

DATE:

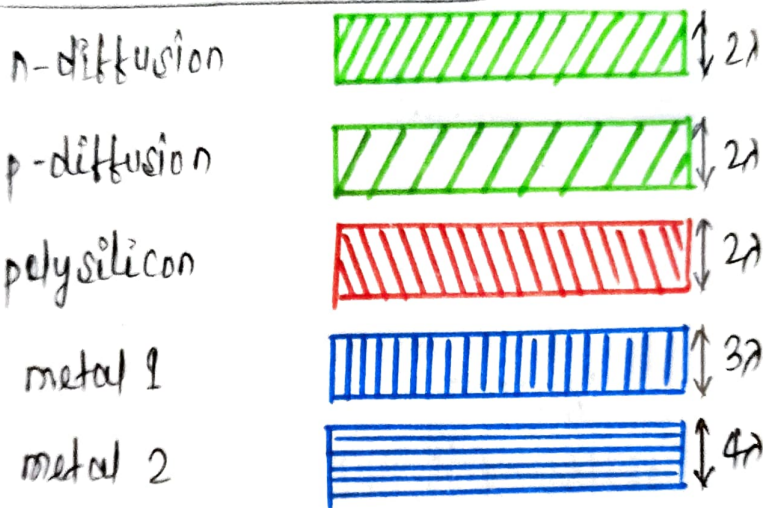
IAT-2

05/11/20

Q1 List and explain λ -based design rules for PMOS, NMOS and CMOS logic diagrams.

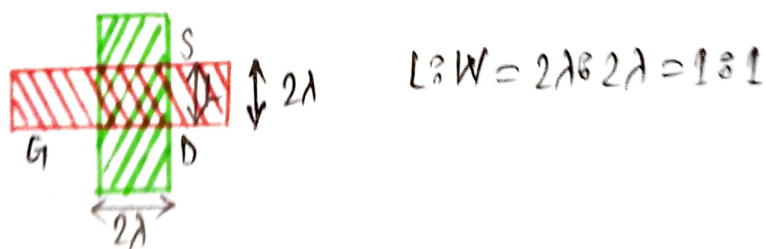
Ans: Lambda based design rules for NMOS and CMOS process:

