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BIEE-016

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

Term-End Examination

00856

June, 2015

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 permitted. Assume suitable data, if missing.*

1. Write short notes on any ***two*** of the following : *2×7=14*

(a) Single-phase Reluctance Motor

(b) Hysteresis Motor

(c) Two-phase Servomotor

(d) Hybrid Stepper Motor

2. (a) Draw a labelled diagram of Kron's Primitive Machine and its basic two pole representation. Write down the voltage equations for v_{ds}, v_{qs}, v_{dr} and v_{qr} in matrix form. *2+2+3*

(b) Consider transformation from 3-phases (a, b, c) to 2-phases (α, p, 0). Draw a schematic diagram of balanced 3-ϕ windings and 2-ϕ windings on the motor. Determine the two phase currents. *2+2+3*

3. (a) For a separately excited dc generator, derive the expressions for steady state and transient armature generated emf. *7*

(b) A separately excited dc generator running at $\frac{4500}{\pi}$ rpm has the following parameters :

$r_f = 80\ \Omega$; $L_f = 40$ H; $r_a = 0{\cdot}1\ \Omega$; $L_a = 0{\cdot}3$ mH; $M_d = 0{\cdot}8$ H;
$K_g = 120$ volts/field amp.

The field is unexcited and the armature is open. Determine the armature voltage as a function of time, if a constant voltage of 160 volts is suddenly impressed across the field terminals. *7*

4. (a) Derive the transfer function for a separately excited dc generator on-load operation. *7*

(b) Derive the expression for armature current in case of dc shunt motor. *7*

5. (a) Derive the expression for synchronizing power in terms of V_t, E_f, X_d, X_q and δ. 7

(b) Derive the expression for terminal voltage of a synchronous generator in case of sudden capacitive unloading. 7

6. (a) Explain 'single phasing' of a 3-ϕ induction motor. 7

(b) For a 3-ϕ induction motor driven by a constant current and constant frequency source of supply, derive the expression for maximum torque and starting torque. 7

7. (a) Draw the equivalent circuit of a poly phase induction motor. 7

(b) Derive the expression for air-gap power in a three-phase induction motor. 7