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**ELH 502**

**Third Semester M.Sc. Degree Examination, Dec. 2018/Jan. 2019**  
**ELECTRONICS**  
**Low Power VLSI**

Time : 3 Hours

Max. Marks : 70

**PART – A**

**Note** : Answer **all** the questions.

**(2×5=10)**

1. a) List the main components of dynamic power dissipation in MOSFETs and mention the factors affecting dynamic power dissipation.
- b) What is meant by switching activity in CMOS circuits and state its importance from the point of view of power dissipation.
- c) List the factors affecting sub-threshold leakage in MOSFETs.
- d) Mention the use of Dual supply for low power operation in CMOS VLSI on the circuit design.
- e) Explain the importance of low swing data communication in VLSI.

**PART – B**

**Note** : Answer the following :

**(20×3=60)**

2. a) Explain
  - i) Average power estimation in combinational circuits and
  - ii) Average power estimation in sequential circuits.
- b) Starting from the fundamentals, derive the expression for
  - i) Switching power and
  - ii) Short circuit power in CMOS inverter and highlight the significance of the expression.

**(10+10)**

OR

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- 3. a) Discuss the hierarchy of low power design strategies.
- b) Compare low power design and power aware design methodologies.
- c) Explain with suitable analysis and illustrations
  - i) Glitch power estimation and
  - ii) Switching activity calculation in logic circuits. **(6+6+8)**

- 4. a) Explain :
  - i) Dual threshold technique and
  - ii) Dynamic body biasing techniques for sub threshold leakage reduction.
- b) Explain MTCMOS technique for low power and discuss the merits and demerits. **(10+10)**

OR

- 5. a) List and explain the major sources of leakage currents in MOSFETs and suggest two techniques each for their reduction.
- b) Discuss with suitable examples
  - i) Low voltage circuit design techniques and
  - ii) Multiple supply voltage techniques. **(10+10)**

- 6. a) With the help of a neat diagram, discuss the low power SRAM architecture.
- b) Explain the need for sense amplifiers in SRAM and explain the operation of sense amplifier with the help of circuit and characteristics. **(10+10)**

OR

- 7. a) With the help of suitable circuit explain the operation of 6-T SRAM and 4-T SRAM.
  - b) Explain different pre-charge techniques employed by SRAMs with their salient features.
  - c) Explain the basic principle of energy recovery technique and discuss the challenges involved in the implementation of such circuits. **(8+6+6)**
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