(i) Minimum width of layers

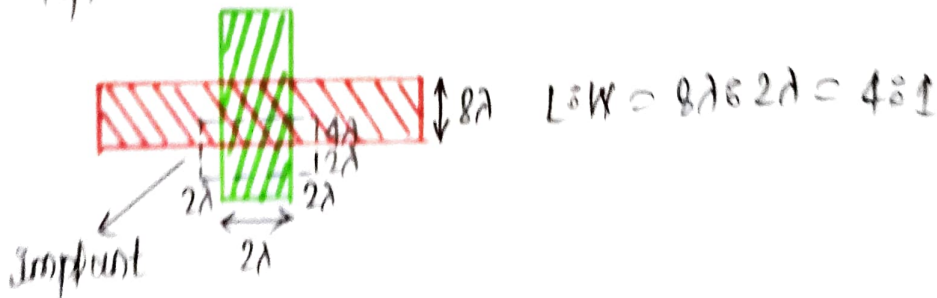


(ii) Overlap of layers

enhancement transistor



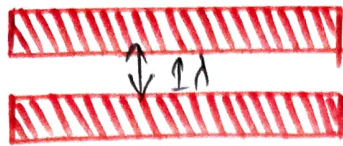
depletion transistor



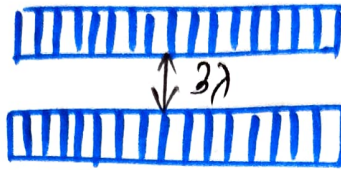
(iii) Rules of separation



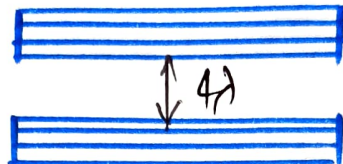
poly-poly



metal 1 - metal 1

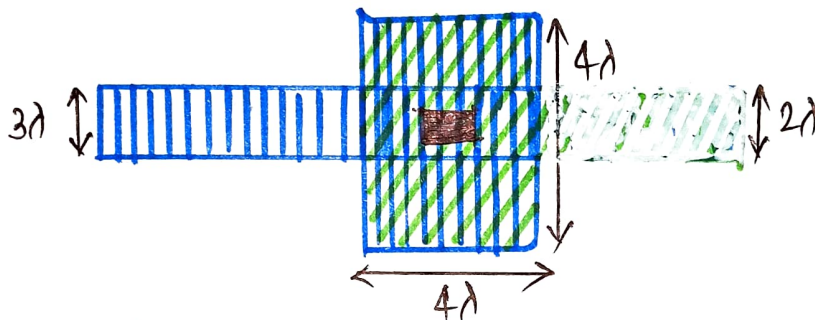


metal 2 - metal 2

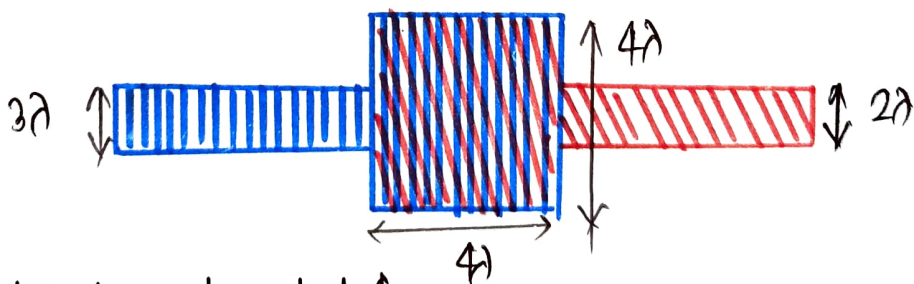


(iv) Contact cuts

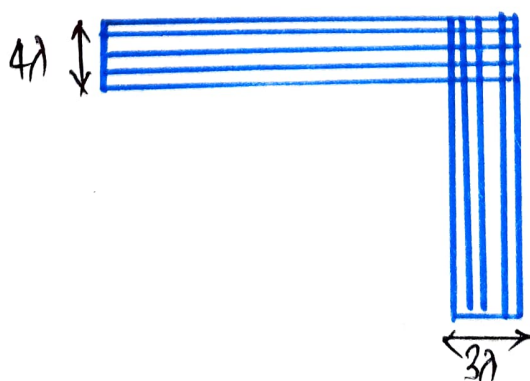
metal to diffusion, poly to metal



poly to metal



metal 2 and metal 1



Q12 Apply the schematic stick diagram for $y = \overline{A}\overline{B} + ABC$ using both NMOS and CMOS design.

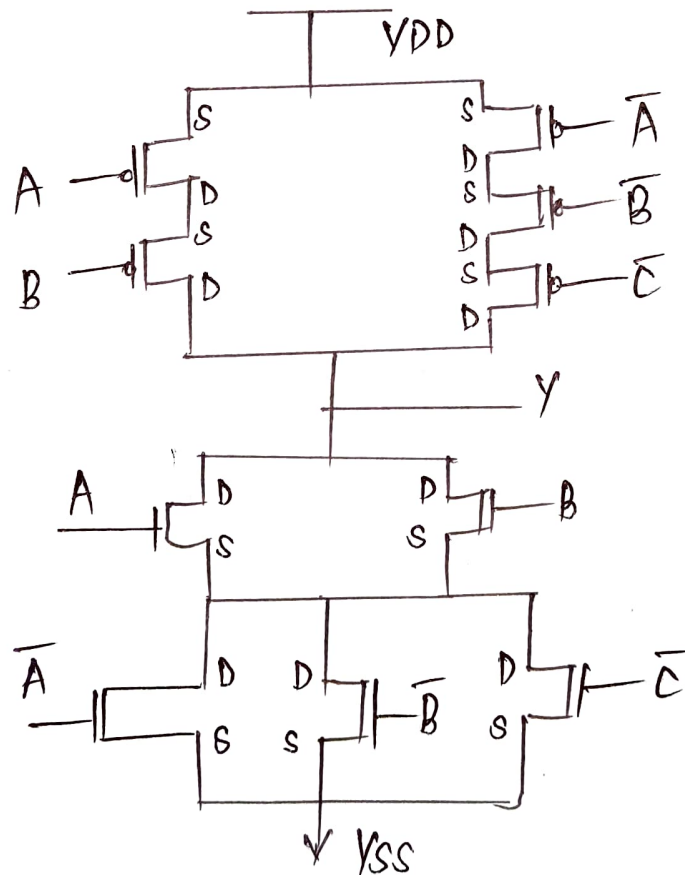
Ans: $y = \overline{A}\overline{B} + ABC$

