BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION MO/2022

CLASS: **M.TECH / PRE-PHD** **SEMESTER: I**
BRANCH: **ECE** **SESSION: MO-2022**

SUBJECT: EC501 LOW POWER DEVICES & INTEGRATED CIRCUITS
TIME: **03 Hours** **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

		Marks	CO	BL
Q.1(a)	Explain why diffusion current occurs in semiconductor. Explain with suitable diagram and hole diffusion current equation.	[2]	1	2
Q.1(b)	Explain how a pulse of excess electrons injected at x = 0 at time t = 0 will spread out in time. Substantiate your answer with suitable diagram.	[3]	1	2
Q.1(c)	Write down the expression of built-in potential and junction capacitance. Briefly explain each term used the expressions.	[5]	1	3
Q.2(a)	Diagram the cross-sectional structure of an NMOSFET and PMOSFET taking a p-type lightly doped substrate.	[2]	2	3
Q.2(b)	Explain the Principle of Operation of and MOSFET with suitable diagram.	[3]	2	4
Q.2(c)	What are the various Regions of Operation of MOSFET. Mention the conditions of each region. Write down the drain-to-source current (I_{DS}) equation in each region.	[5]	2	3
Q.3(a)	What are the various Short Channel Effects?	[2]	3	2
Q.3(b)	Write down the expression to show the effect of the vertical field on the mobility and explain each term in it.	[3]	3	3
Q.3(c)	Explain Channel Length Modulation (CLM) and its effect on drain-to-source current and small-signal resistance of a MOSFET.	[5]	3	4
Q.4(a)	Write down the Dynamic Power Consumption and explain each tern in it.	[2]	4	6
Q.4(b)	Write down the various leakage currents in CMOS Devices and explain the mechanism of gate leakage current (I_G).	[3]	4	6
Q.4(c)	Explain the mechanism of gate-induced drain leakage current (GIDL) and punch-through.	[5]	4	4
Q.5(a)	Schematize the layout an CMOS Inverter.	[2]	5	6
Q.5(b)	Write the significance of any three design rules.	[3]	5	6
Q.5(c)	Explain the various Leakage reduction Techniques.	[5]	5	4

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