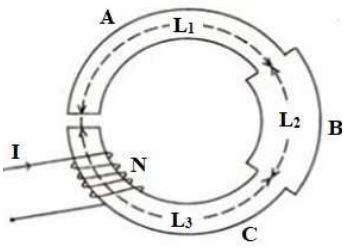
VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

D1+TD1

SCHOOL OF ELECTRICAL ENGINEERING
FALL SEMESTER 2023-2024
CAT-II

Programme Name & Branch: B.Tech and EE/EI/EL
Course Name & code: Basic Electrical and Electronics Engineering & BEEE102L
Class Number (s): VL2023240107422, VL2023240107428, VL2023240107435
Faculty Name (s): Dr. B. Saravanan, Dr. Mrutunjaya Panda, Dr. Anusuya Bhattacharyya
Date: 18/10/2023 AN **Maximum Marks: 50** **Exam Duration: 90 Min.**

General instruction(s): Answer ALL Questions. Use three decimal points for the numerical calculations.

Q.No.	Question	Max Marks
1.	A series R-L-C circuit is connected to 230V, 50Hz, AC supply. The voltage drop across the inductance is 205.77 V and across resistance is 218.4 V while current drawn by the circuit is 43.67 A. Calculate, (i) resistance and Inductance. (ii) capacitance of the circuit and voltage drop across the capacitor. (iii) power factor angle and power factor of the circuit. (iv) power consumed by the circuit (real and reactive power).	10
2	A $440\angle 0°$ V, 50 Hz, balanced Δ-connected source is connected to a balanced Δ −connected load (7.08+j7.07) Ω per phase. Calculate (i) the phase and line voltages (positive sequence) (ii) phase and line currents. (iii) power factor angle and power factor. (iv) active power, reactive power and apparent power. (v) draw the phasor diagram of line and phase currents.	10
3	In the given figure, $L_1=L_3=0.2$ m, $L_2=0.1$ m. Air gap length is 1 mm. The cross sectional area of A, B and C are 0.001 m^2, 0.002 m^2, and 0.001 m^2, respectively. The relative permeability for sections A, B and C are 1000, 2000 and 5000, respectively. The coil has 200 turns with 5 A of current is flowing through it. through it. Determine (i) reluctance of each section. (ii) MMF. (iii) Flux (φ) in the thickest section of the core. (iv) magnetic flux density (B) in the air gap. 	10
4.	Coil "A" and coil "B" lie in a parallel plane having 1500 and 2000 turns, respectively. A current of 5 A produces 0.6×10^{-4} Wb of flux in coil-A and the same amount of current produces 0.7×10^{-4} Wb of flux in coil-B. 30 % of flux from coil-A links the coil-B. Deteremine (i) self inductance of coil-A (ii) self inductance of coil-B (iii) mutual inductance between the coil (iv) coefficient of coupling between the coil. (v) What will be the maximum possible value of mutual inductance between the coil?	10

P.T.O.

5. (A) Perform the following code conversion and operation. 10

(i)Binary $(11101011)_2$ to decimal.

(ii) Hexadecimal $(1E2.23)_{16}$ to decimal.

(iii) Octal $(651.124)_8$ to hexadecimal condition

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(B)**F = A'BC+AB'C+ABC'+AB'C'+ABC+A'**

(i) Realize the given expression using logic gates

(i) Minimize the Boolean expression

Q-1 (i) $R = 5\,\Omega$, $X_L = 4.71\,\Omega$, $L = 15$ mH

(ii) $V_c = 133.65$ V, $C = 1.061 \times 10^{-3}$ F, $X_c = 3\,\Omega$

(iii) $\phi = 18.8°$ Lagging, $\cos\phi = 0.946$

(iv) $P = 9503$ Watt, $Q = 3250$ VAR

Q-2 (i) $V_{ph} = V_L = 440\angle 0°$, $440\angle -120°$, $440\angle -240°$

(ii) $I_{ph} = 44\angle -45°$ A

(iii) $\phi = 45°$ Lagging, $\cos\phi = 0.707$

(iv) $P = 41062$ Watt, $Q = 41068$ VAR, $S = 58060$ VA.

(v) current Lags by $45°$ (phasor)

