

M.E. ELECTRICAL ENGINEERING FIRST YEAR SECOND SEMESTER EXAM 2025

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. Describe a method to estimate the temperature of the stator winding of an IM. 16
- Q2. In IM thermal modeling, how the following thermal resistances are estimated: 16
- a) Thermal resistance between surfaces to ambient
 - b) Thermal resistance of the air gap between stator and rotor
 - c) Thermal contact resistance between stator and frame
- Q3. What do you understand by Finite Difference Approximation? What is : a) Explicit formulation b) Implicit formulation. Which one is preferred 16
- Q4. Derive the shape function of a first order triangular element for a two dimensional problem and discretize the energy functional . 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

| Turn over

No. of questions	Answer for 50 marks for Part II	Marks
	<u>Answer any three questions and 2 mark for neatness.</u> <u>All symbols have their usual significance.</u>	
1.	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
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 in a 3-phase induction motor, develop the equivalent circuit having only reactances 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 any two: a) Instantaneous Symmetrical components of voltage and current of Induction machines by Lyon's Method. b) Method of coordinate transformation and stator voltage vector of Induction machine to rotor plat-form and vice-versa. c) Instantaneous power using Symmetrical components of voltage and current of Induction machines by Lyon's Method.	8+8=16