Ref No: Ex/PG/EE/T/127A/2024

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

SUBJECT: - Modeling and Analysis of Electrical Machines and Drives

Full Marks 100

Time: ~~Two hours~~/Three hours/ ~~Four hours/ Six 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.	Develop the H-G diagram of an induction motor from its equivalent circuit	16
Q2.	What do you understand by FEM? Derive the shape function of a first order triangular element for a two dimensional FEM analysis. State all the assumptions.	16
Q3.	Describe a lumped parameter thermal circuit of an IM. How the thermal parameters are determined?	16
Q4.	Describe the different steps to analysis any electric machine by FEM	16
Q5.	A pair of buried pipes is being used to transmit electrical signals, determine the distribution of voltage signal along the line by using FEM. States the assumptions clearly.	16

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M.E. Electrical Engineering First Year 2024 EXAM Second Semester

SUBJECT: Modeling and Analysis of Electrical Machines & Drives

No. of questions	Answer for 50 marks for Part II	Marks
	Answer any three questions and 2 mark for neatness. All symbols have their usual significance.	
1.	A 3-phase induction motor is started by applying 3-phase AC balanced voltages and then describe with a drawing of construction of stator and rotor coils for 3-phases , how **space currents vectors** for 2-poles are produced in a 3-phase Induction Motor. Also show the method of coordinate transformation and stator **voltage vector** of Induction machine to rotor plat-form and vice-versa.	16
2.	Using 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 derive stator vector voltage equation $\overline{u_s} = \overline{i_s}\, R_s + \frac{d\overline{\psi_s}}{dt}$ Also derive the transformed **rotor** vector voltage equation of a 3-phase induction motor if the stator voltage equation is $\overline{u_s} = \overline{i_s}\, R_s + \frac{d\overline{\psi_s}}{dt}$.	16
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.	Using **Lyon's method** of instantaneous **symmetrical** components, derive the expression for **total torque** on the rotor of a 3-phase induction motor.	16
5.	Write short notes on:	
a)	**Instantaneous Symmetrical** components of voltage and current of Induction machines by Lyon's Method.	8+8=16
b)	**Transient currents** in a 3-phase Induction Motor until rotor starts rotating.	