using de morgan's theorem's

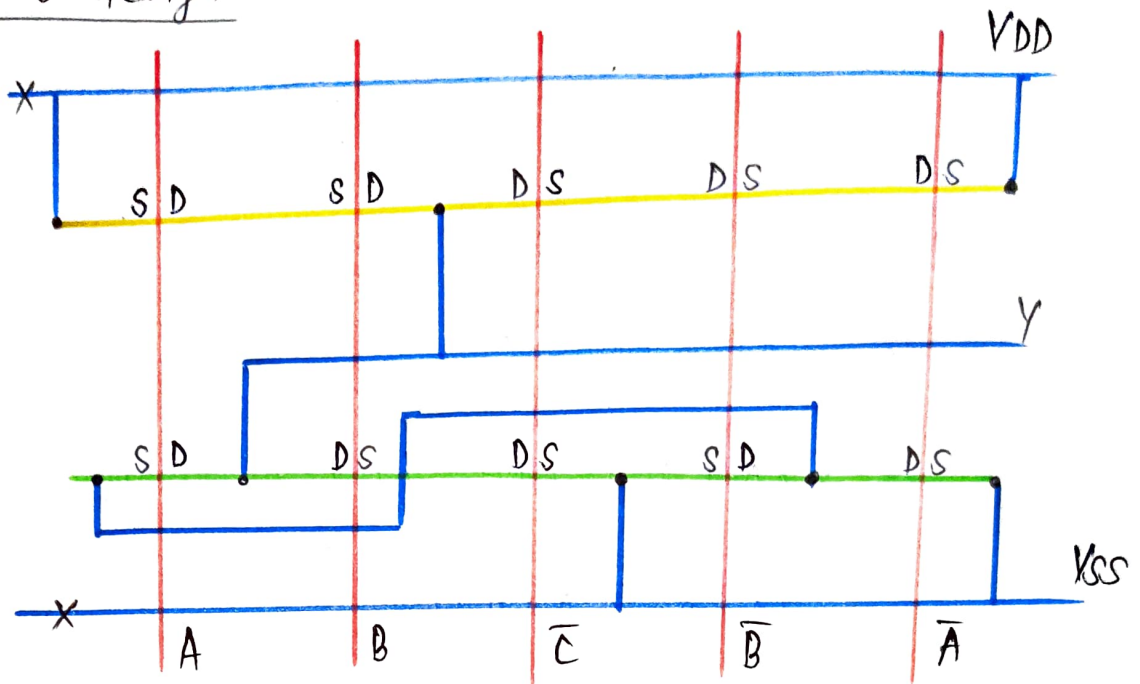
$$y = \overline{\overline{\overline{A}\overline{B} + ABC}} = \overline{\overline{A}\overline{B} \cdot ABC}$$

$$= \overline{(\overline{\overline{A} + \overline{B}}) \cdot (\overline{A + B + C})}$$

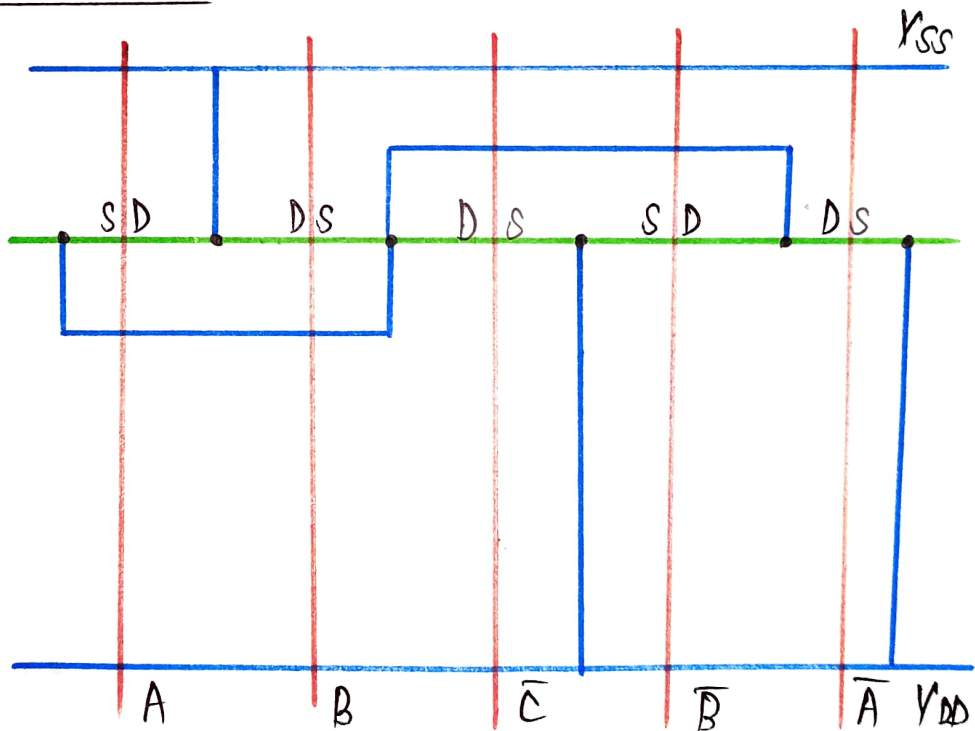
$$y = (A + B) (\overline{A} + \overline{B} + \overline{C})$$



