TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

B. TECH 2nd – YEAR (III SEM.) – Mid Term-I

Electrical Machine-I (**3EE4-07**)

Time**: 2 Hr**   Max. Marks: **70**

Note:
1) The paper is divided into 2 parts: Part-A and, Part-B
2) Part-A contains 10 questions and carries 2 mark each.
3) Part-B contains 5 questions. Each question is having two options and carries 10 marks each.

Part- A (20 Marks)

A. Explain Fleming's left-hand rule and its application.	CO1
B. Explain the term flux and flux density.	CO1
C. State and explain Faraday's law of electromagnetic induction.	CO1
D. What is transformer? List the type of transformer.	CO1
E. What is B-H curve of magnetic material?	CO2
F. State the Ampere Law and its application	CO2
G. State the Biot-Savart Law and its application.	CO2
H. Define the self inductance and mutual inductance and coefficient of coupling, also give mathematic expressions for the same.	CO2
I. Draw the phasor diagram of transformer at No load.	CO3
J. An electromagnet has a gap of 4 mm and flux density in the gap is 1.3 Wb/m^2. Determine the ampere turns for the gap.	CO3

Part- B (50 Marks)

1. Explain principle of operation, construction and working of a single-phase transformer and its application.	CO1

OR

1. A rectangular shaped core is made of mild steel plate 15 mm x 20 mm cross section. The mean length of magnetic path is 18 cm. The exiciting coil has 300 turns and current 0.7 A. Calculate:
  I.   Magnetising force.
  II. Flux density.
  III. Reluctance.
  IV. Flux of magnetic circuit.
Assume relative permeability of mild steel is 940.
	CO1

2. **A.** Derive an expression of the induced e.m.f. of the transformer. **B.** Derive an expression for the energy stored in a magnetic field.	CO1

OR

2. A single phase, 50 Hz core type transformer square cores of 20 cm side, permissible maximum flux density is 1 Wb/m^2. Calculate the number of turns per limb on the right on the high and low voltage sides for a 300/220 V ratio.	CO1

3.	What is an ideal transformer? Draw the phasor diagram of the ideal transformer and explain in detail. Also explain the voltage and current transformation ratio of transformer.	CO2

OR

3.	A coil of 100 turns is wound on toroidal magnetic core having a reluctant of 10^4 AT per Wb. When the coil current is 5 A and is increasing at the rate of 200 A/s, Determine:
	    I. Energy stored in the magnetic circuit.
	    II. Voltage applied across the coil.
	 Assume coil resistance as zero.
		CO2

4.	Draw and explain hysteresis loop. What is its significance? What is meant by saturation and residual magnetism? Show them in diagram.	CO2

OR

4.	A single phase transformer has 350 primary and 1050 secondary turns. The net cross-section area of a core is 55 cm^2. If the primary winding be connected to a 400 V, 50 Hz single phase supply, Calculate:
	    I. Maximum value of flux density in the core.
	    II. The voltage induced in secondary winding.
		CO2

5.	Derive an expression of magnetic field on the axis of a circular current loop.	CO3

OR

5.	Two coils having 100 and 150 turns respectively are wound side by side on a closed iron circuit of a section 125 cm^2. If the permeability of iron is 2000, Calculate:
	    I. Self inductance of each coil.
	    II. Mutual inductance between them
	 The EMF induced in the second coil if the current in the first coil changes from 0 to 5 A in 0.2 s.
		CO3