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BIEE-016

B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

00286

Term-End Examination

June, 2014

BIEE-016 : ELECTRO-MECHANICAL ENERGY CONVERSION – III

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of scientific calculator is allowed. Assume suitable data if missing.*

1. (a) Outline the various steps of applying the generalized theory of various rotating electrical machines. List the various limitations of generalized theory of electrical machines.

(b) What is the generalized model of rotating electrical machines ? How are the various windings of a machine represented by the primitive machine ? Obtain an expression for the electrical torque of the Kron's primitive machine. *2×7=14*

2. (a) For a DC machine, show that the motional inductance M_d is given by

$$M_d = \frac{\phi Z}{\pi a} \cdot \frac{1}{I_f}$$

The symbols used have their usual meaning.

(b) Obtain and discuss the steady state and transient response characteristics of a separately excited DC generator. *2×7=14*

3. (a) Derive the expression for synchronous power in terms of the load angle for a salient pole machine and also plot the steady state power-angle characteristics.

(b) What are the various basic parameters of a synchronous machine ? Derive the expressions for armature to field mutual inductances for a salient pole synchronous machine. *2×7=14*

4. (a) Discuss the behaviour of synchronous generators when subjected to sudden balanced inductive loading. Also plot the characteristics of the variation of terminal voltage with time. Show how voltage regulators maintain a constant voltage at the alternator terminals.

(b) Discuss the behaviour of an alternator when a sudden three-phase short circuit takes place at its armature terminals. *2×7=14*

5. (a) Write down the voltage equations for the mathematical model of a polyphase induction machine in matrix form and hence obtain an expression for the steady state torque when balanced polyphase supply is applied on the stator.

(b) Draw the equivalent circuit of a polyphase induction motor and state what is represented by the various parameters involved in this circuit. What advantage is gained if core loss is not represented in the equivalent circuit ? *2×7=14*

6. (a) When running on full load at 400 V, a 3-phase delta connected induction motor takes an input current of 60 A at 0·85 pf. When running on light load at 400 V, the motor input current and power are 16 A and 2200 W respectively. Its friction and windage losses are 800 W. If stator resistance per phase is 0·6 Ω, calculate the shaft power and its efficiency at a full load slip of 0·04.

(b) Give the constructional features of a 2-phase servomotor. Explain how the performance analysis of this motor is done by resolving the stator supply voltages into positive and negative sequence voltages. *2×7=14*

7. Discuss the working principle and constructional features of any ***two*** of the following : *2×7=14*

(a) Linear Induction Motor

(b) Brushless DC Motor

(c) Universal Motor