CMOS design
















NMOS design



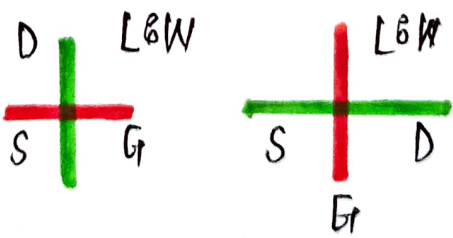
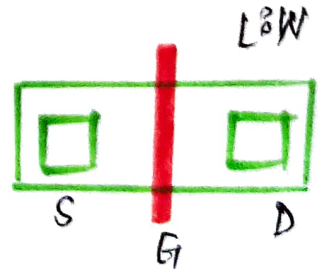
Q13

List the colour coding, mask layout encoding and CIF layers for different layers used.

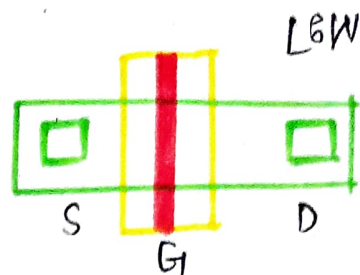
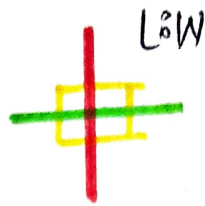
Ans

colour	stick encoding	layer	mask encoding	CIF layer
Green		n-diffusion		ND
Red		polysilicon		NP
Blue		metal 1		NM
Black		contact cut		NC
Gray	N/A	overglass		NG
Yellow		implant		NI
Brown		buried contact		NB

Stick diagrams are used to convey layer information through the use of color code.

Feature	Feature (stick)	Feature (symbol)
n-type enhancement mode transistor		

n-type depletion mode transistor (nmos only)

