Name... **Roll. No......**

DEPARTMENT OF PHYSICS, C.C.S. UNIVERSITY MEERUT
1 Internal Test M.Sc. (Physics) IVth Semester, A.Y. 2023-24
Course: Design and fabrication of integrated circuits

Time: 1.30 Hours **Marks: 18**

Section A (Quiz)

Attempt any five parts of question 1. Each part carries one mark.

Q1. (i) What are the main features that have led to the evolution and enhancement of VLSI Integrated Circuits?
(ii) What are limitations of Czochralski (CZ) crystal growth technique?
(iii) How much Si needs to be consumed to grow 250 nm of oxide?
(iv) Give a flowchart for IC chip fabrication.
(v) Discuss the applications of Silicon Dioxide (SiO_2) in ICs using its thickness chart.
(vi) What is thermal nitridation?
(vii) Classify various ICs.

Section B

Attempt any two questions. Each question carries 2.5 marks

Q2. How EGS is obtained from MGS? Also give block diagram for the production of EGS with chemical reactions.

Q3. Describe all CMOS fabrication steps and give a suitable sketch for each step.

Q4. In a diffusion process, N^+ diffusion is performed into p-type silicon having a uniform dopant concentration of 5×10^{23} atoms/m³. If the dopant concentration in the gas above the wafer is maintained constant 5×10^{26} atoms/m^3 and process time is 30 min. Calculate the depth of the n-type diffusion. The diffusion coefficient is 5×10^{-17} m^2/sec and erfc(2.3)=10^{-3}.

Section C

Attempt any two questions. Each question carries 4 marks.

Q5. Explain Float-Zone Crystal Growth technique with a suitable diagram and find the equation for the distribution of an impurity $C_s(x)$ in the grown crystal. Discuss the advantage of Float-Zone Crystal Growth technique.

Q6. Explain Deal-Grove model for thermal oxidation with proper mathematical equations.

Q7. Why ion-implantation is preferred over diffusion for impurity doping? Explain ion-implantation technique with suitable schematic. Define projected range and straggle with respect to ion Implantation.

08. Drive the equation for doping concentration, C(x, t) for two common doping conditions (constant surface concentration and constant total dopant) that exist in thermal diffusion.