

AMIETE – ET (New Scheme)

Time: 3 Hours

June 2018

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

- a. Analogous electric circuit equation for the magnetic circuit shown in Figure 1 is

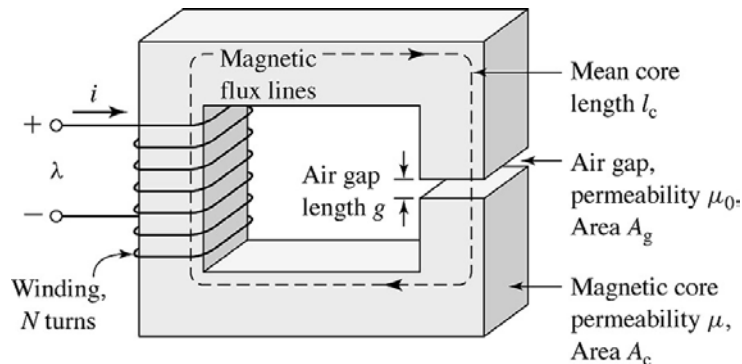


Fig. 1 Magnetic circuit

- (A) $I = V/R_c$ (B) $I = V/R_g$
 (C) $I = V$ (D) $I = V/R_c + R_g$
- b. Frequency of the voltage available in the secondary side of the transformer will be :
 (A) greater than the primary side (B) lesser than the primary side
 (C) equal to the primary side (D) Zero
- c. Which of the following will be useful for traction purposes?
 (A) Differentially compound motor (B) Cumulative compound motor
 (B) DC shunt motor (D) DC series motor
- d. Efficiency of a machine will be maximum
 (A) at no-load condition
 (B) at full load condition
 (C) when constant losses are equal to variable losses
 (D) when constant losses > copper losses

- e. Operating power factor of a synchronous motor
 - (A) depends on speed
 - (B) depends on frequency
 - (C) depends on field excitation
 - (D) depends on load
- f. Slip for the induction generator will be
 - (A) 0
 - (B) positive
 - (C) negative
 - (D) equals to stator resistance
- g. Synchronous speed for a 400 V, 60 Hz, 6 pole induction machine will be
 - (A) 1500 RPM
 - (B) 1200 RPM
 - (C) 0 RPM
 - (D) 2020 RPM.
- h. In a transmission system weight of copper used is proportional to
 - (A) E
 - (B) E^2
 - (C) $1/E$
 - (D) $2E$
- i. Resolution of an instrument is
 - (A) The minimum quantity it can measure
 - (B) The maximum quantity it can measure
 - (C) The maximum non-linearity
 - (D) the ability to distinguish the polarity.
- j. The reason for selecting magnetic field instead of electric field for energy conversion process is
 - (A) Magnetic field is stronger than electric field
 - (B) Magnetic field is weaker than electric field.
 - (C) Magnetic field energy is equal to electric field energy
 - (D) Magnetic field can be easily created.

Answer any FIVE Questions out of EIGHT Questions.

Each question carries 16 marks.

- Q.2** a. Figure 2. represents the magnetic circuit of a primitive relay. The coil has 500 turns and the mean core path length is $l_c = 360$ mm. When the air gap lengths are 1.5 mm each, a flux density of 0.8 tesla is required to actuate the relay. The core is cast steel (Assume $B_c = 0.8$ Tesla and $H_c = 510 \text{ At/m}$)
- (i) Find the current in the coil.
 - (ii) Compute the values of permeability and relative permeability of the core.
 - (iii) If the air gap is zero, find the current in the coil for the same flux density (0.8 T) in the core.

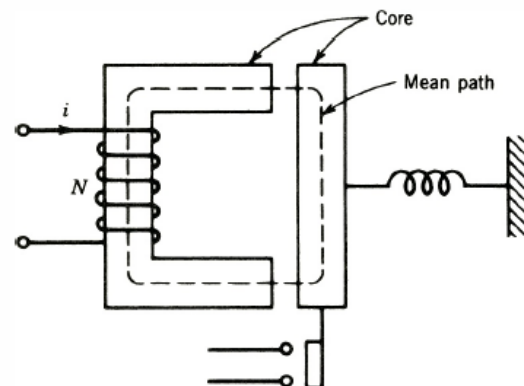


Fig. 2 Magnetic circuit for Q.2 (a)

(3+3+2)

- b. For the magnetic circuit of Fig. 3, $N=400$ turns, Mean core length $l_c = 50$ cm, Air gap length $l_g = 1.0$ mm. Cross-sectional area $A_c = A_g = 15$ cm². Relative permeability of core $\mu_r = 3000$, $i=1.0$ A. Calculate (i) Flux and flux density in the air gap, (ii) Inductance of the coil. (4+4)

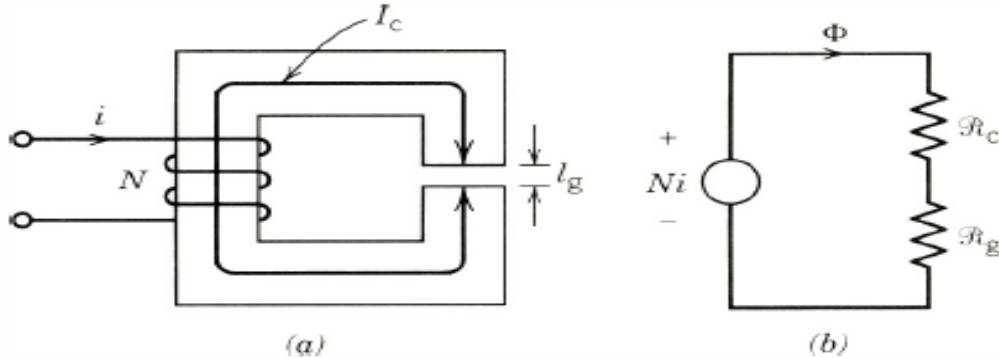


Fig. 3 Circuit for question 2 (b)

- Q.3** Tests are performed on a single phase, 10 kVA, 2200/220 V, 60 Hz transformer and the following results are obtained.

	Open circuit test (high-voltage side open)	Short circuit test (Low voltage side shorted)
Voltmeter	220 V	150V
Ammeter	2.5 A	4.55 A
Wattmeter	100 W	215 W

- (i) Derive the parameters for the approximate equivalent circuits referred to the low-voltage side and the high-voltage side. (8)
(ii) Express the excitation current as a percentage of the rated current. (4)
(iii) Determine the power factor for the no-load and short-circuit tests. (4)
- Q.4** a. Explain the working principle of a DC generator. (10)
b. Explain the characteristics of DC shunt motor. (6)
- Q.5** a. Explain three point starter with neat diagrams. (8)
b. Derive the EMF equation for synchronous machine. (8)
- Q.6** a. Derive the equivalent circuit of three phase induction motor. (8)
b. Explain the torque – slip characteristics of three phase induction motor. (8)
- Q.7** a. Explain the various aspects of a typical power system through one line diagram. (10)
b. Prove that power transmission capability of HVDC transmission is higher than that of AC transmission system. (6)
- Q.8** Explain double field revolving theory with relevant diagrams. (16)
- Q.9** a. Define earthing. State the need for earthing. (4)
b. Explain the functions and different types of fuses. (10)
c. Mention different types of indicative instruments. (2)