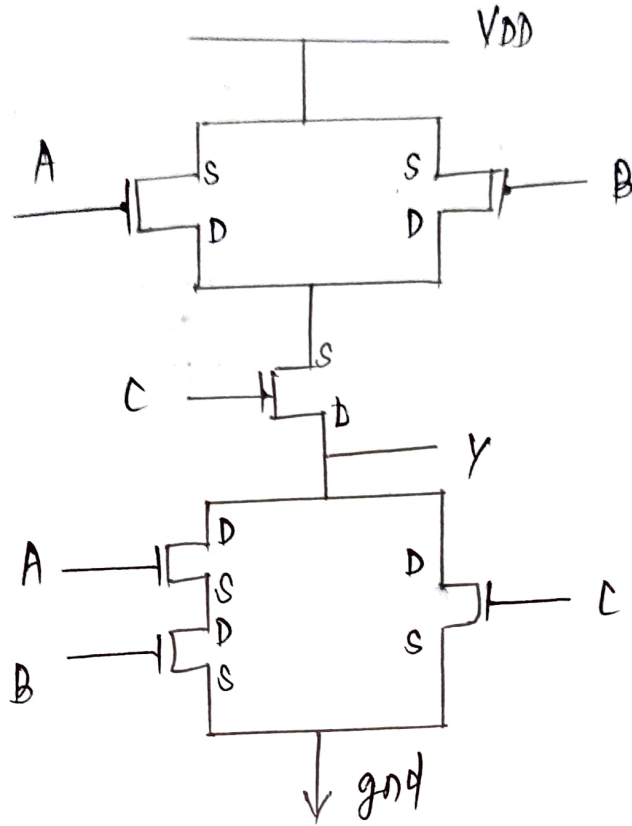


L/W = Transistor length to width ratio
encoding for CMOS process

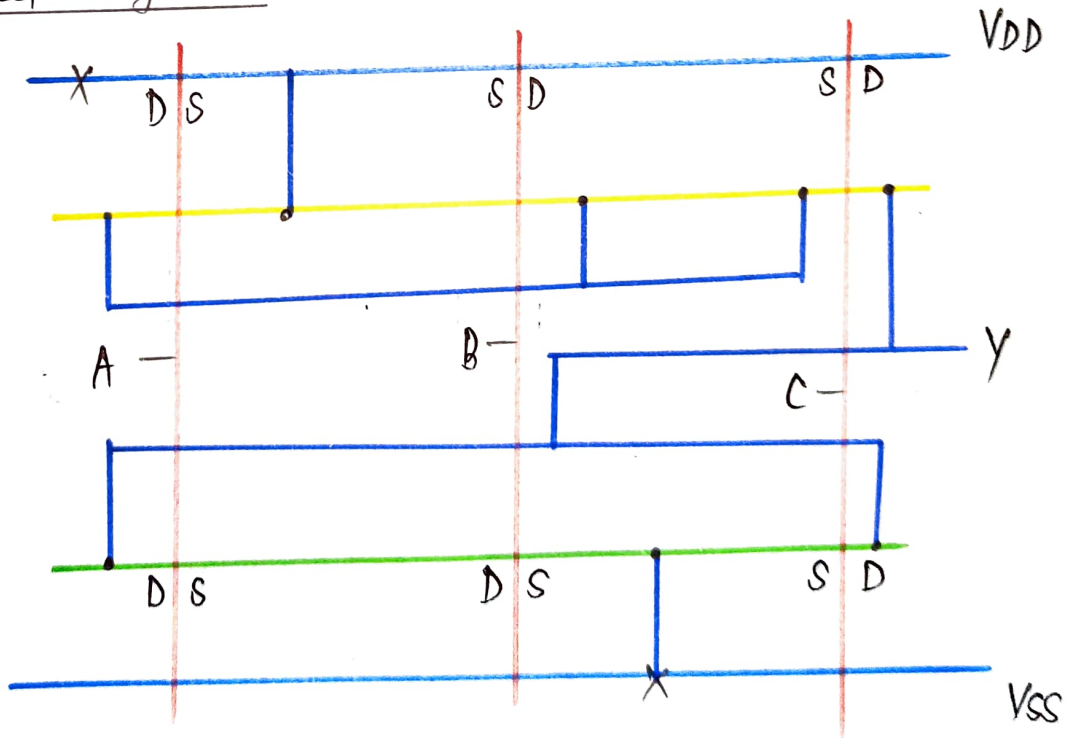
colour	stick encoding	layers	mask layout	CIF layer
green		n diffusion	thin ox = n diff. p diff + transistor	CAA or CNA
red		polysilicon		CPF
blue		metal 1		CMF
black		contact cut		CC
yellow stick		p diffusion (pt active)		CAA or CPA
yellow		pt mask		CPP
dark blue		metal 2		CMS
black				CVA
brown		p well		CPW
black	X	VDD or VSS		CC

Q4 Draw schematic circuit, stick diagram and layout for $Y = AB + C$ using CMOS design.

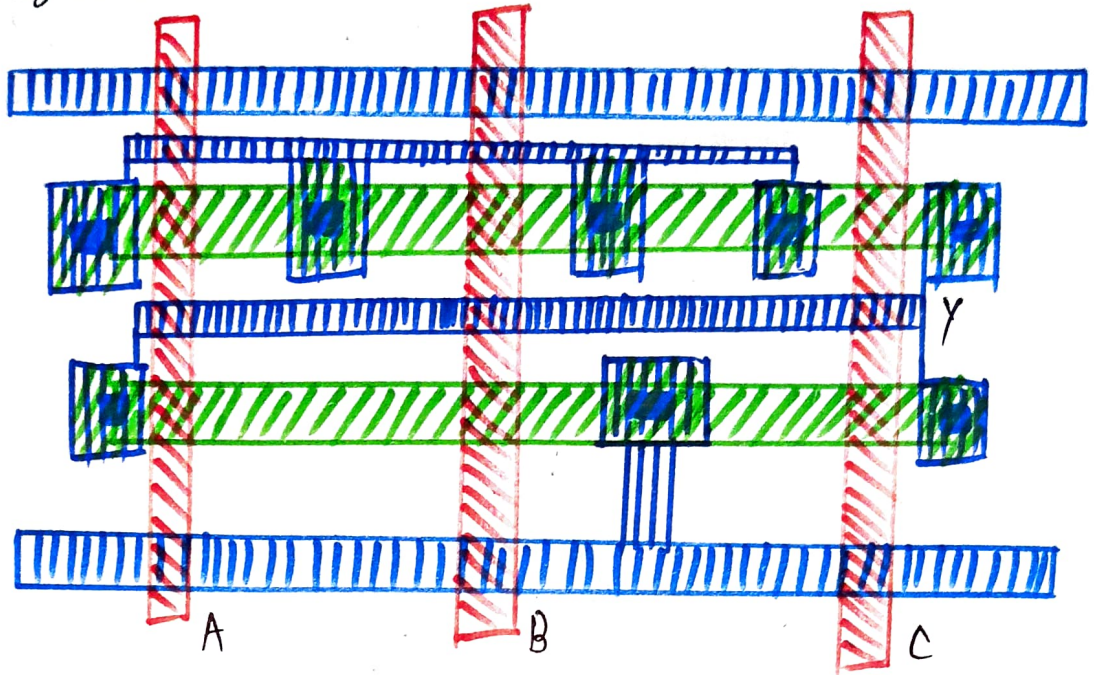
Ans:



