

## EM – Test questions

1. When and who invented the integrated circuit?
2. What are today's most advanced technologies of integrated circuits? Write the main features and characteristics.
3. What describes Moor's laws?
4. What is described by Kirchhoff's laws?
5. What is described by Ohm's law?
6. Properties of ideal and nonideal voltage and current sources.
7. What is the duality of voltage and current sources?
8. What is the Thévenin theorem? Describe.
9. How can we calculate the capacity plate capacitor?
10. What is Fermi level?
11. What is the diffusion current in semiconductors?
12. What is intrinsic and what is doped semiconductor?
13. Define P and N type semiconductor.
14. Where is the Fermi level in the P and N type semiconductor? Draw in the band structure.
15. Draw metallurgical PN junction in thermal equilibrium, indicate space charge region, ionized acceptors and donors.
16. Draw a structure of PN junction diode. Draw the voltage characteristic in the forward and reverse region.
17. What is the breakdown voltage of the diode? What kinds of breakdown mechanisms you know? Mark V-A characteristics.
18. Draw one way rectifier, explain the principle of operation.
19. Draw two way rectifier, explain the principle of operation.
20. Draw bridge rectifier, explain the principle of operation.
21. Draw structures and symbols of NPN and PNP bipolar transistors.
22. What operational modes of bipolar transistor you know? Define them.
23. Draw bipolar transistor input and output characteristics.
24. Draw schematics of common emitter amplifier. Define input and output resistance.
25. Draw schematics of common collector amplifier. Define input and output resistance.
26. Draw schematics of common base amplifier. Define input and output resistance.
27. What is "A" Class Amplifier? How do we set the operating point?
28. Draw the structure of the JFET transistor, explain how it works.
29. Draw the output characteristics of JFET, tick linear and the saturation region.
30. Draw a cross-section of an NMOS transistor. Explain how an inverse layer is formed under the Gate.
31. Draw the output characteristics of an NMOS transistor; indicate the linear and saturation region.
32. Draw the small signal model for an NMOS transistor
33. What is the "clean room", what is it for?
34. Describe the basic steps of preparation of silicon substrates.
35. Describe a technology for silicon single crystals growth?

36. What types of lithography you know? What are the differences?
37. What kind of lithography is used for ICs manufacturing? Why?
38. What is thermal oxidation in IC manufacturing process, how is it done?
39. What is diffusion, how is it done?
40. What is Ion implantation, how is it done?
41. What is the chemical vapor deposition (CVD), what is it used for?
42. What qualities must have an ideal integrated circuit package?
43. Explain CMOS inverter functionality and draw DC Transfer Curve.
44. How CMOS logic gates are designed by Pull-Up and Pull-Down Network?
45. Draw NAND and NOR CMOS logic gates.
46. Draw schematic circuit for  $F = A.D + B(A+C)$  function using Pull-Up and Pull-Down Network.
47. What are differences between Combinational and Sequential circuits?
48. What are Multiplexors and Demultiplexors?
49. What is Full Adder, how does it work?
50. What is SR latch, how does it work? Write true table.
51. What is D latch, how does it work? Write true table.
52. What is an advantage of of Master-Slave Latches.
53. What is Flip Flops? How does it work?