



School of Electrical Engineering

Fall Semester 2023-2024

Continuous Assessment Test – II

Programme Name & Branch: B.Tech. & Computer Science Engineering

Course Name & code: BEEE 102L Basic Electrical and Electronics Engineering

Class Number (s): VL2023240107743, VL2023240107792, VL2023240107798, VL2023240107760

Faculty Name (s): Dr. Janaki M, Dr.Arun N, Dr. Albert Alexander S, Dr. Mukul Chankaya

Exam Duration: 90 Min.

Maximum Marks: 50

Q.No.	Question	Max Marks	CO	BL
1.	<p>In a balanced three-phase Y-Y system, the source is an abc sequence of voltages and $V_{an}=120\angle 0^{\circ}$. The line impedance per phase is $1+j2 \Omega$ while the per-phase impedance of the load is $19+j13\Omega$. Calculate the line currents, neutral current, phase currents, phase voltages and line voltages.</p> <p>SOLUTION:</p> <p>a) line currents: $I_a = \frac{V_{an}}{Z_L + Z_Y} = \frac{120\angle 0^{\circ}}{(19+j13)(1+j2)} = \frac{120\angle 0^{\circ}}{20+j15} = 4.8\angle -36.87^{\circ} \text{ A}$ $I_b = I_a\angle -120^{\circ} = 4.8\angle -156.87^{\circ} \text{ A}$ $I_c = I_a\angle 120^{\circ} = 4.8\angle 83.13^{\circ} \text{ A}$</p> <p>b) neutral current: As a balanced system, $I_n=0$</p> <p>c) Phase currents are same as the line currents.</p> <p>d) Phase voltages: $V_{an}= 120\angle 0^{\circ}$, $V_{bn}= 120\angle -120^{\circ}$, $V_{cn}= 120\angle -240^{\circ}$</p> <p>e) line voltages: $V_{ab} = \sqrt{3}V_p\angle 30^{\circ} = \sqrt{3}\times 120\angle 0^{\circ} + 30^{\circ} = 207.85\angle 30^{\circ}$ $V_{bc} = V_{ab}\angle -120^{\circ} = 207.85\angle 150^{\circ}$ $V_{ca} = V_{ab}\angle +120^{\circ} = 207.85\angle 270^{\circ}$</p>	10	1	BL3

2. For the delta-delta circuit of Fig. 1, calculate the phase and line currents.

10

1

BL3

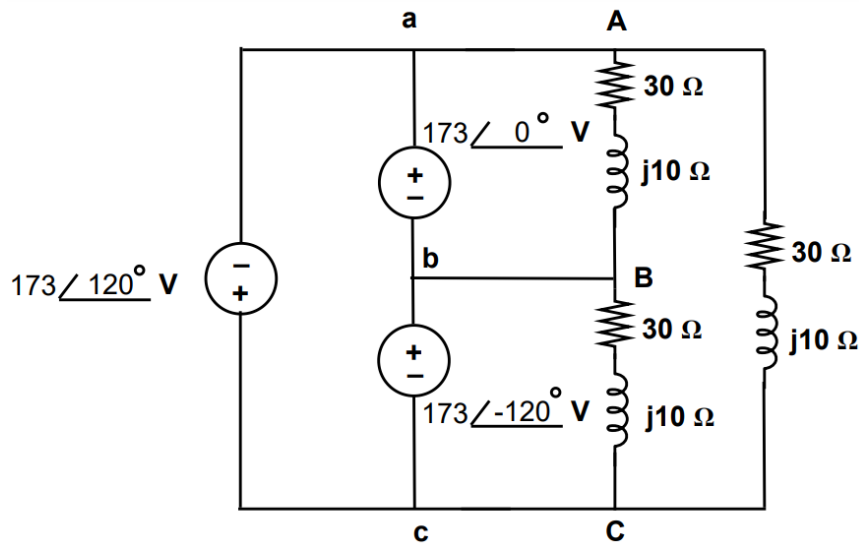


Fig.1

SOLUTION:

