

Total No. of Questions : 8]

SEAT No. :

PD-4058

[Total No. of Pages : 3

[6402]-17

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8,
- 2) Neat diagrams must be drawn whenever 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) Compare simple Lap & wave winding. [4]
- b) Draw the power flow diagram of DC motor. [6]
- c) A 4P, 250 V wave connect DC shunt motor gives 11.190 kW when running at 1000 rpm & drawing armature & field current 50 A & 1 A respectively. It has 540 arm conductors & $R_a = 0.12 \Omega$. Assume voltage drop 1 V / brush calculate [8]
- i) Total torque
 - ii) Useful torque
 - iii) Rotational losses &
 - iv) Efficiency

OR

- Q2)** a) State the parts of Stator & Rotor of DC machine. [4]
- b) Derive the equation for : [6]
- i) Armature torque &
 - ii) Shaft torque of DC motor
- c) Draw the connection diagram of shunt , series & separately excited DC motors. State their current & back emf equations. [8]

P.T.O.

- Q3) a)** State any two applications 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 220 V DC series motor takes 40 A when running at 700 rpm. Calculate the speed which motor will run & current taken from the supply if the field is shunted by resistance equal to field resistance & torque is increased by 50 %. Take $R_a = 0.12 \Omega$ & $R_{se} = 0.1 \Omega$. Assume unsaturated magnetic field. [8]

OR

- Q4) a)** State the possible ways to reverse the direction of rotation of DC shunt motor. [3]
- b)** Sketch the circuit diagram & explain the methods of speed control of DC series motor by flux control. [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)** Prove that; rotor Cu loss = slip x rotor input. [6]
- c)** A 30 kW, 4P, 50 Hz, 3-ph Induction motor has stator losses equal to rotor losses & rotational losses of 1.5 % of output power. Full load slip is 4 %. [8]

Calculate;

- i) Rotor Cu loss
- ii) Rotor input power
- iii) Efficiency

OR

- Q6)** a) Calculate the slip & frequency of rotor current of a 3-ph, 50 Hz induction motor when running at 720 rpm. [4]
- b) Obtain the torque equation of induction motor under running condition & there of derive the condition of maximum torque. [6]
- c) Sketch the family of torque-slip characteristics of 3-ph induction motor & explain [8]
- i) operating region
 - ii) maximum torque &
 - iii) when slip is one
- Q7)** a) State the types of starters used for induction motors. [3]
- b) Demonstrate the IS Std 325 for testing of 3-ph 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) Obtain the approximate equivalent circuit diagrams of 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 current, pf, full load slip, rotor Cu loss, stator Cu loss, locate the points for slip = 0, 1 & infinity. [10]
