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Question Paper Code : 70424

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Second Semester

Electronics and Communication Engineering

EC 6201 — ELECTRONIC DEVICES

(Regulations 2013)

(Also Common to PTEC 6201 – Electronic Devices for B.E.(Part-Time) – First Semester – Electronics and Communication Engineering – Regulations 2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Determine the built in potential in a silicon PN junction with $N_a = 10^{15}$ cm^{-3}, $N_D = 2 \times 10^{16}$ cm^{-3}, $n_i = 1.5 \times 10^{10}$ cm^{-3} at T = 300K.

2. What do you understand by "Hyper abrupt" junction?

3. The common emitter gain of a BJT, $\beta = 450$. Calculate the emitter current, if the collector current is 1 mA.

4. What is the need for multi emitter bipolar transistor?

5. Calculate the flat band voltage for a MOS device with $\phi_{ms} = 0.96$, $N_{oc} = 10^{14}$/m^2 and $C_{ox} = 1.15 \times 10^{-3}$ F/m^2.

6. Determine the resistance of a MOSFET operating in the linear region with $\beta = 1.75 \times 10^3$, $V_{GS} = 5V$ and $V_T = -2.5V$.

7. Calculate the space charge width for a metal semiconductor junction having $\varepsilon_r = 11.7$, $\varepsilon_0 = 8.854 \times 10^{-14}$, $V_{bi} = 0.67\,V$, $N_d = 7 \times 10^{18}$ at zero bias.

8. State the principle of Light dependent resistor.

9. Define intrinsic standoff ratio of an UJT.

10. Silicon is a preferred material for solar cell — Justify.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Explain the basic structure of PN junction with diagrams illustrating doping profile and space charge regions. (8)

(ii) From the basic principles, derive an expression for the built in potential barrier in a PN junction. (8)

Or

(b) (i) Draw the band diagram of a PN junction under reverse bias and derive an expression for the maximum electric field in the PN junction. (10)

(ii) Explain the switching behavior of PN junction diode from forward to reverse bias, with diagrams illustrating minority carrier concentration and current characteristics during switching. (6)

12. (a) (i) Discuss the current density components of a NPN bipolar transistor operating in active mode. (10)

(ii) Explain the input and output characteristics of a NPN transistor in CE mode. (6)

Or

(b) (i) From the basic principles, deduce the expressions for Ebers - Mall equations for a bipolar transistor and also draw the basic Ebers - Moll equivalent circuit. (10)

(ii) Compare the features of Ebers - Moll and Gummel Poon models. (6)

13. (a) (i) Explain the basic JFET structure and principle of operation with relevant diagrams. (10)

(ii) Deduce an expression for drain current in the case of JFET. (6)

Or

(b) (i) Explain the various regions of operation of a MOSFET with relevant diagrams. (10)

(ii) Discuss about channel pinch off and velocity saturation in MOSFETs. (6)

14. (a) (i) Enumerate the characteristics of a metal semiconductor junction under forward and reverse bias with necessary band diagrams. (10)

(ii) Explain Schottky effect in metal dielectric interface. (6)

Or

(b) (i) Compare the characteristics of Silicon and Gallium Arsenide. (6)

(ii) Outline the principle and operation of a laser diode. (10)

15. (a) (i) Discuss the construction, operating principle of a Silicon controlled rectifier and its characteristics. (10)

(ii) Compare the features of SCR and TRIAC. (6)

Or

(b) (i) Explain the carrier generation in solar cells using relevant band diagrams. (6)

(ii) List the basic differences between solar cell and photo diode. (4)

(iii) Brief about the principle of charge coupled device. (6)

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