

# Unit 3

## Two Mark Q & A

### 1. Mention the advantages of integrated circuits.

- \*Miniaturisation and hence increased equipment density.
- \*Cost reduction due to batch processing.
- \*Increased system reliability due to the elimination of soldered joints.
- \*Improved functional performance.
- \*Matched devices.
- \*Increased operating speeds.
- \*Reduction in power consumption.

### 2. Write down the various processes used to fabricate IC's using silicon planar technology.

- \*Silicon wafer preparation.
- \* Epitaxial growth
- \*Oxidation.
- \*Photolithography.
- \*Diffusion.
- \*Ion implantation.
- \*Isolation.
- \*Metallisation.
- \*Assembly processing and packaging.

### 3. What is the purpose of oxidation?

- \*SiO<sub>2</sub> is an extremely hard protective coating and is unaffected by almost all reagents.
- \*By selective etching of SiO<sub>2</sub>, diffusion of impurities through carefully defined windows can be accomplished to fabricate various components.

### 4. Why aluminum is preferred for metallization?

- \*It is a good conductor.
- \*it is easy to deposit aluminium films using vacuum deposition.
- \*It makes good mechanical bonds with silicon.
- \*It forms a low resistance contact.

### 5. What are the popular IC packages available?

- a. Metal can package.
- b. Dual-in-line package.
- c. Ceramic flat package.

What is an integrated circuit?

An integrated circuit (IC) is a combination of interconnected circuit elements inseparably associated or with in continuous substrate.

### 6. Define substrate.

The substrate is the supporting material upon or with in which an IC is fabricated or to which an IC is attached.

### 7. Define monolithic IC.

A monolithic IC is an IC whose elements are formed in place upon or within a semiconductor substrate with at least one of the elements formed within the substrate.

### **8. What is a hybrid IC?**

A hybrid IC consists of a combination of two or more IC types.

### **9. Define wafer.**

It is the basic physical unit used in processing. It consists of large number of identical ICs.

### **10. What are the advantages of ICs over discrete circuits?**

There are many advantages of ICs over discrete circuits. They are:

Low cost.

Small size.

Improved performance.

Low power consumption.

High reliability.

Mass production capability.

Increased operating speed.

Less weight.

Easy replacement.

### **11. What are the limitations of ICs?**

The limitations of ICs are as follows :Since ICs are small and unable to dissipate large amount of power, the heat produced by large elements may destroy the IC. The transformers and inductors cannot be fabricated using IC technology.

### **12. What are the applications of ICs?**

Integrated circuits have become part and parcel of human life. Computers cellular phones and other digital appliances are now inextricable parts of the structure of modern societies. That is, modern computing, communications, instrumentation, manufacturing and transport systems, including the internet, all depend on the existence of integrated circuits. Among the most advanced integrated circuits are the microprocessors and microcontrollers which control everything from computers, cellular phones to household appliances.

### **13. What is the classification of ICs based on complexity level?**

Based on the complexity level (number of gates on a chip) ICs are classified as Small scale integration (SSI).

Medium scale integration (MSI).

Large scale integration (LSI).

Very large scale integration (VLSI).

### **14. What is the classification of ICs based on fabrication process?**

Depending on the fabrication process ICs are classified as i) monolithic IC ii)Hybrid IC.

### **15. What is the classification of ICs based on the function performed?**

Based on the functions performed integrated circuits can be classified into analog and digital ICs.

**15. What is meant by epitaxial growth?**

The term epitaxial growth means “arranging upon”. It is the process of depositing a thin layer (0.5 to 20 microns) of single crystal material over a single crystal substrate.

**16. What is photolithography?**

Photolithography is a process used in semiconductor device fabrication to transfer a pattern from a photo mask to the surface of a wafer.

**17. Define etching. What are the different types?**

It is a process of removing a film or layer from the substrate in those areas not covered with photo resist. There are two types of etching i) wet etching and ii) dry etching.

**18. What are the properties of the chemicals used for etching?**

The chemicals used for etching (etchant) should have the following characteristics:

It should react with the film etched in a smooth manner producing suitable products that can be carried away from the surface.

It should not react with photo resist.

It should act with film to be etched and not with other microelectronic materials.

**19. Define diffusion.**

Diffusion is a process where the particles move from regions of higher concentration to regions of lower concentrations.

**20. What is meant by ion implantation?**

**Ion implantation is the introduction of ionized particles atoms into targets with enough energy to penetrate beyond surface regions.**

**21. What are the advantages of ion implantation?**

Unlike diffusion, which is a high temperature process, ion implantation is a low temperature process.

It permits greater flexibility in designing.

It is a high precision tool. It precisely controls the number of dopant atoms.

**22. What is meant by surface passivation?**

The process of creating the protective SiO<sub>2</sub> layer on the wafer surface is known as surface passivation.

**23. What is the purpose of formation of SiO<sub>2</sub> layer?**

The formation of SiO<sub>2</sub> layer serves many purposes.

It serves as a diffusion mask and allows diffusion of impurities through carefully defined windows etched into oxide.

It serves as an insulator on the wafer surface.

It protects the junction from moisture and other atmospheric contaminants.

**24. What is meant by metallization?**

After devices have been fabricated in the silicon substrate, interconnections must be made to link all the components on the chip. This process is called metallization.

**25. Why aluminum is most preferred for metallization?**

Aluminum is the mostly used metal for metallization. It has the following advantages:

It is a good conductor.

It makes good mechanical bonds with silicon.

It is cheap.

It is easy to deposit aluminum films using vacuum decomposition.

**26. What are the different IC packages?**

There are three different IC packages. They are

To- glass metal.

Ceramic flat package.

Dual-in-line (ceramic or plastic type).

**27. What are the different CMOS technologies?**

The CMOS technologies are p-well process, n-well process, twin-tub process and silicon on insulator.

**28. What is a differential amplifier? What is the ideal value of its gain?**

A differential amplifier is one which amplifies the difference between its two input signals. The gain with which it amplifies the difference is called its differential gain and ideally it should be infinite.

**29. What is common mode gain of a differential amplifier?**

If the two input signals to a differential amplifier are same, then its output should be zero. But practically it produces a small output which is proportional to the average common level of the two input signals. The factor by which the differential amplifier amplifies the common mode signal is called its common mode gain.

**30. What is CMRR? State its ideal value.**

The ability of the differential amplifier to reject common mode signal is expressed by the ratio of differential gain to the common mode gain which is called its common mode rejection ratio CMRR. The ideal value of CMRR is infinite.

**31. List out various configurations of a differential amplifier.**

Dual input, balanced output.

Dual input, unbalanced output.

Single input, balanced output.

Single input, unbalanced output