showing constructional details of a DC motor, clearly mark all parts. State the details of any two parts (name of part. material used for it. its function.   **[6]**

c)   Draw and explain power stage diagram (power flow diagram) of DC motor.   **[8]**

OR

Q2) a)   State any four applications of DC Series motor.   **[4]**

b)   State the significance of back emf in dc motor.   **[6]**

c)   Draw the connection diagram of shunt. series DC motors. Write their current & voltage distribution equations.   **[8]**

Q3) a)   Explain in detail what precaution is necessary to be taken while operating DC Series motor.   **[3]**

b)   Sketch & explain the Torque-Armattire current characteristics of DC shunt motor.   **[6]**

P.T.O.

c) A 250 V d.c. shunt motor has an armature circuit resistance of 0.5 Ohm and a field circuit resistance of 125 Ohm. It drives a load at 1000 r.p.m. and takes 25 A. The field circuit resistance is then slowly increased to 150 Ohm If the load torque remains constant, calculate the new speed and armature current. **[8]**

OR

Q4) a) What is meant by reactance voltage in ease of commutation in DC machine? **[3]**

b) Draw the circuit diagram & explain the speed control of DC shunt motor by flux control also draw the nature of graph (Field current Vs. Speed). **[6]**

c) Draw the connection diagram of 3 point starter used for DC shunt motor & explain the function of (i) Hold on coil & (ii) Over load coil. **[8]**

Q5) a) Draw the power flow diagram of 3-ph Induction motor. **[4]**

b) A 6 pole, 3 phase induction motor is connected to 400 volt, 50 Hz ac supply. Calculate- **[6]**

   i) the speed of rotating magnetic field of the motor

   ii) speed of motor at 2% slip

   iii) the rotor emf frequency at 2% slip

c) Compare 3 phase slip-ring induction motor with Squirrel cage induction motor (Minimum 4 points of comparison expected) **[8]**

OR

Q6) a) Derive the condition for maximum torque under running of 3 phase induction motors with usual notations. **[4]**

b) With suitable diagram explain constructional details of 3pahse slipring induction motor. **[6]**

c) Explain concept of rotating magnetic field in ease of 3 phase induction motor.

Draw respective phasor diagrams and write respective equations **[8]**

[6002]-131

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Q7) a) With a suitable diagram explain rotor resistance starter for three-phase induction motor. **[7]**

b) With suitable circuit diagram explain no load and blocked rotor test on 3 phase induction motor. Also write respective formulate involved in calculation part for determining he respective parameters. **[10]**

OR

Q8) a) Obtain the approximate equivalent circuit diagrams of 3-ph induction motor step by step. Also draw the phasor diagram of 3 phase induction motor.**[7]**

b) Using data from No load & Blocked rotor test on 3-ph induction motor, write down the calculations and draw circle diagram Indicate different losses and point of maximum torque in the circle diagram. **[10]**

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PB-3607

[6261]-12
S.E.(Electrical Engineering)
ELECTRICAL MACHINES - I
(2019 Pattern) (Semester - IV) (203146)

Time : 2½ Hours] *[Max. Marks : 70*
Instructions to the candidates:

1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Use of non-programmable calculator is allowed.*
5) *Assume suitable additional data if necessary.*

Q1) a) State features of wave winding. **[4]**

b) Derive the torque equation of DC motor by usual notations. **[6]**

c) A 6 pole, Lap wound DC shunt motor takes armature current of 110 Ampere at 480 volt. It has armature resistance of 1 Ohm and total 864 armature conductors.The flux per pole is 0.05 Weber. Calculate- **[8]**

    i) Mechanical power developed in armature

    ii) Gross torque

    iii) Speed of the motor

OR

Q2) a) Sate the material used and function of following parts of a DC machine- **[4]**

    i) Armature core

    ii) Brushes

b) Draw the power flow diagram of DC motor. Write respective expressions of power and power loss for respective blocks. **[6]**

c) What is armature reaction in DC Machines? Explain the effects of armature reaction with suitable diagrams. Suggest the remedial measure on it. **[8]**

P.T.O

Q3) a) Explain why DC Series motor should not be started on - No load condition? **[3]**

b) Sketch & explain the Torque - Armature current characteristics of DC shunt motor. **[6]**

c) Draw the connection diagram of 4 point starter used for DC shunt motor & explain the function of **[8]**

   i) Hold on coil &

   ii) Over load coil.

<div align="center">OR</div>

Q4) a) What is meant by reactance voltage in case of commutation in DC machines? **[3]**

b) Draw the connection diagram & explain the speed control of DC shunt motor by flux control method. **[6]**

c) A DC series motor is running at 350 rpm at 220V, taking a current of 25Amp. The motor armature plus field resistance is 1 Ohm. Calculate -
[8]

   i) the resistance to be added in series to reduce the speed to 250 rpm at constant torque.

   ii) The power wasted in the resistor.

Q5) a) A 4-pole, 3phase induction motor connected to 50 HZ supply. If the machine runs at 3% slip at full-load, determine **[4]**

   i) Rotor speed

   ii) Frequency of rotor currents

   iii) Frequency of rotor currents at stand still

   iv) Speed of rotating magnetic field

b) Obtain the torque equation of induction motor under running condition & there of derive the condition of maximum torque under running condition **[6]**

c) Draw torque-slip characteristics of 3-ph induction motor & explain **[8]**

   i) Stable and unstable operating region

   ii) maximum torque

   iii) torque ,when slip is one.

<div align="center">OR</div>

Q6) a) Draw a neat sketch of squirrel cage induction motor, label all the parts and explain its constructional details. **[4]**

b) With suitable phasor diagrams elaborate the concept of rotating magnetic field in case of 3 phase induction motor **[6]**

c) A 4 - pole, 50 Hz, 3 - phase induction motor gives output power of 14710 Watt. It has friction and windage losses of 2% of the output. The full - load slip is 3%. Calculate the **[8]**

    i) Rotor cu. loss and

    ii) Rotor input

Q7) a) Draw equivalent circuit of 3 Phase induction motor ,name all parameters involved in it. **[3]**

b) With the help of circuit diagram explain procedure to conduct - No load test and blocked rotor test on 3 phase squirrel cage induction motor.**[6]**

c) Draw the connection diagram of star-delta starter & explain the starting and running operation of 3-ph induction motor. **[8]**

OR

Q8) a) Compare star-delta starter and Rotor Resistance starter on any 4 poins. **[8]**

b) Draw the circle diagram & write the procedure to find full load current, p.f, full load slip, locate the points for slip = 0 and slip = 1. Assume rotor Cu loss = stator Cu loss. **[9]**

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