Stick diagram

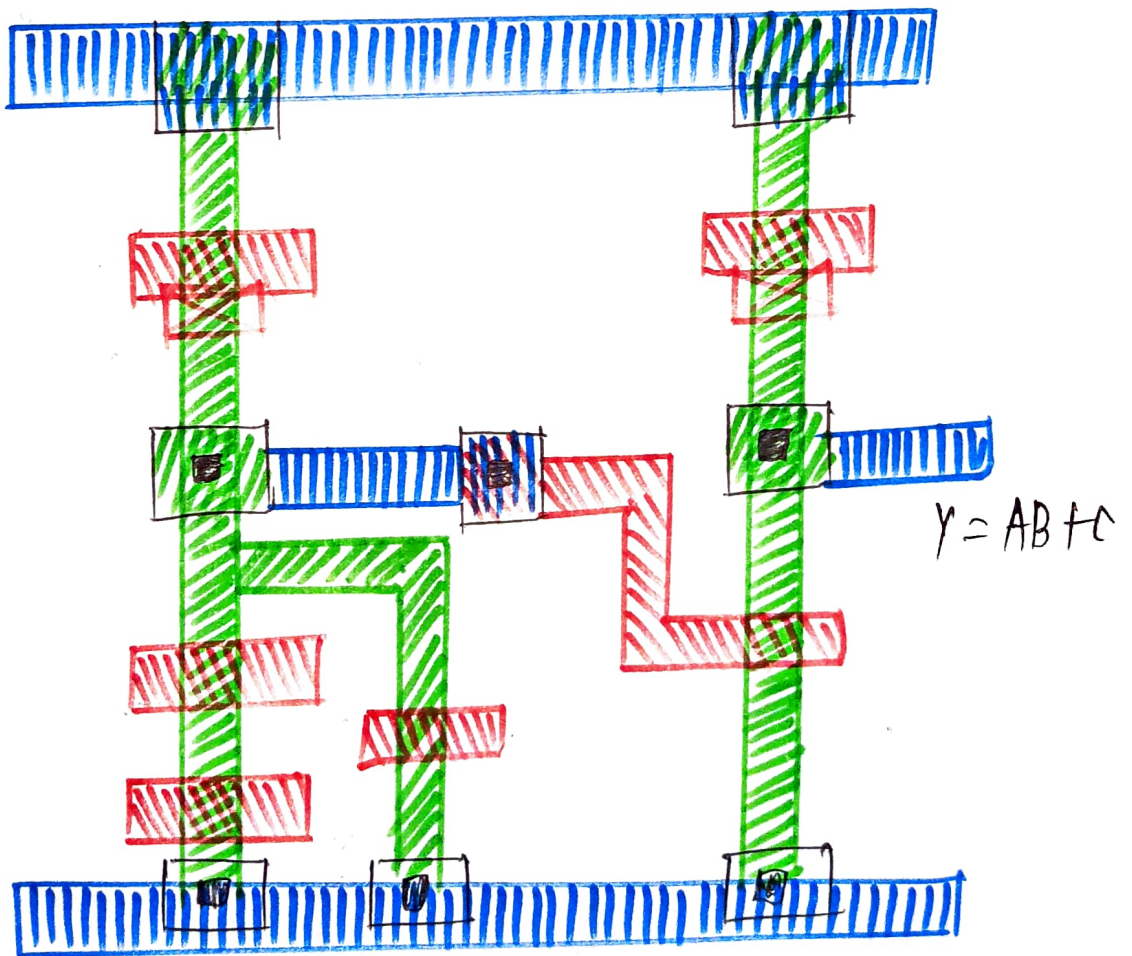


layout diagram

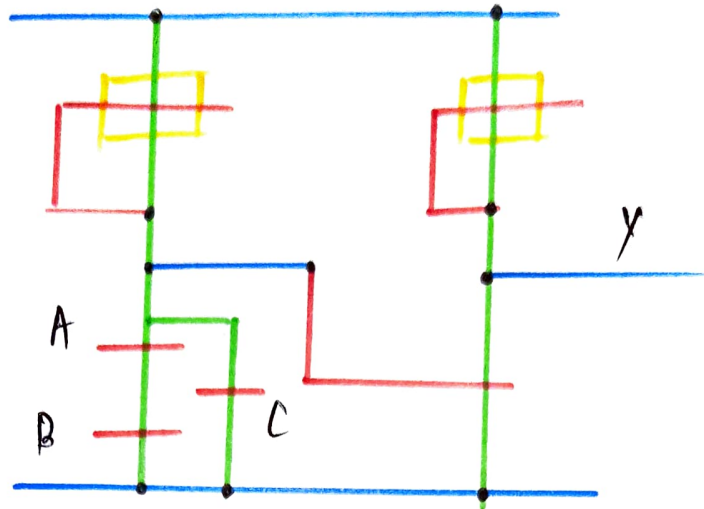


Q15 Draw schematic diagram of $Y = AB + C$ using NMOS design.

