VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)
Vellore – 632014, Tamil Nadu, India

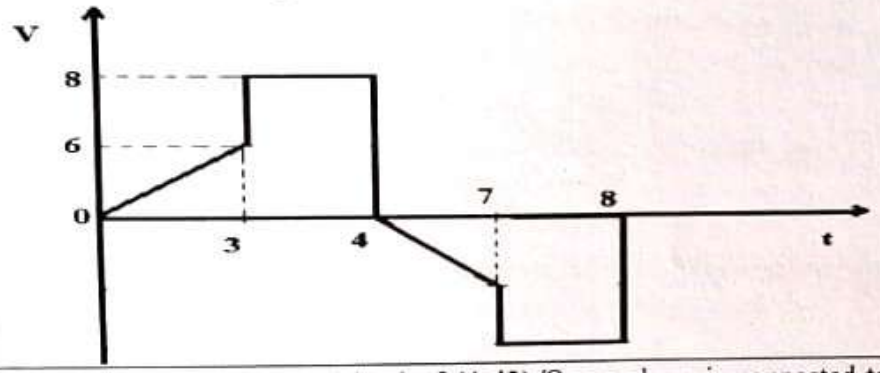
**SLOT: A1+TA1**

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

Programme Name & Branch : B. Tech. Course Code: BEEE102L
Course Name : Basic Electrical and Electronics Engineering
Faculty Members : Dr Washima Tasnin, Dr. Raja Singh, Dr. Satyajit Das, Dr. Satyajit Mohanty, Dr. Kalaiselvan N
Class Number(s) : 7767, 7761, 7773, 7857, 7878
Date of the Examination : 15-10-2023

**Duration : 90 minutes** **Max. Marks : 50**

**General instruction(s): Answer All the Questions**

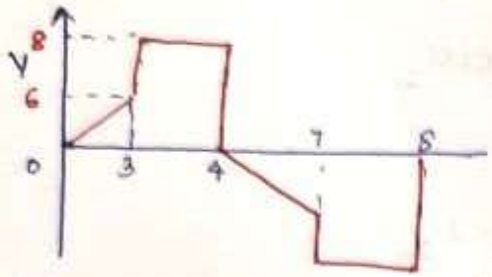
| Q. No | Question | Mark |
|---|---|---|
| 1. | A voltage wave has variations as shown in Figure below. Find the average value, effective value, form factor and peak factor.   | 10 |
| 2 | A balanced star connected load of (4+j3) Ω per phase is connected to a balanced 3- phase 400V supply. The phase current is 12 A. Find the (i) Total active power (ii) Reactive power (iii) Total apparent power | 10 |
| 3 | a. Determine xx and reduce the following number system<br>(i) $(756)_{10}$ - $(432)_8$ + $(4FA)_{xx}$ = (____)$_2$<br>(ii) $(4DC)_{16}$ + $(537)_2$ + $(523)_{16}$ = (____)$_2$<br><br>b. Draw the logic circuits for the expression: A'B+ ABC'+ AB'C'+AC | 10 |
| 4 | a. Reduce the Boolean expression using Boolean rules<br>A'BC + AB'C'+ A'B'C'+AB'C+ABC<br>b. Minimize the following Boolean function using K-map<br>F(A, B, C, D) = Σm (0, 1, 2, 5, 7, 8, 9, 10, 13, 15) | 10 |
| 5 | Design a combinational circuit to add three-bit binary numbers namely A, B and C using K-map. Also, draw its logic diagram using AND and OR gates. | 10 |

# CAT - II

BEEE102L Answer Key Basic Electrical and Electronics Engineering

class Number(s) : 7767 , 7761
7773 , 7857 , 7878

1.