Phase currents:

$$\diamond I_{AB} = \frac{V_{AB}}{Z_{\Delta}} = \frac{173\angle 0^\circ}{30+j10} = \frac{173\angle 0^\circ}{31.62\angle 18.43^\circ} = 5.47\angle -18.43^\circ \text{ A}$$

$$\diamond I_{BC} = I_{AB}\angle -120^\circ = 5.47\angle -138.43^\circ \text{ A}$$

$$\diamond I_{CA} = I_{AB}\angle 120^\circ = 5.47\angle -101.57^\circ \text{ A}$$

Line currents:

$$\diamond I_a = I_{AB}\sqrt{3}\angle -30^\circ = 5.47\sqrt{3}\angle -48.43^\circ = 9.474\angle -48.43^\circ \text{ A}$$

$$\diamond I_b = I_a\angle -120^\circ = 9.474\angle -168.43^\circ \text{ A}$$

$$\diamond I_c = I_a\angle 120^\circ = 9.474\angle 71.57^\circ \text{ A}$$

3. a) Fill the table with aid of number base conversions:

5

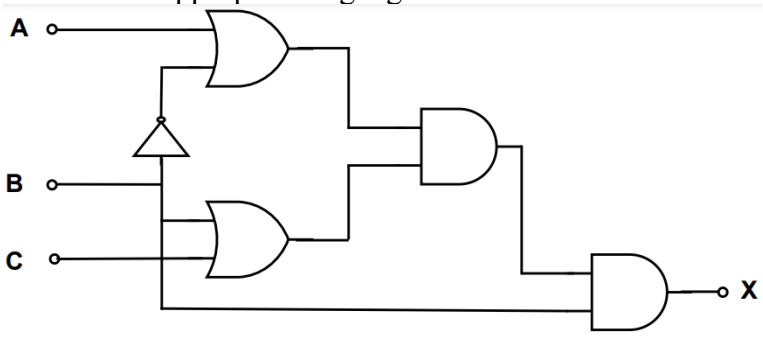
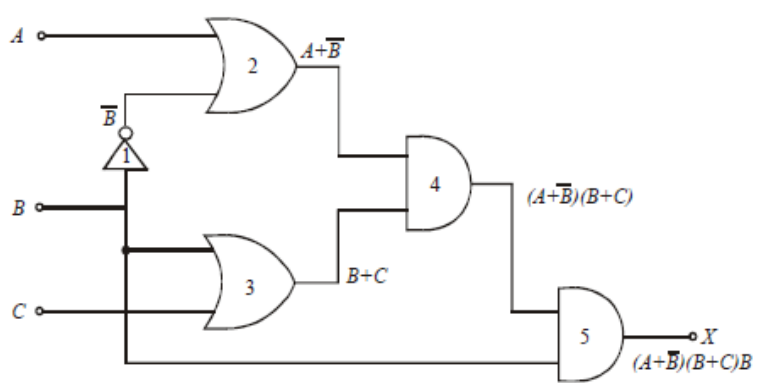
4

BL3

Decimal	Binary	Octal	Hexa-decimal
225.225	?	?	?
?	11101.111100	?	?
?	--	3.07	?

SOLUTION:

Decimal	Binary	Octal	Hexa-decimal
225.225	11100001. 00111	341.16316	E1.39
29.9375	11101.111100	35.74	1D.F
3.109375	11.000111	3.07	3.1C

	<p>b) Determine the Boolean expression for the output, X of a logic circuit shown in Fig.2. For the obtained expression simplify it and implement the same with the appropriate logic gate.</p>  <p style="text-align: center;">Fig.2</p> <p>SOLUTION:</p>  $X = (A + \bar{B})(B + C)B$ <p>Apply distributive law: $X = (A + \bar{B})(BB + CB)$ $X = (A + \bar{B})(B + CB)$ since, $BB = B$</p> <p>Apply $A + AB = A$: $X = (A + \bar{B})B$</p> <p>Apply distributive law: $X = AB + \bar{B}B$ $X = AB$ since, $B\bar{B} = 0$</p> <p>The minimized expression can realize using an AND gate</p>	5	4	BL3
4.	<p>a) Transform each of the following canonical expressions into other canonical form in decimal notation and express its simplified form in decimal notation.</p> <p>(i) $f(x, y, z) = \sum m(0, 1, 3, 4, 6, 7)$ (ii) $f(w, x, y, z) = \pi M(0, 1, 2, 3, 4, 6, 12)$</p> <p>SOLUTION:</p> <p>(i) Given: The expression $f(x, y, z) = \sum m(0, 1, 3, 4, 6, 7)$ There are three variable x, y, z Then the total number of term $2^3 (= 8)$. The given expression is SOP, it contains six term from the total number of term. So, the POS form contain remaining two terms, 2 and 5. The POS form of expression is given below: $f(x, y, z) = \pi M(2, 5)$</p>	5	4	BL3