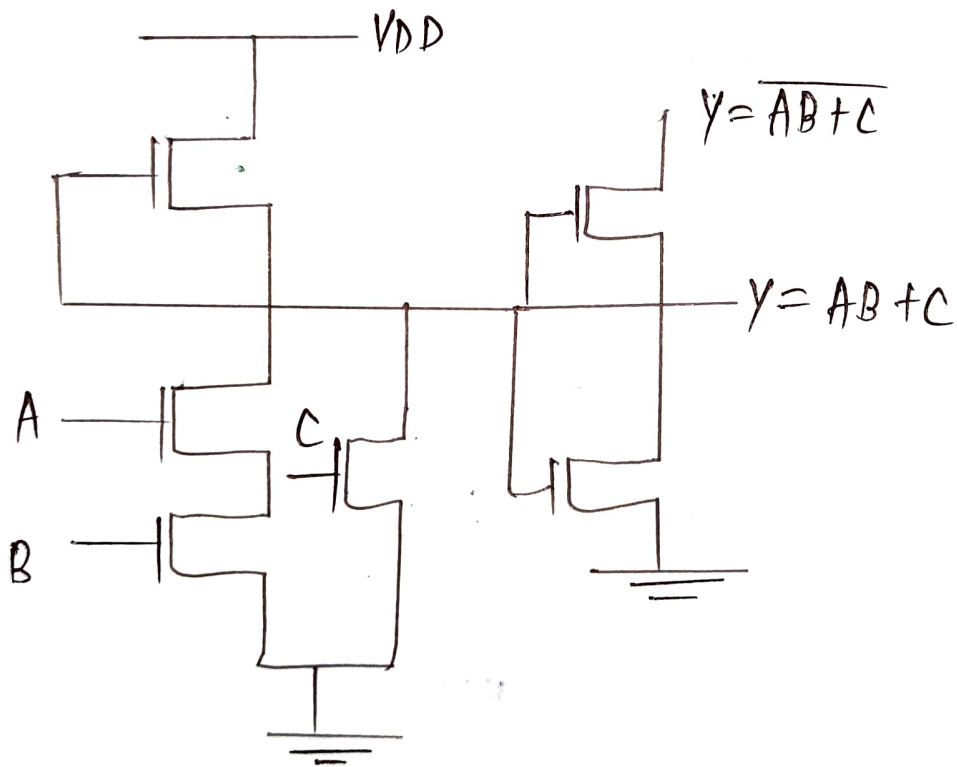
ANSR



mask layout diagram

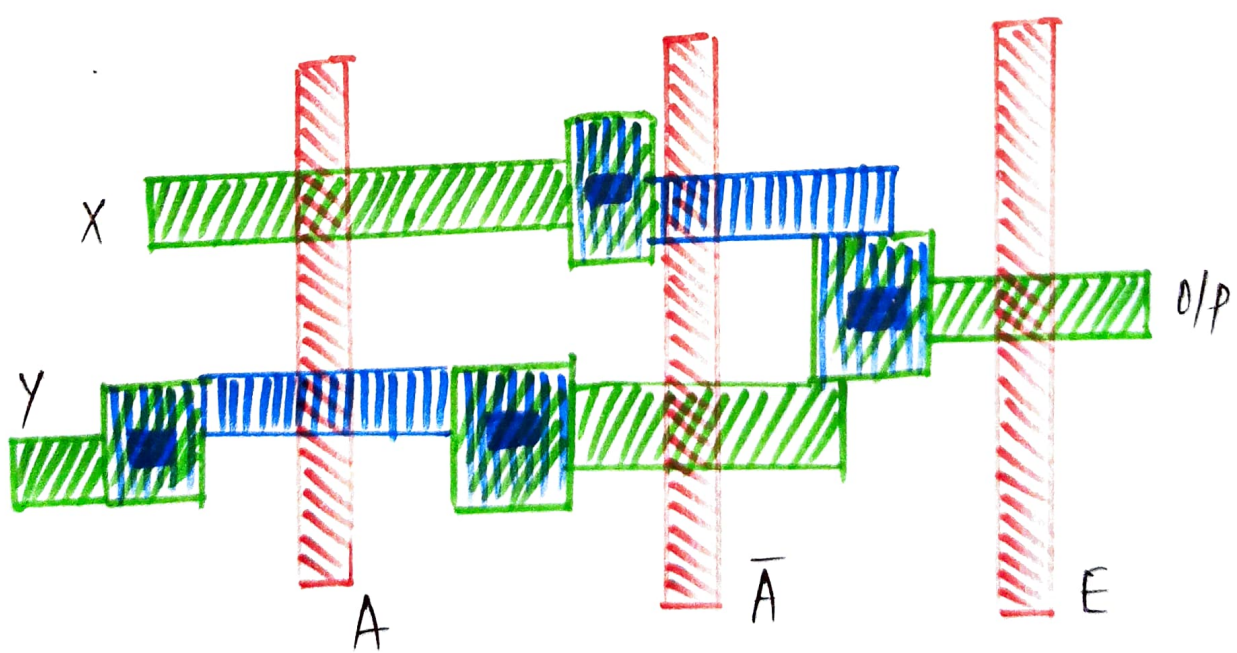
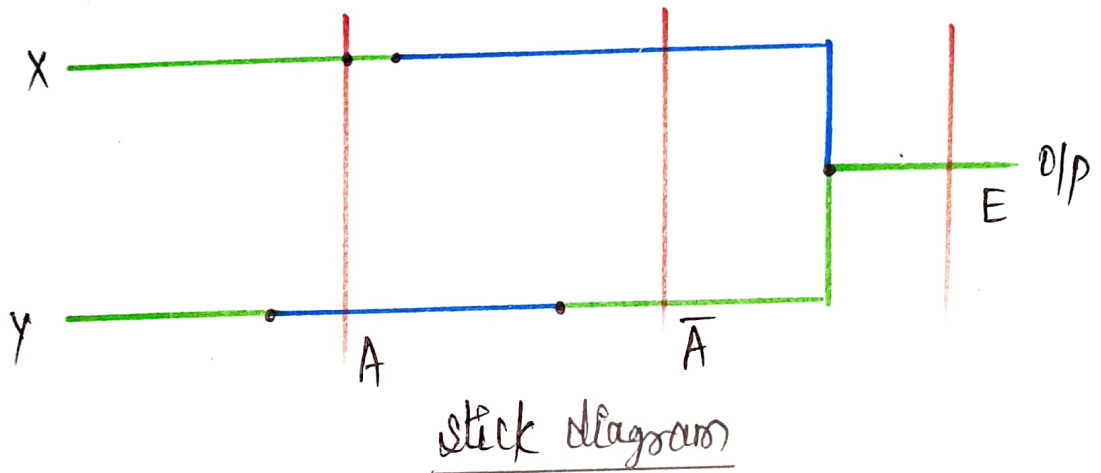
