Subject Code: KEC301

PAPER ID-312071

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM III) THEORY EXAMINATION 2024-25
ELECTRONIC DEVICES

TIME: 3 HRS **M.MARKS: 100**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q no.	Question	CO	Level
a.	Explain the Heisenberg's uncertainty principle.	1	2
b.	Define the various quantum numbers.	1	1
c.	Define mobility and effective mass. .	2	1
d.	If the majority carrier concentration of Si at 300 K is $\mathbf{10^{18}\ cm^{-3}}$, find the concentration of minority carriers.	2	2
e.	Define built-in potential of a p-n junction.	3	1
f.	Explain the dependence of junction capacitance on applied voltage under reverse bias condition.	3	2
g.	Differentiate between avalanche and Zener breakdown.	4	2
h.	Differentiate between p-n junction diode and Schottky diode.	4	2
i.	State the condition for strong inversion in MOS capacitor.	5	1
j.	Write the conditions for which the MOSFET will be working in triode and saturation region.	5	1

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 20**

Q no.	Question	CO	Level
a.	Derive the Schrodinger wave equation for a microscopic particle.	1	3
b.	Show that the minimum conductivity of a semiconductor sample occurs, when $n_0 = n_i\sqrt{\mu_p/\mu_n}$. Also find the expression for minimum conductivity.	2	3
c.	Explain the shifting of fermi energy level for intrinsic, n type and p type semiconductor along with all the energy band diagram.	3	2
d.	With advantages and disadvantages discuss the Eber's Moll model of a transistor.	4	2
e.	Explain the working of photo diode with the V-I characteristics.	5	2

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

Q no.	Question	CO	Level
a.	Derive the solution of infinite height potential well problem.	1	3
b.	Discuss the quantum mechanical tunnelling of a microscopic particle. Also discuss the E-K diagram.	1	2

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4. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Illustrate the energy splitting concept for the formation of continuous energy band. Also draw the diagram showing the energy levels of Si as function of interatomic distance.	2	4
b.	An N-type semiconductor is implanted with Boron. The donor and acceptor concentrations are $N_D = 10^{16}/cm^3$ and $N_A = 4 \times 10^{18}/cm^3$. Calculate the Contact Potential (V_0), Depletion layer width (W), E_0, x_{n0} and x_{p0}. (Given, $n_i = 1.5 \times 10^{16}/cm^3$, $\epsilon_0 = 8.85 \times 10^{-14} F/cm$, $\epsilon_r = 11.8\,\epsilon_0$).	2	4

5. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Derive the diode current expression for a P-N junction.	3	3
b.	Derive the expression of depletion layer width of a P-N junction.	3	3

6. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Explain the avalanche and Zener breakdown mechanism in a P-N junction with the relevant energy band diagrams.	4	2
b.	Explain the following parameters for BJT: a) Carrier injection efficiency b) Base transportation factor c) Current transfer ratio d) Current amplification factor	4	2

7. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Illustrate photovoltaic principle in solar cell. Draw and explain VI Characteristic, open circuit voltage and short circuit current	5	4
b.	Explain the various modes of operation of MOS capacitor with their energy band diagram. Also draw the C-V characteristics.	5	4