Average Value : $\frac{\text{Area under the half cycle}}{\text{Period}}$

$= \frac{(\text{Area of triangle} + \text{Area of Rectangle})}{\text{Period}}$

$= \left[\frac{1}{2} \cdot bh + b \cdot h\right] / 4$

$= \frac{1}{2}(3 \times \frac{3}{6}) + (1 \times 8) / 4$

$= 17/4 = 4.25\ V$

Effective Value (RMS) $= \sqrt{\frac{\text{Area under the Squared half the cycle}}{\text{Period}}}$

$=$ Area under the squared triangle wave + Area under the squared rectangle wave

$= \sqrt{\frac{(\frac{1}{3} \times 6^2 \times 3) + (1 \times 8^2)}{4}}$

$= \sqrt{\frac{100}{4}} = 5V$

Form Factor $= \frac{V_{RMS}}{V_{Avg}} = \frac{5}{4.25} = 1.176$

Peak Factor $= \frac{\text{Maximum Value}}{\text{RMS Value}} = \frac{8}{5} = 1.6$

2. Star Connected

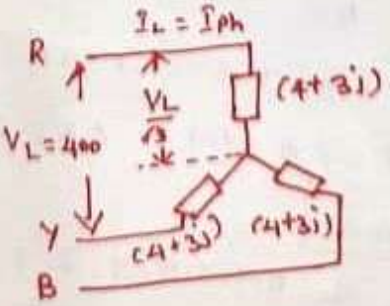
$Z = 4 + 3j$ ; $V = 400V$ Supply

$V_L = \sqrt{3} V_{ph}$ $I_L = I_{ph} = 12A$

$V_{ph} = \frac{V_L}{\sqrt{3}} = \frac{400}{\sqrt{3}} = 231\ V$

$Z_{ph} = 4 + 3j = 5 \angle 36.86^\circ$

$\phi = 36.86^\circ \Rightarrow \cos(36.86^\circ) = 0.8$




(1) Total active power $= \sqrt{3} V_L I_L \cos\phi$

$= \sqrt{3} \cdot 400 \cdot 12 \cdot \cos 36.86 = 6.65\ kW$

(ii) $Q = \sqrt{3} V_L I_L \sin\phi$

$= \sqrt{3} \cdot (400)(12) \sin 36.86 = 4.9$ KVAR

(iii) $S = \sqrt{3} V_L I_L$

$= \sqrt{3} \cdot 400 \cdot 12 = 8.31$ kVA

(3) (i) $(756)_{10} - (432)_8 + (4FA)_{XX} = (-)_2$

$1011110100_2 - 100011010_2 + 10011111010_2$

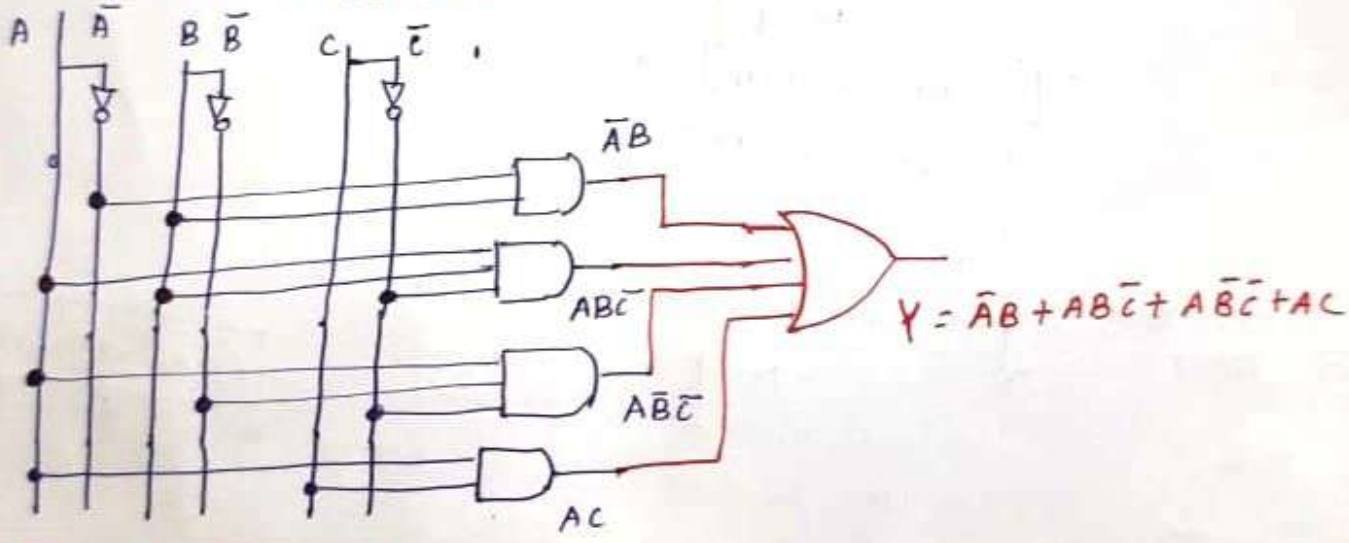
$= 011011010100_2$

