(c) Explain the VVVF method of speed control of a three phase induction motor. An AC induction motor is used for a speed control application. It is driven from an inverter with a constant V/f control. The motor name plate details are as follows: No. of poles-2, V:415 volts, phases : 3, frequency : 50 hertz, speed: 2850 RPM. The motor is run with the inverter output frequency set at 40 Hz, and with half the rated slip. Find the running speed of the motor?

5. Attempt any <u>two</u> parts of the following: 10 x 2 = 20

(a) Explain why a single phase induction motor is not self starting. Explain the double revolving field theory. Mention two starting methods of the single phase induction motor.

(b) Can a DC motor work when fed with a single phase AC supply? Explain the construction and principle of operation of a Universal motor.

(c) Explain briefly the principle of operation of a Stepper motor and a Repulsion motor.

—x—

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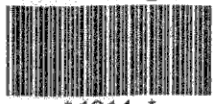

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NEE-401

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 121401

Roll No. | | | | | | | | | | |

B.Tech. (Semester-IV)

SPL. THEORY EXAMINATION, 2014-15

ELECTRO-MECHANICAL ENERGY CONVERSION-II

Time : 3 Hours] *[Total Marks : 100*

Note: Attempt all questions.

1. Attempt any <u>four</u> parts of the following: 5×4=14

(a) Derive the EMF equation of a three phase Alternator.

(b) A 20-pole alternator is having 180 identical stator slots with 6 conductors in each slot. All the coils of a phase are in series. If the coils are connected to realize single phase winding, the generated voltage is Va. If the coils are reconnected to realize three-phase star-connected winding, the generated phase voltage is Vb. Assuming full pitch, single-layer winding, find the ratio Va/Vb.

(c) Explain the open circuit and short circuit tests in a three phase Alternator. Why is the SCC a straight line? Explain.

(d) Explain the parallel operation of two Alternators under loaded conditions when mechanical power input to one of the Alternators is increased.

(e) What is armature reaction in a synchronous machine? Explain the effects of armature reaction for zero power factor lagging, zero power factor leading and unity power factor load.

(f) Explain the short circuit ratio (SCR) in a synchronous machine.

2. Attempt any two parts of the following: 10×2=20

(a) Derive the expression of the power in a salient pole synchronous generator. Explain whether the alternator would continue to work after the field voltage is reduced to zero.

(b) Explain and derive with the help of phasor diagrams, the V curve and the inverted V curve of a synchronous machine (both Motor and Alternator). Also show with the help of phasor diagrams why does the field current required for higher load is more.

(c) Explain the working of a synchronous condensor with the help of phasor diagrams.

3. Attempt any four parts of the following: 5×4=20

(a) Explain the principle of operation of a 3 phase Induction Motor. What are the similarities and differences between 3 phase Induction motor and a Transformer?

(b) A squirrel cage type induction motor has a starting torque of 100% and a maximum torque of 200% of full load torque. Calculate the slip at which the maximum torque occurs and the full load slip.

(c) Derive the torque-speed characteristic of a three phase induction motor showing all the three modes of operation.

(d) Explain how the core losses are neglected during the full load operation in a 3 phase induction machine.

(e) Explain how the power factor, peak torque and starting torque vary with airgap in a three phase induction motor.

(f) Explain the working region of operation in a 3 phase induction motor torque speed characteristic.

4. Attempt any two parts of the following: 10×2=20

(a) Explain why starters are required for a three phase induction motor. Describe the various types of starters used.

(b) Explain the phenomena of cogging and crawling in three phase induction motors. The standstill impedance of the outar cage of a double cage induction motor is (0.3 + j0.4) ohms and that of the inner cage is (0.1 + j1.5) ohms. Find the ratio of the currents and torques of the two cages (i) at standstill and (ii) at a slip of 5%. Neglect the stator impedance.