P615

[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]**

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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