(ii) $(ADC)_{16} + (537)_2 + (523)_{16} = (-)_2$

$010011011100_2 + 100001100l_2 + 101001000ll_2$

$= 011000001l000_2$

(b) $\bar{A}B + AB\bar{C} + A\bar{B}\bar{C} + AC$




(4) Reduce the Boolean Expression using boolean Rules

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

$\bar{A}BC + AB\bar{C} + A\bar{B}\bar{C} + \bar{A}B\bar{C} + A\bar{B}C + ABC$ $\quad [\because AB\bar{C} = AB\bar{C} + AB\bar{C}]$

$BC[\bar{A}+A] + B\bar{C}$

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

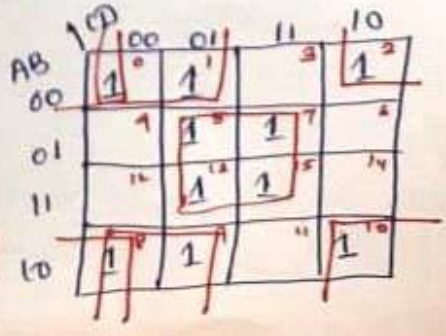
$BC(A+\bar{A}) + B\bar{C}(\bar{A}+A) + A\bar{B}(C+\bar{C})$

$\therefore A+\bar{A} = 1$

$C+\bar{C} = 1$

$\boxed{BC + B\bar{C} + A\bar{B}}$

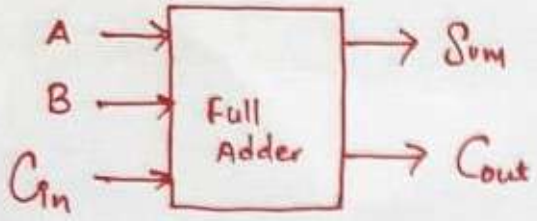
(b) $F(A,B,C,D) = \Sigma m(0,1,2,5,7,8,9,10,13,15)$




$\boxed{Y = \bar{B}\bar{D} + BD + B\bar{C}}$

(5) Three bit Full Adder [Won Combination with 3 min term]

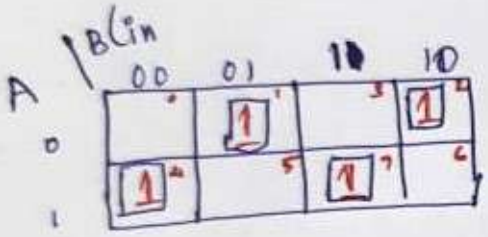
5. Full Adder




Truth Table

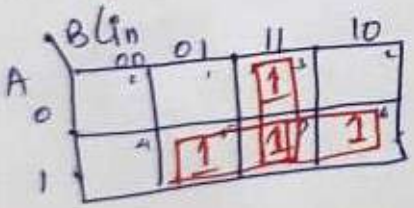
| | Input | | | output | |
|---|---|---|---|---|---|
| | A | B | Cin | Sum | Cout |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 | 0 |
| 2 | 0 | 1 | 0 | 1 | 0 |
| 3 | 0 | 1 | 1 | 0 | 1 |
| 4 | 1 | 0 | 0 | 1 | 0 |
| 5 | 1 | 1 | 0 | 0 | 1 |
| 6 | 1 | 0 | 1 | 0 | 1 |
| 7 | 1 | 1 | 1 | 1 | 1 |

Logical Expression For Sum




$S = \bar{A}\bar{B}C_{in} + \bar{A}B\bar{C}_{in} + A\bar{B}\bar{C}_{in} + ABC_{in}$

Logical expression for Carry




$C = AC_{in} + AB + BC_{in}$