Q-3 (i) $S_A = 159154.9\ H^{-1}$

$S_B = 19894.36\ H^{-1}$

$S_c = 795774.7\ H^{-1} \Rightarrow 31830.98$

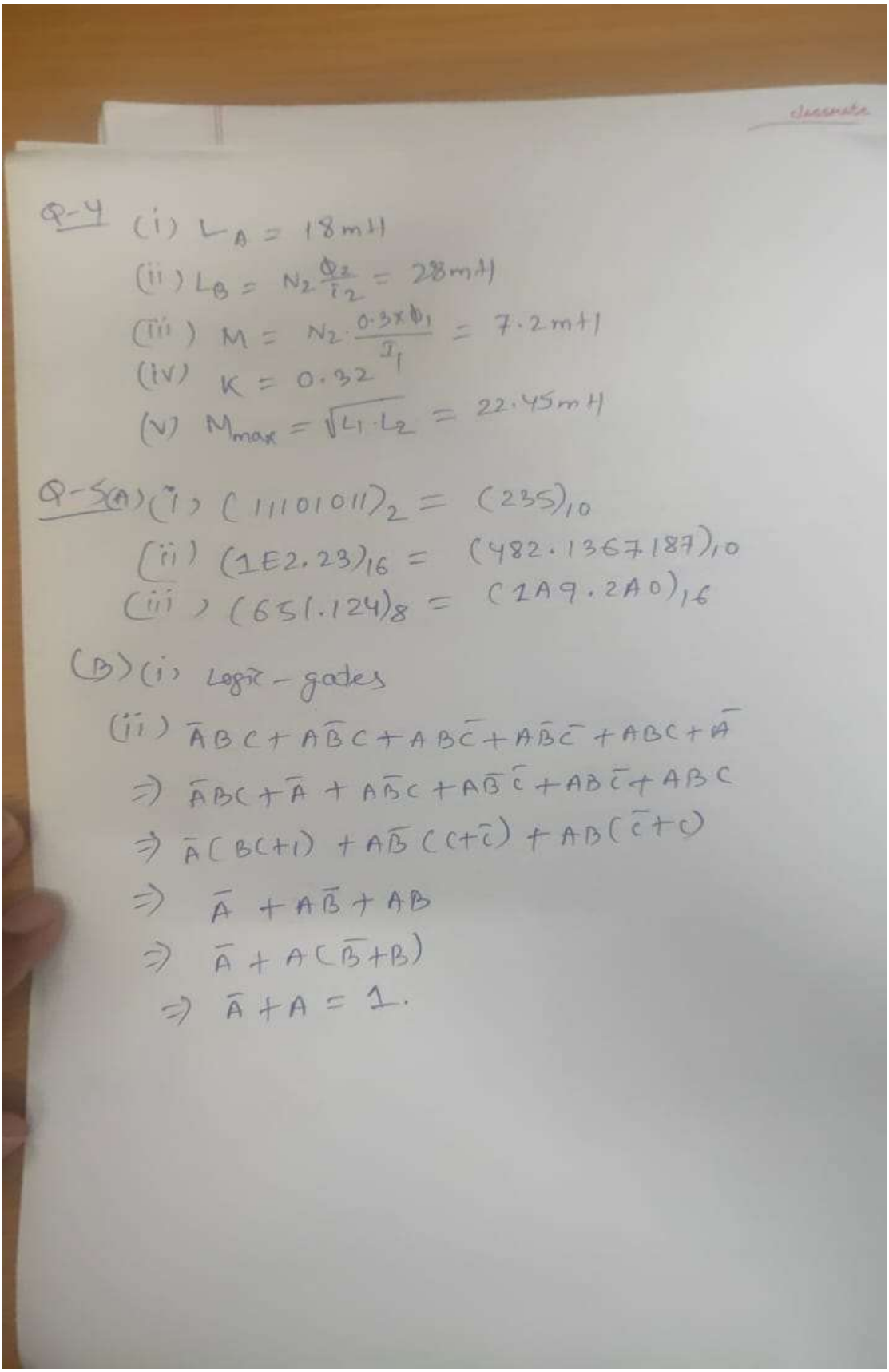
$S_{gap} = 1006654.94\ H^{-1}$ $\Rightarrow 795774.7\ H^{-1}$

$S = 1006654.94\ H^{-1}$

(ii) $Mmf = 200 \times 5 = 1000$ AT

(iii) $\phi_B = \frac{1000}{1006654.94} = 993.34\ \mu$Wb.

(iv) $B = \frac{\phi}{A} = \frac{993.34 \times 10^{-6}}{0.001} = 0.99334$ T



Q-4 (i) $L_A = 18mH$

(ii) $L_B = N_2 \frac{\phi_2}{i_2} = 28mH$

(iii) $M = N_2 \cdot \frac{0.3 \times \phi_1}{I_1} = 7.2mH$

(iv) $K = 0.32$

(v) $M_{max} = \sqrt{L_1 \cdot L_2} = 22.45mH$

Q-5(A) (i) $(11101011)_2 = (235)_{10}$

(ii) $(1E2.23)_{16} = (482.1367187)_{10}$

(iii) $(651.124)_8 = (1A9.2A0)_{16}$

(B) (i) Logic - gates

(ii) $\bar{A}BC + A\bar{B}C + AB\bar{C} + A\bar{B}\bar{C} + ABC + A\bar{C}$

$\Rightarrow \bar{A}BC + \bar{A} + A\bar{B}C + A\bar{B}\bar{C} + AB\bar{C} + ABC$

$\Rightarrow \bar{A}(BC+1) + A\bar{B}(C+\bar{C}) + AB(\bar{C}+C)$

$\Rightarrow \bar{A} + A\bar{B} + AB$

$\Rightarrow \bar{A} + A(\bar{B}+B)$

$\Rightarrow \bar{A} + A = 1.$