Ref No: Ex/PG/EE/T/127A/2019

M.E. Electrical Engineering - First Year - Second Semester

SUBJECT: - Modeling and Analysis of Electrical Machines and Drives

Full Marks 100

Time: Three hours/ (50 marks for each part)

Use a separate Answer-Script for each part

PART I

Answer any Three Questions

ALL questions carry equal marks

Two marks are for neat and systematic answers

Q1. What do you understand by Finite Difference Approximation? What is : a) Explicit formulation b) Implicit formulation. Which one is preferred? 10+4+2

Q2. Derive the shape function of a first order triangular element for a two dimensional problem and discretize the energy functional . 16

Q3. Develop the H-G diagram of an induction motor from its equivalent circuit 16

Q4. In IM thermal modeling, how the following thermal resistances are estimated:

a) Thermal resistance between surfaces to ambient 16

b) Thermal resistance of the air gap between stator and rotor

c) Thermal contact resistance between stator and frame

Q5. Discretize one dimensional heat flow equation by Finite Difference Approximation. 16

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M.E.E. 2-nd semester **EXAMINATION, 20 19**

SUBJECT: Modeling and Analysis of Electrical Machines & Drives

Full Marks ~~30~~/ 100

Time : Three hours/ **(~~15~~/50 marks for each part)**

Use a separate Answer-Script for each part

No. of questions		~~Part I~~ / Part II	Marks
		Answer any three questions (3X16) and 2 marks for neatness. All symbols have their usual significance.	
1.	a)	With the help of suitable current configurations of the **stator** of a 3-phase induction motor, describe how rotating magnetic fields having **2-pole** can be produced when motor is supplied from a 3-phase AC source of 50 Hz. What is synchronous speed?	8
	b)	Showing suitable current configurations of the **rotor** of a 3-phase induction motor, describe how rotating magnetic fields having **4-pole** can be produced when rotor at stand-still is supplied from a 3-phase AC source of 50 Hz. Derive its synchronous speed .	8
2.	a)	What are space vectors for flux, voltage and currents ($\overline{\psi_s}$, $\overline{u_s}$ and $\overline{i_s}$) in a **stator** of 3-phase induction motor? Using space vectors derive stator vector voltage equation $\overline{u_s} = \overline{i_s} R_s + \frac{d\overline{\psi_s}}{dt}$	8
	b)	Derive the transformed **rotor** vector voltage equation of a 3-phase induction motor if the stator voltage equation is $\overline{u_s} = \overline{i_s} R_s + \frac{d\overline{\psi_s}}{dt}$	8
3.		Using space vectors for flux, voltage and currents ($\overline{\psi}$, $\overline{u}$ and $\overline{i}$) in a 3-phase induction motor, develop **the equivalent circuit** having resistances and inductances of the windings, which is valid during **transient** process.	16
4.		A 3-phase induction motor is started by applying 3-phase AC balanced voltages; obtain expressions for total **transient currents** in the machine until rotor starts rotating. Discuss about the time constants related to this transient currents.	16
5.		Using **Lyon's method** of instantaneous **symmetrical** components, derive the expression for **total torque** on the rotor of a 3-phase induction motor.	16