Master of Electrical Engineering, 2017

(1st Year, 1st Semester)

FIELD COMPUTATION OF ELECTROMAGNETIC DEVICES

Time: Three Hours **Full Marks:** 100

Use a separate Answer-Script for each Part

PART - I

Answer *any two* questions from this part.
One markis reserved for neat and well organised answer.

1. Sketch a sectional view of a Semicircular bottom Slot used in electrical machines and derive expression for Specific Permeance for the bottom portion. 16

2. With a neat sketch find the Specific Permeance of a slot with double layer winding used in electrical machines. 16

3. Write a note on any one of the following: 16

   a) Effect of Eddy Current in the Laminations on the Magnet Field

   b) Eddy Currents in Solid Rectangular Cores

M.E. E. 1ST. SEMESTER EXAMINATION, 2017

(1st Year, 1st Semester)

FIELD COMP. OF ELECTROMAGNETIC DEVICES

Time: Three Hours | **Full Marks:** 100

(33 marks for this part)
Use a separate Answer-Script for each Part

PART-II.(One THIRD)

Answer *any Two* questions from this part.
One marks is reserved for neat and well organised answer

Answer *any Two* questions from this part.
One mark~~s are~~ reserved for neat and well organised answer

6.	a)	State and explain Ampere's law. Show how the same can be used to achieve a solution for magnetic field in the three dimensional case of an electrical machine.	4+5
	b)	State and explain Uniqueness theorem. Show how this theorem can be utilized to obtain the solution for current density.	2+5
7.	a)	Deduce the expression of the airgap permeance of an electrical ac machine assuming constant airgap.	12
	b)	Indicate the possible modifications on the above derivation if slotted length is considered.	4
8.	a)	State Faraday's Law of electromagnetic induction. Show how this Law can be used to obtain both displacement and conduction current densities.	2+6
	b)	Derive the general expression of induced e.m.f. in a rigid coil of an electrical machine moving under a time varying electric field.	8

Ref.No. EX/PG/EE/T/111A/14/2017

MASTER OF ELECTRICAL ENGINEERING EXAMINATION, 2017

(1-ST YEAR, 1-ST SEMESTER)

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Time: 3 hours Full Marks: 100

(34 marks for this part)

Use separate Answer-script for each part

Answer any two questions. All symbols have their usual significance

PART-III

1. a) Explain the importance of the relation $\nabla \times \mathbf{H} = \mathbf{J} + \partial \mathbf{D}/\partial t$ in terms of Machine design and also draw all fields **H,J,D**.

b) Calculate the electric field density *D* over an insulation layer 0.5mm thick when the potential of the winding is 400V and the magnetic circuit of the system is at earth potential. The relative permittivity of the insulation material is $\varepsilon_r = 3$ and $\varepsilon_0 = 8.854 \times 10^{-12}$ F/m. Also calculate the displacement current over the slot insulation at 50 Hz when the insulation surface is $0.01 m^2$. 10+7=17

2. a)Explain Gauss's law for magnetic field $\nabla . \mathbf{B} = 0$ in an Electrical Machine.

b) Explain $\nabla \times \mathbf{E} = - \partial \mathbf{B}/\partial t$ in terms of Machine design and energy conversion.

c) What do you understand by Magnetic Vector Potential? 6+6+5=17

3 a) Develop the following equation explaining each symbol

$$\nabla \times \left(\frac{1}{\mu} \nabla \times A\right) + \sigma \frac{\partial A}{\partial t} + \sigma \nabla \phi = 0.$$

b) Illustrate a two-dimensional **B** field and its boundary conditions for a salient-pole synchronous machine using the magnetic vector potential **A** with Dirichlet's boundary condition, and Neumann's boundary condition. 10+7=17