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HirasugarInstitute of Technology, Nidasoshi.

Inculcating Values, Promoting Prosperity

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ECE Dept.
Exam.
Internal Assessment
Even Sem(2017-18)

THIRD INTERNAL ASSESSMENT

Sem :VI	Sub: VLSI DESIGN	Sub. Code: 15EC63
Date:19/05/2018	Time: 11:00AM-12.00N	Max. Marks: 25

Note: Answer two full questions, draw sketches wherever necessary.

Q. No		Discription of Question	Marks	CO	RBT LEVEL
1.	a.	Define scaling and find the scaling factors for: i) Saturation current ii) Current density iii) Gate capacitance iv) Powerdissipation/unit area v) Maximum operating frequency	6	CO311. 3	L2
	b.	With a neat diagram, explain 4x4 barrel shifter.	6	CO311. 3	L3
		OR			
2.	a.	Explain Pseudo nMOS logic for NAND gate and Inverter	6	CO311. 6	L2
	b.	Explain Parity generator with basic block diagram and stick diagram.	6	CO311. 6	L3
3.	a.	Explain 3 transistor dynamic RAM cell with stick diagram	6	CO311. 3	L2
	b.	Explain switch logic implementation of a 4x4 four way multiplexer	7	CO311.3	L3
		OR			
4.	a.	Explain in detail the Generic Structure of an FPGA fabric.	6	CO311. 4	L2
	b.	Explain any two fault models in combinational circuits.	7	CO311. 5	L2

Course Coordinator **Module Coordinator** **HOD**

SCHEME OF EVALUATION

Sem : 6. | Subject : VLSI Design | Sub Code : 15EC63 | Date : 19-05-18

Q. No.	Bit	Description	Marks	CO's	RBT LEVEL
1	a.	The process of reducing vertical and horizontal size or dimensions of the MOSFET is referred to as scaling. Scaling factors for:			
		i) Saturation Current : $I_{dss} = \frac{1}{2}\mu_n C_{ox}\frac{W}{L}(V_{gs}-V_t)^2$ $= \frac{1}{2}\mu_n C_o \frac{W}{L}(V_{gs}-V_t)^2$ $= \beta \frac{1}{\beta^2} = \frac{1}{\beta}$	6	CO311. 3	L_2
		ii) Current density $J = \frac{I_{dss}}{A} = \frac{1/\beta}{1/\alpha^2 \beta^2} = \alpha^2$			
		iii) Gate Capacitance $C_g = C_o LW = \frac{\beta}{\alpha^2}$			
		iv) power dissipation/unit area $= P_a = \frac{P_g}{A_g}$ $P_a = \frac{1/\beta^2}{1/\alpha^2} = \alpha^2/\beta^2$			
		v) Max. operating frequency f_o $f_o = \frac{W}{L}\frac{\mu_n C_o V_{DD}}{C_g} = \frac{\alpha^2}{\beta}$			
	b.	4×4 barrel shifter. The barrel shifter ; interbus switches have their gate i/p's connected in a stair-case fashion in groups of four and there four shift control i/p's which must be mutually exclusive in the active state. (2) CMOS. transmission gate may be used in place of pass transistor. + diagram (4).	6	CO311.3	L_3

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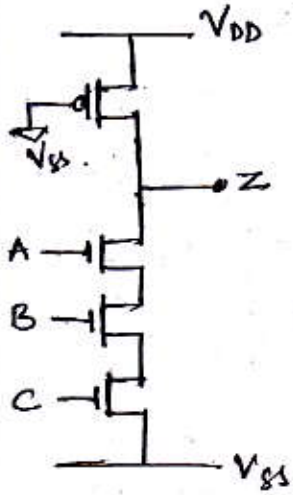
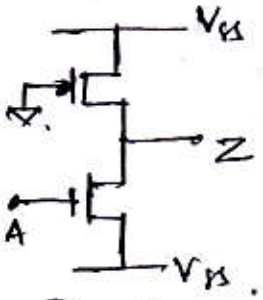
Q. No.	Bit	Description	Marks	CO's	RBT LEVEL
2.	a.	Pseudo nMOS logic factor in explanation			



