Jaypee Institute of Information Technology

Test - 2 Examination, Odd Semester 2021-22

B. Tech. 3rd Semester

Course Title: Electrical Science-2 Maximum Marks: 20 M

Course Code: 15B11EC211 Maximum Time: 1 Hr

Note:

1.This is a pen paper examination. Answers have to be written on papers only in your own hand writing. No answer has to be given on Google form.

2. Write on the first page, your Name, Enrollment Number, Batch, Course Title, Course Code and Date of Exam and Name, Enrollment Number and Page numbering on subsequent pages compulsorily.

3. The steps to obtain the answers should be written in answer sheet.

4. Answers should be uploaded collectively in a single .pdf file at the end of the examination renamed as BATCH_ENROLLNO_NAME.

5. Answers must be written in order of questions and no space should be left between answers of two subsequent questions.

6. Each student must keep his camera and mic 'ON' through Google Meet during exam.

1. **[CO3]** The electron and hole concentrations in an intrinsic semiconductor are n_i per cm^3 at 300 K. Now, if acceptor impurities are introduced with a concentration of N_A per cm^3 (where $N_A \gg n_i$, Find the electron concentration per cm^3 at 300 K? **(1 Mark)**
2. **[CO3]** What is the value of bandgap of Silicon at room temperature? **(1 Mark)**
3. **[CO3]** When acceptor type impurities are added to the intrinsic semiconductor, what is the position of discrete energy level produced due to acceptor impurity? **(1 Mark)**
4. **[CO2]** What is the function of difference amplifier and how it responds to common mode signal? **(1 Mark)**
5. **[CO2]** Given the lower and higher cut-off frequency of a band-pass filter are 2.5kHz and 10kHz. Determine its bandwidth. **(1 Mark)**
6. **[CO2]** Design an op-amp circuit such that output voltage $v_o = -2(3v_1+4v_2+2v_3)$. Given $R_f = 120k\Omega$. **(1 Mark)**
7. **[CO2]** In a series RL circuit connected with voltage source V, what is the type of filter if output is taken across R. **(1 Mark)**
8. **[CO2]** If transfer function of a filter is (1-s)/(1+s)? Which type of filter is this? **(1 Mark)**
9. **[CO2]** For an ideal op amp, the differential voltage across the input terminals is zero. True or false? **(1 Mark)**
10. **[CO2]** In a series resonant circuit, to obtain a low-pass characteristic, across which element should the output voltage be taken? **(1 Mark)**

11. **[CO3]** In an n type silicon, the donor concentration is 1 atom per 2×10^8 silicon atoms. Assume that the effective mass of the electron equals the true mass and the density of atoms in the silicon is 5×10^{22} atoms/cm^3. At what temperature will the Fermi level coincide with the edge of the conduction band? **(2 Marks)**

12. **[CO2]** For the circuit shown in Fig. 1, if input voltage V_s is 9V the output voltage V_o is _____. **(2 Marks)**

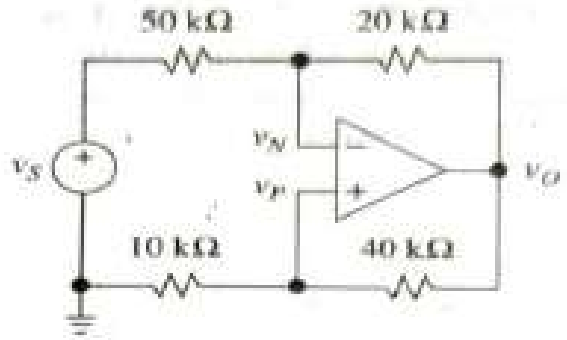

Fig 1

13. **[CO3]** A silicon sample is doped such that $n_o = 1.2 \times 10^{12}$ cm^{-3} and $p_o = 8 \times 10^{11}$ cm^{-3} at 100°C. Determine n_o and p_o assuming that all the dopants are ionised and $n_i = 1.5 \times 10^{10}$ cm^{-3} at 300 K. **(3 Marks)**

14. **[CO2]** In the inverting amplifier as shown in Fig.2 if capacitor C_1 is connected in parallel with resistance R_1 and capacitor C_2 is connected in parallel with resistance R_2 then derive the transfer function H(jω). Specify the suitable component for a low frequency gain of 40dB, a high frequency gain of 0 dB so that the geometric mean of its pole and zero frequencies is 1KHz. **(3 Marks)**

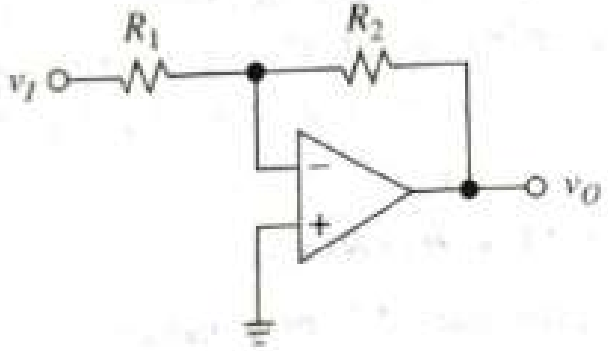

Fig 2