All. 3

BUSTA 3

1) Il candidato illustri la sua esperienza di studio e lavorativa inerente alle tematiche del bando discutendo in maniera sintetica il CV strutturato presentato in sede di domanda di concorso.

2) Il candidato illustri quale contributo crede di poter dare con le sue competenze in un ente di ricerca e nello specifico presso l'Istituto di Scienze dell'Atmosfera e del Clima del CNR.

3) Il candidato descriva come progetterebbe la gestione remota di un osservatorio climatico ambientale che sia in grado di funzionare senza il supporto di un operatore fisso. Il candidato faccia un esempio delle possibili soluzioni per poter valutare la bontà dei segnali ricevuti ottenuti da strumentazione a sua scelta (e.g. analizzatori di gas in traccia, campionatori di particolato, stazioni meteo, strumentazione radiometrica).

PROVA INGLESE

Il candidato legga e traduca le prime 4 righe del CAP 7 *Millman Halkias - Integrated Electronics* allegato.

PROVA INFORMATICA

Il candidato descriva un linguaggio di programmazione a sua scelta illustrandone le caratteristiche e le potenzialità.

[redacted]

Busta 3

7 / INTEGRATED CIRCUITS: FABRICATION AND CHARACTERISTICS

An integrated circuit consists of a single-crystal chip of silicon, typically 50 by 50 mils in cross section, containing both active and passive elements and their interconnections. Such circuits are produced by the same processes used to fabricate individual transistors and diodes. These processes include epitaxial growth, masked impurity diffusion, oxide growth, and oxide etching, using photolithography for pattern definition. A method of batch processing is employed which offers excellent repeatability and is adaptable to the production of large numbers of integrated circuits at low cost. In this chapter we describe the basic processes involved in fabricating an integrated circuit.

7-1 INTEGRATED–CIRCUIT TECHNOLOGY

The fabrication of integrated circuits is based on materials, processes, and design principles which constitute a highly developed semiconductor (planar-diffusion) technology. The basic structure of an integrated circuit is shown in Fig. 7-1*b*, and consists of four distinct layers of material. The bottom layer ① (6 mils thick) is *p*-type silicon and serves as a *substrate* upon which the integrated circuit is to be built. The second layer ② is thin (typically 25 μm = 1 mil) *n*-type material which is grown as a single-crystal extension of the substrate. All active and passive components are built within the thin *n*-type layer using a series of diffusion steps. These components are transistors, diodes, capacitors, and resistors, and they are made by diffusing *p*-type

BUSTA 2

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3) Il candidato descriva come progetterebbe la gestione remota di un osservatorio climatico ambientale per poter controllare e gestire remotamente le osservazioni acquisite da uno strumento a sua scelta (e.g. analizzatori di gas in traccia, campionatori di particolato, stazioni meteo, strumentazione radiometrica).

PROVA INGLESE

Il candidato legga e traduca le prime 4 righe del CAP 6 *Millman Halkias - Integrated Electronics* allegato.

PROVA INFORMATICA

Il candidato descriva un linguaggio di programmazione a sua scelta illustrandone le caratteristiche e le potenzialità.

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Busn 2

6 / DIGITAL CIRCUITS

Even in a large-scale digital system, such as a computer, or a data-processing, control, or digital-communication system, there are only a few basic operations which must be performed. These operations, to be sure, may be repeated very many times. The four circuits most commonly employed in such systems are known as the OR, AND, NOT, and FLIP-FLOP. These are called *logic* gates, or circuits, because they are used to implement Boolean algebraic equations (as we shall soon demonstrate). This algebra was invented by G. Boole in the middle of the nineteenth century as a system for the mathematical analysis of logic.

This chapter discusses in detail the first three basic logic circuits mentioned above. These basic gates are combined into FLIP-FLOPS and other digital-system building blocks in Chap. 17.

6-1 DIGITAL (BINARY) OPERATION OF A SYSTEM

A digital system functions in a binary manner. It employs devices which exist only in two possible states. A transistor is allowed to operate at cutoff or in saturation, but not in its active region. A node may be at a high voltage of, say, 4 ± 1 V or at a low voltage of, say, 0.2 ± 0.2 V, but no other values are allowed. Various designations are used for these two quantized states, and the most common are listed in Table 6-1. In logic, a statement is characterized as *true* or *false*, and this is the first binary classification listed in the table. A switch may be *closed* or *open*, which is the notation under 9, etc. Binary arithmetic and mathematical manipulation of switching or logic functions are best carried out with classification 3, which involves two symbols, 0 (zero) and 1 (one).

BUSTA 1

1) Il candidato illustri la sua esperienza di studio e lavorativa inerente alle tematiche del bando discutendo in maniera sintetica il CV strutturato presentato in sede di domanda di concorso.

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3) Il candidato descriva come progetterebbe la gestione remota di un osservatorio climatico ambientale per poter trasferire in Near Real Time (NRT) le osservazioni acquisite da uno strumento a sua scelta (e.g. analizzatori di gas in traccia, campionatori di particolato, stazioni meteo, strumentazione radiometrica) verso un database centralizzato.

PROVA INGLESE
Il candidato legga e traduca le prime 4 righe del CAP 3 *Millman Halkias - Integrated Electronics* allegato.

PROVA INFORMATICA
Il candidato descriva un linguaggio di programmazione a sua scelta illustrandone le caratteristiche e le potenzialità.

[redacted]

3 / JUNCTION-DIODE CHARACTERISTICS

In this chapter we demonstrate that if a junction is formed between a sample of *p*-type and one of *n*-type semiconductor, this combination possesses the properties of a rectifier. The volt-ampere characteristics of such a two-terminal device (called a *junction diode*) is studied. The capacitance across the junction is calculated.

Although the transistor is a triode (three-terminal) semiconductor, it may be considered as one diode biased by the current from a second diode. Hence most of the theory developed here is utilized in Chap. 5 in connection with the study of the transistor.

3-1 THE OPEN-CIRCUITED *p*-*n* JUNCTION

If donor impurities are introduced into one side and acceptors into the other side of a single crystal of a semiconductor, a *p*-*n* junction is formed, as in Fig. 2-17*b*. Such a system is illustrated in more schematic detail in Fig. 3-1*a*. The donor ion is represented by a plus sign because, after this impurity atom "donates" an electron, it becomes a positive ion. The acceptor ion is indicated by a minus sign because, after this atom "accepts" an electron, it becomes a negative ion. Initially, there are nominally only *p*-type carriers to the left of the junction and only *n*-type carriers to the right.

Space-charge Region Because there is a density gradient across the junction, holes will initially diffuse to the right across the junction, and electrons to the left. We see that the positive holes which neutralized the acceptor ions near the junction in the *p*-type silicon have disappeared as a result of combination with electrons which have diffused across the junction. Similarly, the neutralizing electrons in