Pseudo nMOS Nand gate



Pseudo inverter

$$V_{inv} = V_{tn} + \left(2\mu_p/\mu_n\right)^{1/2} \frac{\left[(V_{DD} - V_{tn})V_{dsp} - V_{dsp}^2\right]}{\left(Z_{p.u}/Z_{p.d}\right)^{1/2}}$$ — (2)

for $V_{inv} = 0.5V_{DD}$,

$V_{tn} = |V_{tp}| = 0.2V_{DD}$

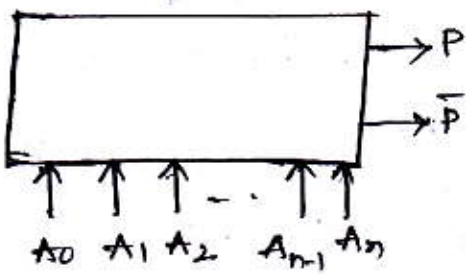
$V_{DD} = 5V$

$\mu_n = 2.5\mu_p$ — (1)

$\frac{Z_{p.u}}{Z_{p.d}} = \frac{3}{1}$

1. Power dissipation is reduced by 60% than in 4:1 inverter (nMOS)
2. The higher pull-up resistance leads to more delay. (Larger by 8.5:5 than nMOS 4:1) (2)

	b.	Parity Generator.			



P = 1 – even no. of 1's
0 – odd no. of 1's.

As no. of bits is undefined, the general solution on a cascadable bit-wise basis so that n can have any value. | 6 | CO311.6 | L3

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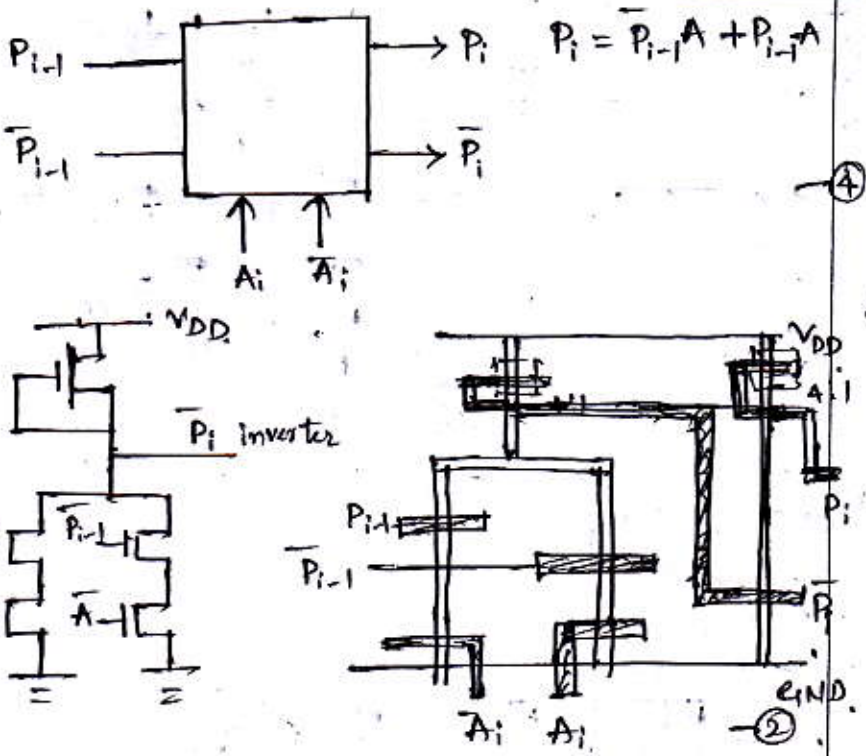
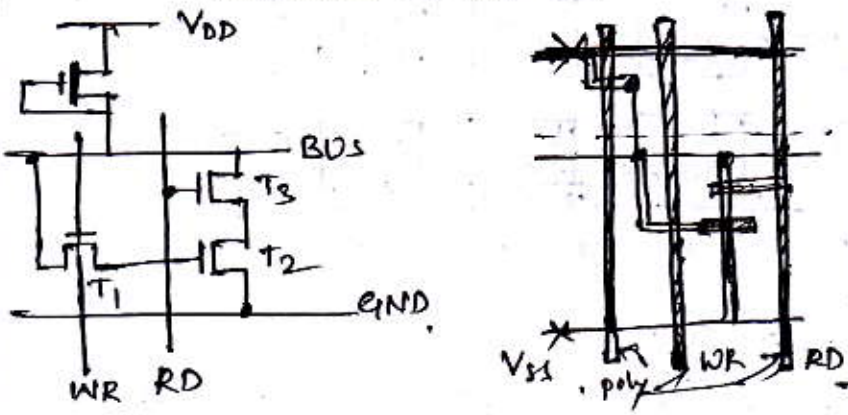
Q. No.	Bit	Description	Marks	CO's	RBT LEVEL
2.	b.	 $P_i = \bar{P}_{i-1}A + P_{i-1}\bar{A}$ — ④	6	CO 311.6	L_3
3.	a.	Three-transistor SRAM cell  — 3 explanation reg. RD & WR. & general. — 3	6	CO311.6	L_2
	b.	Implementation of 4×4 Way multiplexer. Multiplexer eqn is, $Z = I_0\bar{S}_1\bar{S}_0 + I_1\bar{S}_1S_0 + I_2S_1\bar{S}_0 + I_3S_1S_0$ =7	6+1	CO311.3	L_3

