2015
B.E. (Electrical and Electronics Engineering)
Fourth Semester
PC-EE-401: Electrical Machine - II

Time allowed: 3 Hours   Max. Marks: 50

NOTE: *Attempt* *five* *questions in all, including Question No. I which is compulsory and selecting two questions from each Part.   Missing data (If any) can be appropriately assumed.*

x-x-x

Q1   **Explain briefly**

A) Show that the net electromagnetic torque developed is zero if the rotating electrical machine has different number of poles on its stator and rotor.   (2)

B) Draw the phasor diagram of a loaded alternator for the lagging power factor   (2)

C) Draw the labeled short circuit current transient response diagram in 3-phase synchronous machine during unloaded condition.   (2)

D) What is the effect of increase in excitation of a synchronous motor?   (2)

E) Explain the effect of varying the excitation and torque of the prime-mover of Synchronous machine connected to infinite bus-bar.   (2)

Part A

Q2 A) Explain the Potier triangle method of finding the regulation of an alternator.   (5)

B) Draw external and internal characteristics of an alternator. Explain the shape of these characteristics with the help of phasor diagrams.   (5)

Q3 A) Explain the effect of excitation on armature current and power factor of a synchronous motor and hence deduce the V and inverted V curves.   (5)

B) A salient pole synchronous generator has the following per unit parameters: (5)
$X_d = 1.2$, $X_q = 0.8$, $r_a = 0.025$
Compute the excitation voltage E_f on a per unit basis when the generator is delivering rated kVA at rated voltage at power factor of 0.8 lagging.

Q4 A) Describe the slip test method for determining the value of direct-axis and quadrature-axis synchronous reactances of a synchronous machine.   (5)

B) Explain the two reaction theory of salient pole machine in detail with phasor diagram.   (5)

Part B

Q5 A) Explain the following: (5)
(i) Why bright lamp of synchronizing is preferred over dark lamp method?
(ii) How do synchronizing lamps indicate the phase variation of the incoming machine and the running machine?

B) The governors of the two 60 MVA, three-phase alternators operating in parallel are set in such a way that the rise in speed from full-load to no-load is 2.5% in one machine and 4% in the other. The characteristics being straight lines in both cases. If each machine is fully loaded when the total load is 120 MW (unity pf), what will be the load on each machine when load is reduced to 80 MW.   (5)

Q6 A) Draw the equivalent circuit diagram off the BLDC motor. Also derive the expressions for torque and speed of a BLDC motor sing appropriate phasor diagram.   (7)

B) Explain how a synchronous motor can operate as synchronous condenser? Mention its applications.   (3)

Q7 A) Derive the torque equation of a reluctance motor and draw the torque slip characteristics. Mention its applications.   (5)

B) Derive the expression for the input and output power developed by Synchronous motor. Also derive the maximum input and output power developed by synchronous motor.   (5)

x-x-x