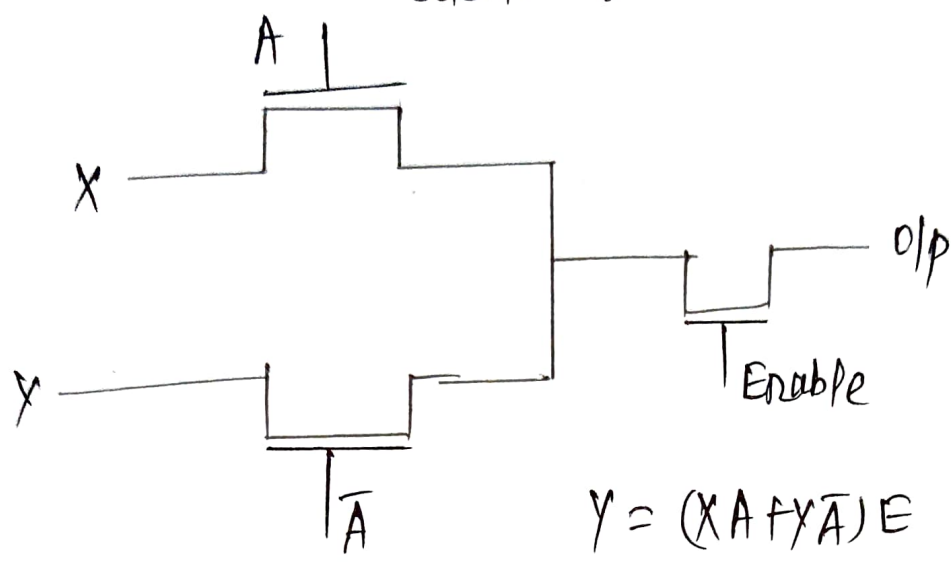


stick diagram



Q16 Draw circuit diagram, stick diagram and layout of two way selector with enable

Ans



mask layout diagram