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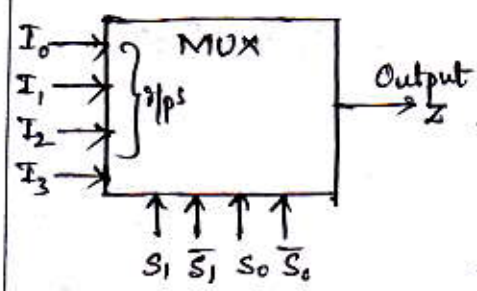
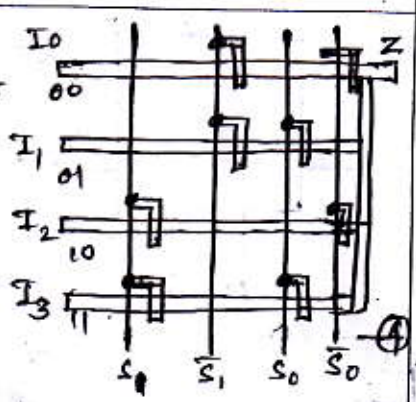
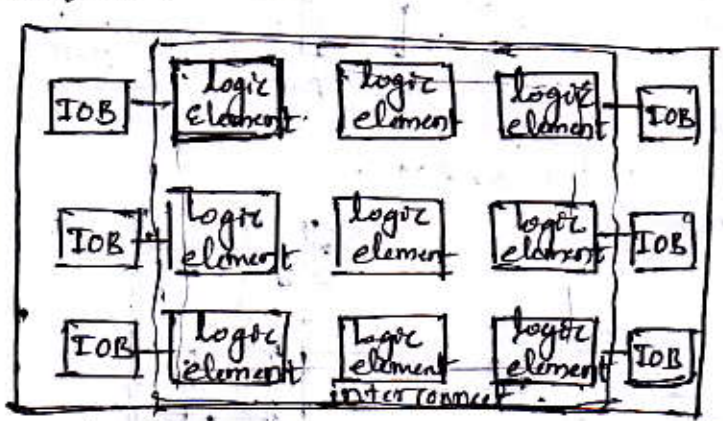
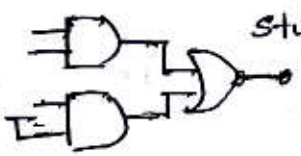
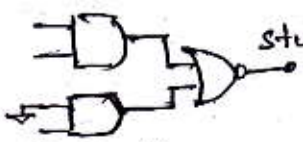
Q. No.	Bit	Description	Marks	CO's	RBT LEVEL
		  factor → ③ ④	7	CO3 11.3	L_3
4	a.	Generic structure of FPGA fabric. FPGAs require three major types of elements • Combinational logic • interconnect • I/O pins  explanation + diagrams — 3+3.	6	CO3 11.2	L_2
	b.	Any two fault models. Stuck-at Faults  Stuck At-1 Stuck At-0  Short Circuit & Open Circuit Faults any of the short ckt and open ckt examples.	7	CO3 11.5	L_2

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