	<p>(ii) Given: The expression $f(w, x, y, z) = \pi M(0, 1, 2, 3, 4, 6, 12)$ There are four variables w, x, y, z, then the total number of term $2^4 (= 16)$. The given expression is POS, it contains seven term from the total number of term. So the SOP form contain remaining nine terms, 5, 7, 8, 9, 10, 11, 13, 14 and 15. The SOP form of expression is given below: $f(w, x, y, z) = \sum m(5, 7, 8, 9, 10, 11, 13, 14, 15)$</p>																											
	<p>Find the equivalent POS for the expression: $F = AC + AB + BC$. SOLUTION: Standard SOP: $ABC + A\bar{B}C + ABC + AB\bar{C} + ABC + \bar{A}BC$ $= (111, 101, 110, 011) = 7, 5, 6, 3$ POS: $0, 1, 2, 4 = (000, 001, 010, 011)$ $= (\bar{A} + \bar{B} + \bar{C})(\bar{A} + \bar{B} + C)(\bar{A} + B + \bar{C})(\bar{A} + B + C)$</p>	5	4 BL3																									
5.	<p>Using K-map realize the following expression using minimum number of gates $Y = ABCD + \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}B\bar{C} + AB$. SOLUTION: $= ABCD + AB'C'D' + AB'C(D + D') + AB(C + C')(D + D')$ $= ABCD + AB'C'D' + AB'CD + AB'CD' + (ABC + ABC')(D + D')$ $= ABCD + AB'C'D' + AB'CD + AB'CD' + ABCD + ABC'D + ABCD' + ABC'D'$ $= ABCD + AB'C'D' + AB'CD + AB'CD' + ABC'D + ABCD' + ABC'D'$</p> <div style="text-align: center;"> <table border="1" style="border-collapse: collapse; margin: auto;"> <tr> <td></td> <td style="padding: 2px;">$C'D'$</td> <td style="padding: 2px;">$C'D$</td> <td style="padding: 2px;">CD</td> <td style="padding: 2px;">CD'</td> </tr> <tr> <td style="padding: 2px;">$A'B'$</td> <td style="width: 30px; height: 30px;"></td> <td style="width: 30px; height: 30px;"></td> <td style="width: 30px; height: 30px;"></td> <td style="width: 30px; height: 30px;"></td> </tr> <tr> <td style="padding: 2px;">$A'B$</td> <td style="width: 30px; height: 30px;"></td> <td style="width: 30px; height: 30px;"></td> <td style="width: 30px; height: 30px;"></td> <td style="width: 30px; height: 30px;"></td> </tr> <tr> <td style="padding: 2px;">AB</td> <td style="width: 30px; height: 30px; text-align: center;">1</td> <td style="width: 30px; height: 30px; text-align: center;">1</td> <td style="width: 30px; height: 30px; text-align: center;">1</td> <td style="width: 30px; height: 30px; text-align: center;">1</td> </tr> <tr> <td style="padding: 2px;">AB'</td> <td style="width: 30px; height: 30px; text-align: center;">1</td> <td style="width: 30px; height: 30px;"></td> <td style="width: 30px; height: 30px; text-align: center;">1</td> <td style="width: 30px; height: 30px; text-align: center;">1</td> </tr> </table> </div> <p style="text-align: right; margin-top: 10px;">$AB + AC + A\bar{D}$</p>		$C'D'$	$C'D$	CD	CD'	$A'B'$					$A'B$					AB	1	1	1	1	AB'	1		1	1	10	4 BL3
	$C'D'$	$C'D$	CD	CD'																								
$A'B'$																												
$A'B$																												
AB	1	1	1	1																								
AB'	1		1	1																								