Q.2 a. Discuss energy stored in the linear magnetic systems.

Answer: 8.7 of Text Book

b. A small piece of metal wire is dragged across the gap between the pole pieces of a magnet in 0.5 second. The magnetic flux between the pole pieces is known to be 8×10^{-4} wb. Estimate the emf induced in the wire.

Answer:

Let l be the length of metal wire and b be the length of the magnetic field through which the wire is dragged. Then the total area swept by the wire,

A=l.b

The emf include in the wire is given as

$E=B.l.v = \Phi.l.b/A.t = \Phi.A/A.t = \Phi /t$

$= 8 \text{ X } 10^{-4}/0.5 = 1.6 \text{ X } 10^{3} \text{ V}$

Q.3 a. Explain the efficiency of a transformer. Deduce the condition for maximum efficiency and maximum efficiency of transformer.

Answer: 9.8 of Text Book

b. Calculate the voltage regulation of a transformer in which the resistive drop is 10% of the output voltage and the reactive drop is 5% of the output voltage, when the power factor is 0.8 lagging?

Answer:

% ohmic drop = $I_2 R_2$ X 100/ E2 =10

and % reactive drop = $I_2 X_2 * 100/E_2 = 5$

% Voltage Regulation = $(I_2R_2 \cos\theta + I_2R_2 \sin\theta) / E_2$

$= I_2R_2 / E_2 \cos\theta + (I_2X_2/ E_{2)}. \sin\theta$

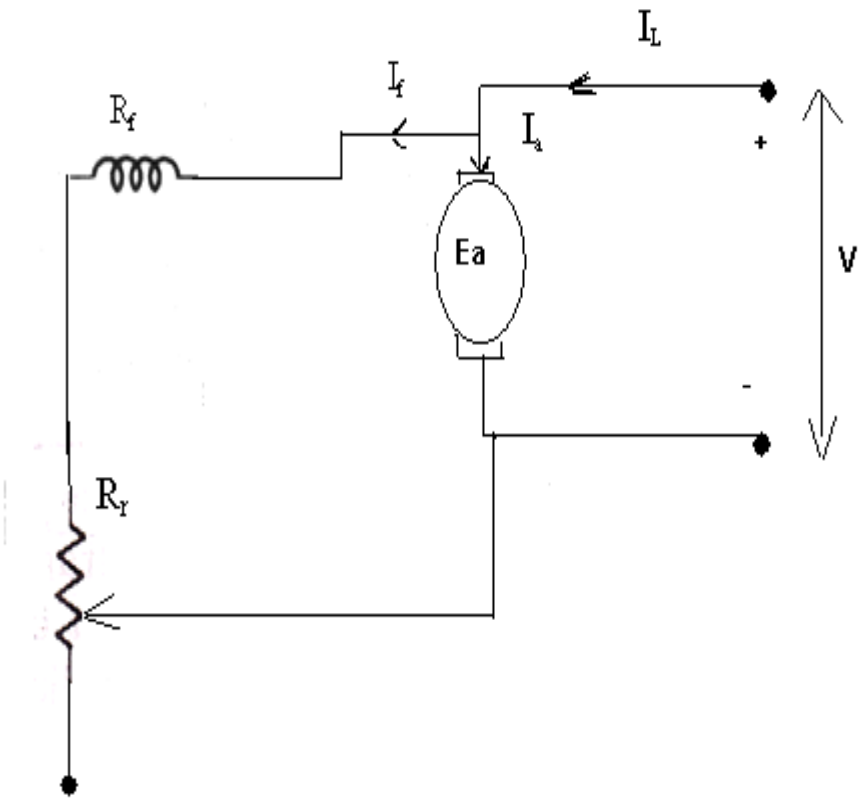
$=10 \text{ X } 0.8 + 5 \text{ X } 0.6 = 8+3 = 11\%$

Q.4 a. Explain two methods of speed control of DC Shunt motors.

Answer: 11.8 of Text Book

b. A 50 KW, 230V DC Shunt motor takes a current of 14.5 A at no load when running at 1640 r.p.m. The armature and field resistance are 0.15Ω and 120Ω respectively. Estimate the motor efficiency when the motor is drawing 215 A. What would be the maximum efficiency of the motor and the load current at which it would occur?

Answer:



$I_f = 230/120 = 1.92$ A

$P_{sh} = (230)^2/120 = 441$ W

<u>At no load</u>

P_{in}=14.5 X 230 = 3335 W

I_a =14.5-1.92 =12.6 A

I_a^2 Ra = $(12.6)^2$ X 0.15 = 24 W (negligible)

$P_k = P_i + P_{wf} + P_{sh}$ = 3335-24 = 3311 W

On load

Ia = 215-1.92 = 213 A

$I_a^2R_a = (213)^2$ X 0.15 = 6805 W

P_L = 6805 + 3311 =10.116 kW

P_{in} = 230 X 215 = 49.45 kW

η = 49.45-10.116/49.45 = 79.54%

for maximum efficiency $I_a^2R_a=P_c$

or 0.15 I_a^2 = 3311

I_a = 148.6 A

I_L = 148.6 + 1.92 = 150A

P_L = 2 X 3311 = 6622 W

P_{in} = 230 X 150 = 34.5 kW

η = 34.5 - 6.62/34.5 = 80.8%

Q.5 a. Explain how can you determine the value of synchronous reactance of a synchronous machine experimentally.

Answer: 12.2 of Text Book

b. Draw and explain V-curves for synchronous machines?

Answer: 12.2 of Text Book

Q.6 a. Explain how a rotating magnetic field is produced in a three-phase induction motor.

Answer: 10.6 of Text Book

b. A 6.6 KV, 20-pole, 50Hz, 3-Phase star connected induction motor has a rotor resistance of 0.12Ω and a standstill reactance of 1.12Ω. The motor has a speed of 292.5 rpm at full load.
Calculate:
(i) Slip at maximum torque
(ii) The ratio of maximum to full load torque. Neglect stator impedance.

Answer:

n_s = 120 X 50/20 = 300 rpm

S_{fL} = 300-292.5/300 =0.025

(a) $S_{max\ T} = R_2/X_2 = 0.12/1.12 = 0.107$

(b) $T_{fL} = [3(V/a)^2 \text{ X } 0.12/0.025] / [w_s(0.12/0.025)^2 + (1.12)^2]$

$=3/w_s\ (V/a)^2 \text{ X } 0.1976$……...(i)

$T_{max} = 3/w_s\ (0.5/1.12)\ (V/a)^2 = 3/w_s\ (V/a)^2 \text{ X } 0.446$……(ii)

From eq. (i) and (ii)

$T_{max}/T_{fL} = 0.446/0.1976 = 2.26$

Q7 a. Explain working and discuss the Torque-slip characteristics for a two value capacitor motor

Answer: 13.2 of Text Book

b. Write short notes on:

(i) Reluctance motor
(ii) Hysteresis motor

Answer: 13.3 of Text Book

Q8. a. Draw block diagram of Nuclear power plant and write function of each block.

Answer: 15.4 of Text Book

b. Write short note on the following:

(i) Bio fuels
(ii) Geothermal Energy

Answer:

(I) 15.12 of Text Book

(II) 15.7 of Text Book

Q9 a. Explain the constructional features and working of fuel cells.

Answer: 15.16 of Text Book

b. What are the advantages and limitations of HVDC transmission system?

Answer: 15.15 of Text Book

Text Book

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