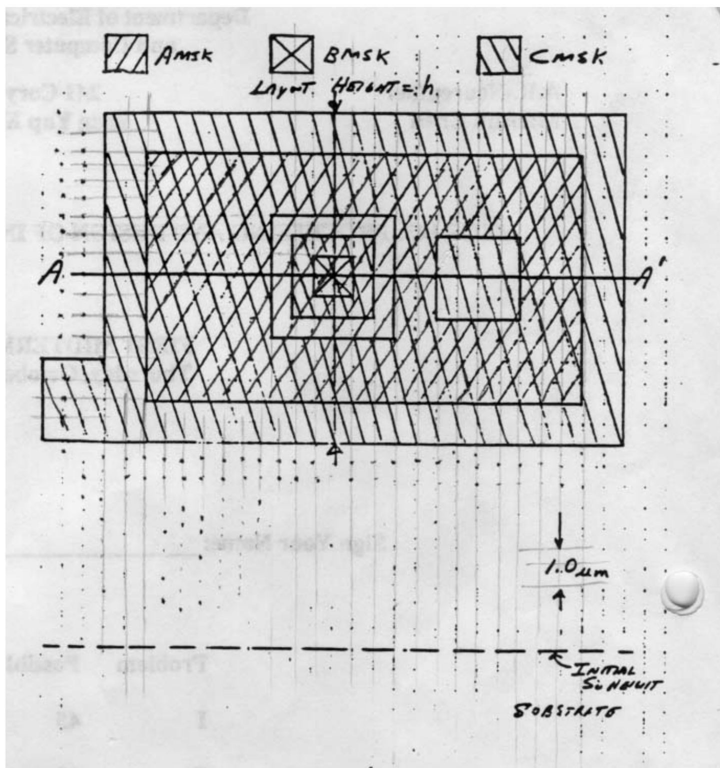
EECS 143: Processing And Design of Integrated Circuits
FALL 1992

Midterm 1
Thursday, October 1, 1992

Total: 150 points

Note: "......" means unreadable

(25 points)
1. a) ....dow and 3 mask layout given below are used to fabricate a device. Sketch the cross section of this device along the 'cut-line' AA'.



Substance	Process	Parameter(s)
0	Substants	P-type 10^16 cm-3
1	Oxidation	1.0 um

2	Lithography	AMSK Neg Resist
3	Etch	Oxide 1.0 um
4	Oxidation	0.05 um
5	Ion Implant	As Xj = 0.25 um
6	Lithography	BMSK Neg Resist
7	Etch	Oxide 0.05 um
8	Deposit	AR 1.0 um
9	Lithography	CMSK Pos Resist
10	Etch	AR 1.0 um

Design Rules	
Waa = 2 lambda2	Eab = lambda1 + lambda5
Saa = 2 lambda2	Eac = lambda1 + lambda6
Wb = 2 lambda3	Eba = lambda1 + lambda7
Sbb = 2 lambda3	Ebc = lambda1 + lambda8
Wc = 2 lambda4	Eca = lambda1 + lambda5
Scc = 2 lambda4	Ecb = lambda1

(20 Poinst)

b) Find the minimum height 'h' first in terms of W's and E's and then as a function of lambda1, lambda2, ..., lambda8.

(2) (30 Points) LITHOGRAPHY

a) An x-ray source .... A is available for proximity contact printing. At 1 mil (25.4 um) separation what will be the working resolution.

b) It is rumored in industry that for a fixed wavelength the total focal range decreases as an algebraic power of the working resolution i.e. k-sub-3 * R^alpha.Find alpha and k-sub-3 as a function of k1, k2, and lambda. Use your result to determine the resolution at which the total focal range is 1 um for the case of k1=0.5, k2=1.5 and lambda=0.2 um.

3) (35 Points) OXIDATION

a) A dry oxidation of <100> ....ried out at 1100 C results in an oxide thickness of 0.4 um. What was the initial oxide thickness. (Hint: A graphical solution is probably quickest.)

b) What is the oxide growth rate in um/hr when the oxide reaches a thickness of 0.4 um? (Hint: Try an algebraic approach.)

c) Is it possible for the oxide thickness growth to be directly proportional to pressure when the surface reaction rate k is independent of pressure? Give an explanation to support your answer.

4) (40 Points) ION IMPLANT

a) Find the implant voltage, implant dose, and reaction depth for an As implant with Rp=0.1 um, Np=10^20 cm-3, and Nb=4x10^15.

b) An SiO2 layer is to be used as an amorphous layer to reduce channeling. What is the maximum thickness which could be used and still result in 98% of the As going into the silicon.

c) Estimate the gate length for which the cross-gate contribution from the source implant would contribute 10% to the drain implant at the drain end of the inversion layer. Use the data from part a) and do not include the SiO2 from part b).

END OF EXAM