Birla Institute of Technology and Science
Ist semester 2016-2017
EEE F214/ INSTR F214 Electronic Devices
Comprehensive Examination [Part A(closed Book) + Part B (Open Book)]
Part A (Close Book)

Date: 07/12/2016 **MM : 40** **Time:60 min**

ID: **Name:** **Sec:**

Note: Put "Tick (√)" Marks on the right option wherever applicable (Bold)/fill in the blanks. Answer should be in fresh & final form. In case of overwriting the corresponding answer will not be evaluated.

1. Diffusion co-efficient **increases / decreases** with raise in temperature and its ratio with mobility **increases / decreases / remain same**. **[2]**
2. The junction potential of a p-n junction **increases / decreases / remain same** with the rise in temperature and the depletion width **increases / decreases / remain same**. **[2]**
3. A solar cell having short circuit current as 0.5 mA and reverse saturation dark current as 0.5 nA at room temperature. The open circuit voltage _____and this voltage would **increase / decrease** with the rise in temperature. **[2]**
4. A light emitting diode having radiation recombination life time as 10% of that of non radiative recombination carrier life time, the inband efficiency would be _____% and if it becomes 20% this would comes out to be _____%. **[2]**
5. In a photodetector, if we increase the incident photon frequency the responsivity will **increase / decrease** and the minimuum acceptable frequency would depend on junction **width / material / temperature**. **[2]**
6. A n^+p based solar cell is designed having junction area A, the suitable expression for reverse saturation current is approximated _____as a function of A, D_n, D_p, n_p, p_n, L_n, L_p and this would **increase / decrease** with slight increase of doping in p-region. **[2]**
7. The impurity scattering based mobolity **increase / decrease** with rise in temperature and dominates over lattice scattering based impurity at **lower / higher** temperature. **[2]**
8. In an n-type Ge sample Haynes-Shockley experiment the distance between probes is 3.0 cm and applied voltage is 4 V and the pulse reaches at output after 1 ms. This will provide mobility of **electron / hole** and the value would be _____. **[2]**
9. A forward biased p^+n diode is changed at t=0 into a reverse bias the behaviour of junction just after would be **forward / reverse / ohmic** and the time taken to make junction voltage to zero will **increase / decrease** if doping of n-region is increased. **[2]**
10. In the MOSFET scaling the impurity concentration is **increased / decreased** and the MOS capacitance of the device **increases / decreases**. **[2]**
11. Usually, Webster effect in BJT **increases / decreases** the base transient time and this is due to_____**[2]**
12. Usually higher base doping **improves / deteriorate** the speed of BJT and gain in this case **increase / decrease**. The device performance can be improved by managing **injection efficiency/ base transport factors** using **homojunction/heterojunction**. **[4]**

[PTO]

13. Sketch and label energy band diagram from source to drain for a n-MOS transistor qualitatively for $V_G=0$ and $V_G=+V$. **[4]**

14. On a given n-channel MOS structure flant band voltage V_{FB} is applied from t=0 to t=1.0 s and at t>1.0 s a voltage $V_g>>V_T$ (Threshold) is applied and a small signal capacitance at high frequency is measured. We then stress the structure to induce trap states. Sketch CV plot for both the cases. **[4]**

15. For a long channel NMOS under normal bias sketch qualitative behaviours of channel mobility with respect to V_{GS} variation, Temperature variation and Substrate doping variation. Now, assume we have a short channel device, comment on the mobility degradation in the channel mentioning the exact location in the channel ? **[6]**

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