

Total No. of Questions : 8]

SEAT No. :

P-7563

[Total No. of Pages : 3

[6180]-77

**T.E. (Electrical Engineering)**  
**ELECTRICAL MACHINES - II**  
**(2019 Pattern) (Semester - I) (303143)**

*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) *Assume suitable additional data, if necessary.*
- 5) *Use of non-programmable calculator is allowed.*

- Q1)** a) Draw the equivalent circuit diagram of 3 phase synchronous motor & state, why it is called doubly fed motor. **[4]**
- b) Draw the phasor diagram of 3 phase synchronous motor for lagging power factor & show **[6]**
- i) Load angle
  - ii) Internal angle
  - iii) Power factor angle on it
  - iv) Write the formula for back emf from phasor diagram.
- c) A 2300 V three phase star connected synchronous motor has armature resistance of 0.2 ohm/ph. and synchronous reactance of 2.2 ohm/ph. The motor is operated at 0.5 leading power factor and takes a current of 200 A from supply. Calculate back EMF generated in the motor & load angle  $\delta$ . **[8]**

OR

- Q2)** a) Sketch V and inverted V curves of synchronous motor and show the power factor regions. **[4]**
- b) What is hunting in synchronous motor? How to minimise it? Explain. **[6]**

**P.T.O.**

- c) A 75 kW, 440 V, three phase star connected 50 Hz, synchronous motor has  $Z_s = 0.04 + j0.4 \Omega/\text{ph}$  & operates at 0.8 leading power factor. The motor efficiency is 92.5 %. Calculate : [8]
- armature current
  - back emf and
  - mechanical power developed in armature Pm.

- Q3)** a) State the methods of speed control of 3 phase Induction motor on stator & rotor side. [3]
- b) Draw the block diagram & explain the V/f method of speed control of 3 phase induction motor. [6]
- c) With the neat construction diagram and explain the working of variable reluctance stepper motor. Show the truth table. How to reverse the direction of rotation. [8]

OR

- Q4)** a) Calculate step angle & resolution of 3-ph stepper motor with 08 stator poles & 06 rotor poles. [3]
- b) How the Energy Efficient three phase Induction Motor differ from Standard motor. [6]
- c) With the neat diagram describe the construction and working of PM A.C. motor. State its applications. [8]

- Q5)** a) Draw the torque speed characteristics of AC and DC series motor on common axis & comment on armature current & torque. [4]
- b) Compare conductively compensated and inductively compensated series motor. [6]
- c) A series motor having resistance  $40\Omega$  & inductance 0.3 H when connected to 240 V DC supply draws a current of 1 A and run at 2000 rpm. If it is supplied by 240 V, 50 Hz AC supply with same loading; Calculate : [8]
- speed
  - power factor
  - Gross power developed and
  - torque

OR

- Q6)** a) What are the modifications necessary in construction of dc series motor to operate it on ac supply? [4]
- b) Draw the approximate phasor diagram of AC series motor & explain. [6]
- c) Derive the expression for self-induced emf in field winding & rotational emf in AC series motor. [8]
- Q7)** a) State the types of 1-ph induction motors. Write applications of capacitor start IM. [3]
- b) How to reverse the direction of rotation of 1-ph induction motor, explain by connection diagram. [6]
- c) Sketch the torque-slip characteristics of 1-ph Induction motor based on double field revolving theory. Prove, how the 1-ph induction motor is not self-starting. [8]

OR

- Q8)** a) Compare single phase motor with 3 phase motor. [3]
- b) Draw the equivalent circuit of 1-ph induction motor under no load and blocked rotor test. Write the necessary formulae used. [6]
- c) 250W, 230V, 50Hz, single phase capacitor start induction motor has following constants [8]

Main winding :  $Z_m = 4.5 + j 3.7 \Omega$  & Auxiliary winding;  
 $Z_a = 9.5 + j3.5 \Omega$ .

Determine value of C which will develop maximum torque.

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