**M.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING**
**1ST YEAR 1ST SEMESTER EXAM 2018**

**MICROELECTRONIC TECHNOLOGY (ED)**          Full Marks: 100          Time: 3 hours

*The figures in the margin indicate full marks.*

Answer *any five* questions.

(*All parts of the same question must be answered together*)

1.a) Briefly describe the *Zone melting scheme.*                                              5
  b) Give an account of how the above scheme can be employed efficiently in          4+3+5+3
      (i)      Growing pure single crystal,
      (ii)     Refining the grown crystal,
      (iii)    Growing doped single crystal,
      (iv)     Distributing the dopants uniformly.

2.a) Describe the *dislocations* that may appear in a single crystal during its growth.  6+2
     How such defects can be reduced?
  b) Show that an oxide layer of thickness $x$ consumes $0.44x$ thick layer of *Si*. Given   6
     that *Si* and $SiO_2$ have molecular weights of 28.9 *gm/mol.*, 60.08 *gm/mol.*
     respectively, and densities of 2.33 *gm/c.c.*, 2.21 *gm/c.c.* respectively.
  c) Define *Failure rate* of a system. How can it determined?                          6

3.a) Define Photoresist. Classify and compare them with examples.                      2+6
  b) What are the basic components of photoresist?                                      3
  c) Write disadvantages of contact printing.                                          3
  d) Describe proximity printing and mention shortcomings associated with it.          6

4.a) Define selectivity. Illustrate over etch and under etch with schematic.           2+6
  b) What are the typical reactions involved in depositing (*i*) Silicon, (*ii*) Silicon   3
     dioxide and (*iii*) Silicon nitride.
  c) Briefly describe the advantages and disadvantages of APCVD.                        4
  d) How is uniform deposition achieved in APCVD?                                       5

5.a) Derive Fick's diffusion equation in context of diffusion of impurities within a   4
     semiconductor.
  b) Write the boundary conditions and the solution of the diffusion equation in       5+6
     case of
     i)Limited source diffusion, and
     ii)Infinite source diffusion.
     Also mention general features of the above impurity distributions.
  c) Explain what is '*Emitter push*' in Microwave bipolar transistor and how it can    5
     be avoided by ion implantation.

6.a) What is *Junction spiking*? How can it be suppressed?                                                    7

b) Explain the phenomenon of *Electromigration* and its influence on the life of an   4+4+5
IC. Also suggest some ways to improve the situation.

7.a) Classify *Interconnects* and briefly describe their features. Also mention the   7+3
functions they perform.

b) Explain the roles of dielectric materials with high and low permittivity in   6+2+2
modern ICs. Give example of dielectric of each category. Sketch the diagram
showing the trend of delays associated with an IC over the years.

8.   Write notes on *any two*:                                                              10×2
a)   Determination of band gap energy by four-probe method,
b)   Reactive ion etching,
c)   Atomic layer deposition,
d)   Improvement of reliability through redundancy.