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[4857]-156**S.E. (Electrical) (Second Semester) EXAMINATION, 2015****ELECTRICAL MACHINES-I****(2008 PATTERN)****Time : Three Hours****Maximum Marks : 100****N.B. :—** (i) Answer any *three* questions from each Section.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Assume suitable data, if necessary.

SECTION I

1. (a) With neat circuit diagrams, explain open circuit and short circuit tests on a single-phase transformer for finding the voltage regulation and efficiency. Why do we get core losses on OC test and copper losses on SC test ? [8]
- (b) Explain different types of losses taking place in transformer and how to minimize them. [8]

Or

2. (a) Draw exact and approximate equivalent circuits in case of single-phase transformer. [8]

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- (b) What do you mean by autotransformer ? Derive the equation for saving of copper in case of autotransformer as compared to two winding transformer along with necessary diagram. State applications of autotransformer. [8]
3. (a) With neat circuit diagram, explain the Scott connection of transformers to convert 3-phase supply into 2-phase supply. [8]
- (b) With neat circuit diagram, explain the V-V connection of transformers. State its merits and demerits. [8]

Or

4. (a) Define parallel operation of single-phase transformers. Explain the necessity of parallel operation. What are the conditions for satisfactory operation of transformer in parallel ? [10]
- (b) Explain the importance of 'Polarity test' for parallel operation of single-phase transformers. [6]
5. (a) Differentiate LAP and WAVE winding of DC machine. [6]
- (b) Derive the EMF equation in case of DC machine. [6]
- (c) Explain power flow diagram of DC motor. [6]

Or

6. (a) Explain the construction of DC Machine along with the diagram and function of each part in detail. [10]
- (b) Explain Armature Reaction in detail. [8]

SECTION II

7. (a) Explain the working of three point starter with a neat sketch. State its merits and demerits. [8]

- (b) Write short notes on : [8]
- (i) interpoles
 - (ii) compensating winding.

Or

8. (a) Sketch and explain the 'Speed Vs Armature current' and 'Torque Vs Armature current' characteristics of dc shunt motors with relevant equations. Also give its *two* applications. [8]
- (b) Explain the speed control method of a DC shunt motor which gives the speed above the rated speed with required diagram and formulae. Also give *one* advantage and *one* disadvantage. [8]
9. (a) Prove that a rotating mmf is produced when 3-ph currents are fed to a symmetrical 3-ph distributed winding. Use analytical method for the answer. Also state the magnitude and frequency of such a field. [7]
- (b) A 3-ph induction motor having a 4-poles, star-connected stator winding runs on 50 Hz supply with 200 V between the lines. The rotor impedance per phase at standstill is $(0.1 + j 0.9)\Omega$. The ratio of rotor to stator turns is 0.67. Calculate : [9]
- (i) Total torque at 4% slip
 - (ii) Maximum torque
 - (iii) Speed at maximum torque
 - (iv) Maximum mechanical power. Neglecting stator impedance.

Or

- 10.** (a) Derive the expression for the torque of a 3-ph induction motor and obtain condition for maximum torque. [7]
- (b) The power input to a 3-ph, 50 Hz, 6-poles, 500 V induction motor running at 975 rpm is 40 kW. Stator losses are 1 kW and friction and windage losses are 2 kW. [9]
- Calculate :
- (i) slip
- (ii) rotor copper losses
- (iii) shaft power
- (iv) efficiency.

- 11.** (a) Why starters are necessary for starting 3-ph induction motor? Describe the operation of autotransformer starter with neat diagram and also give related equations. [10]
- (b) Draw the exact and approximate equivalent circuit diagram of an induction motor. Give the relevant equations referred to stator. [8]

Or

- 12.** (a) Draw and explain the circle diagram of an induction motor. Also express the maximum torque, maximum input, maximum output on the circle diagram. [10]
- (b) State the different methods of speed control of a 3-ph induction motor. Explain any *one* with its merits and demerits. [8]