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BIEE-012

01015

B.Tech. ELECTRICAL ENGINEERING

Term-End Examination

June, 2012

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**.*

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1. (a) Write in sequence, the steps needed to connect a synchronous generator with infinite bus by 'Two bright, One dark lamp method.' **3**

(b) Two alternators rated 800 KW and 600 KW operate in parallel sharing a 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. Derive the expressions for distribution factor and pitch factor for armature windings of a three phase synchronous generator. **10**

3. Draw Open circuit and Short circuit characteristics and also explain synchronous impedance method of estimating voltage regulation for a synchronous generator. **10**

4. 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**

5. Starting from first principles develop the equivalent circuit of a three phase induction motor. Draw and explain the phasor diagram for same. **10**

6. A 3 phase, 50 Hz, 4 pole induction motor has a full load speed of 1440 rpm. For this motor, Calculate the following : **10**

   (a) full load slip and rotor frequency.

   (b) speed of stator field with respect to :

      (i) stator structure and

      (ii) rotor structure .

   (c) speed of rotor field with respect to :

      (i) rotor structure

      (ii) stator structure

      (iii) stator field

7. A 10 KW, 400 V, 4 pole delta connected squirrel cage induction motor gave the following test results : **10**

No load test : 400 V, 8 A, 250 Watts

Blocked-rotor test : 90 V, 35 A, 1350 Watts

The stator winding resistance per phase is 0.72Ω.

Calculate the rotational losses and equivalent circuit parameters.

8. Enlist the methods used for speed control of a three phase induction motor and explain (V/f) method to control speed in detail. **10**

9. A 230 V, 4 pole, 50 Hz, single phase induction motor has the following constants and losses : **10**

$r_1 = 2.3\ \Omega$ $x_1 = 3.2\ \Omega$

$r_2 = 4.2\ \Omega$ $x_2 = 3.2\ \Omega$

$x_m = 74\ \Omega$

Core loss = 98 watts, Friction loss = 30 watts. If this motor is running with a slip of 5% at rated voltage and frequency, Calculate the stator current, power factor, power output and efficiency with auxiliary winding open.

10. Write short note answers on ***any*** **two** of the following three questions : **2x5=10**

(a) Permanent split, capacitor run single phase induction motor starting method.

(b) No load and Blocked rotor tests on single phase induction motors.

(c) Stepper motor construction and working.
