Indian Institute of Information Technology Ranchi Roll No. 2022 41,3001

Department of Electronics & Communication Engineering

Semester: First

B. Tech End-Semester Examination - Autumn Semester 2022-23

Course Code: EC-1001

Course Instructor: Prof. S. K. Mandal, Dr. Rashmi Panda

Course Name: Electronics Devices and Circuits

QUESTION PAPER

Duration: 3 hrs. Instructions:

Max Marks: 100

- (1). Number in [] indicates marks.
- (2). Any missing data can be assumed suitably.
- (3). Symbols have their usual meaning.

Section A (Answer All)

1. Explain the "pinch-off" phenomena in JFET (a)

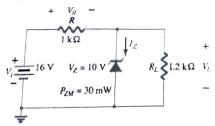
[2]

[2]

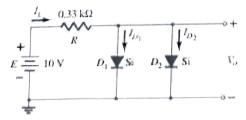
Calculate the stability factor $S(I_{co})$ and the change in I_C due to change in I_{co} when the **(b)** temperature varies from 25°C to 100°C for the Silicon Transistor (β=50). The following table shows variation of parameters with temperature for the emitter-bias circuit where $R_B=250R_E$

T (°C)	I_{CO} (nA)
25	0.1
100	20

- (c) What is the role of capacitors at low frequencies and high frequencies in BJT modelling? [2]
- (d) Obtain the relation between the parameters α , β , Υ of a bipolar junction transistor? [2]
- Differentiate between knee voltage and breakdown voltage. (e) [2]
- Write a short note on light emitting diode (LED). (f) [2]
- Compare different configurations (CE, CB and CC) of BJT. [2] (g)
- Determine the currents V_L , $V_R I_Z$ [2] (h)

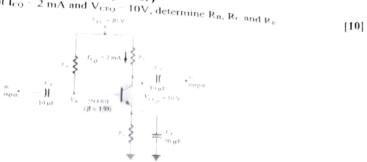


Determine the currents V_0 , I_1 , I_{D1} , and I_{D2} for the following circuit having Silicon diodes [2] (i)



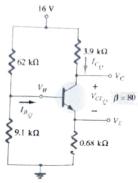
The resistivity of a uniformly doped n -type silicon sample is $0.5~\Omega$ -cm. If [2] **(j)** the electron mobility (µ_n) is 1250 cm²/V-sec and the charge of an electron is 1.6×10⁻¹⁹ Coulomb, then find the donor impurity concentration (N_D) in the sample.

2. (a) For the following circuit I_{CO} = 2 mA and V_{cros}

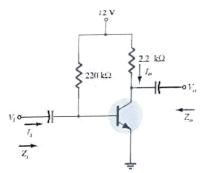


(b) For the following circuit with a silicon NPN BJT determine
(i) I_C (ii) V_E (iii) V_C (iv) V_B, (v) V_{CE}

[10]



- 3. (a) What are the significances of small signal Low & High frequency analysis? [5]
 - (b) For the following circuit find input impedance, output impedance, voltage gain and current [15] gain.



$$h_{fe} = 110$$
, $h_{ie} = 1.6 \text{ k}\Omega$, $h_{re} = 2 \times 10^{-4}$, $h_{oe} = 20 \frac{\mu A}{V}$

- 4 (a) Derive a differential equation governing the carrier concentration in N-Type [14] semiconductor as a function of time and distance.
 - (b) Find the solution of (a) in the context of concentration independent of distance with no [6] electric field.
- 5. Explain the construction and working of a junction field effect transistor (JFET) with its [20] characteristics graphs and relevant equations.
- 6. Write Short notes on any four

[4x5]

- (a) Schottky diode
- (b) RC and LC first order low pass filter
- (c) Hall effect
- (d) Realize NOT Gate using Transistor along with active/passive circuit elements
- (e) Stability Criteria of BJT