B.Tech. ELECTRICAL ENGINEERING

Term-End Examination

December, 2011

BIEE-012 : ELECTRO-MECHANICAL ENERGY CONVERSION - II

Time : 3 hours   *Maximum Marks : 70*

Note : *Attempt any 7 questions out of total 10 questions. Use of scientific calculator is permitted.*

1. (a) What are the conditions to be checked before connecting two synchronous generators in parallel ?   3

   (b) Two alternators rated 800 kW and 600 kW operate in parallel sharing a total load of 1000 kW. While running isolated, the frequency of first alternator drops from 51 Hz on no load to 49 Hz on full load and that of second alternator drops from 50.5 Hz to 48.5 Hz from no load to full load. Calculate the load shared by each alternator and frequency at which they operate.   7

2. Explain potier triangle method for determination of voltage regulation of a synchronous generator.   10

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3. Explain two reaction theory applicable to salient pole synchronous machine. For a salient pole synchronous machine, derive the equation of output power per phase and draw power-angle characteristics. **10**

4. What is synchronous condenser ? Give its practical utility. **3**

   A synchronous motor improves power factor of a load of 500 kW from 0.707 lagging to 0.95 lagging. The motor also carries a load (mechanical), for which electrical equivalent is of 100 kW. **7**

   Find :

   (a) The leading KVAr supplied by the motor.

   (b) KVA rating of the motor

5. Derive from the fundamental, the expression for maximum torque in case of a three phase induction motor and show that while maximum torque is independent of rotor resistance, slip at which maximum torque occurs depends upon rotor resistance. **10**

6. A 415V, 6 pole, 50 Hz, three phase delta connected induction motor running on full load develops a shaft torque of 160 N-m when rotor frequency is 2 Hz. Determine the shaft power output. If the mechanical torque lost in friction and windage is 10 N-m and stator loss is 1 kW, estimate : **10**

   (a) rotor copper loss

   (b) motor input power

   (c) efficiency.

7. Explain the principle of operation of a double cage 4
   induction motor.

   The impedances at standstill of inner and outer 6
   cages of a double cage rotor are $(0.01 + j\,0.5)$ ohm
   and $(0.05 + j\,0.1)$ ohm respectively. Calculate ratio
   of torque developed by two cages at starting.
   Stator impedance may be neglected.

8. Give detailed explanation of cogging and crawling 10
   phenomenon in a three phase induction motor.

9. Explain, why a single phase induction motor is 10
   not self starting ? Also explain double revolving
   field theory in detail.

10. Write short note. Answers on *any two* out of the
    following 3 topics :   2x5=10
    (a) Capacitor start method for starting single
        phase induction motor.
    (b) Draw and explain equivalent circuit for
        single phase induction motor.
    (c) Discuss the construction and working of an
        a.c. series motor.