**20EI302**

**Hall Ticket Number:**

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| **II/IV B.Tech (Regular / Supplementary) DEGREE EXAMINATION** | | | |
| **February, 2023** | **Electronics & Instrumentation Engineering** | | |
| **Third Semester** | **Electronic Devices & Circuits** | | |
| **Time:** Three Hours | | **Maximum: 7**0 Marks | |
| *Answer Question No.1 compulsorily.* | | | (14X1 = 14 Marks) |
| *Answer ONE question from each unit.* | | | (4X14=56 Marks) |
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| 1. | a) | | | Describe the concept of tunnelling. | CO1 | L3 |  |
|  | b) | | | What is effective mass? | CO1 | L1 |  |
|  | c) | | | What is a donor impurity'? What is an acceptor impurity? | CO1 | L1 |  |
|  | d) | | | Where does the maximum electric field occur in the space charge region? | CO2 | L1 |  |
|  | e) | | | Describe the avalanche breakdown mechanism in a p-n junction. | CO2 | L3 |  |
|  | f) | | | What is meant by high injection? | CO2 | L1 |  |
|  | g) | | | Draw the forward bias characteristic of a diode. | CO2 | L1 |  |
|  | h) | | | Sketch the cross-section of p-channel MOSFET structure. | CO3 | L3 |  |
|  | i) | | | Define threshold voltage. | CO3 | L1 |  |
|  | j) | | | Draw the small signal model of FET. | CO3 | L3 |  |
|  | k) | | | Explain the three regions of operation of a MOSFET. | CO3 | L2 |  |
|  | l) | | | Define CMRR (Common mode rejection ratio). | CO4 | L1 |  |
|  | m) | | | What is the advantage of current-mirror biasing? | CO4 | L1 |  |
|  | n) | | | What is the advantage of using active load in differential amplifier? | CO4 | L1 |  |
|  | | **Unit - I** | | | | | |
| 2. | a) | | A piece of crystalline silicon is doped uniformly with phosphorus atoms. The doping density is 1016 atoms/cm3. Determine the electron and hole densities in this material at the room temperature. | | CO1 | L3 | 7M |
|  | b) | | Explain the concept of 'hole'. How n-type and p-type semiconductors are formed? Explain. | | CO1 | L2 | 7M |
|  | | **(OR)** | | | | | |
| 3. | a) | | In an experiment, it is desired to obtain equal electron and hole drift currents. How should the carrier densities be chosen? | | CO1 | L3 | 7M |
|  | b) | | Consider the scenario depicted in Fig. 1. Suppose the electron concentration is equal to N at x = 0 and falls linearly to zero at x = L. Determine the diffusion current.    Fig.1 | | CO1 | L4 | 7M |
|  | | **Unit - II** | | | | | |
| 4. | a) | | Qualitatively explain the forward and reverse characteristic of p-n junction diode. | | CO2 | L2 | 7M |
|  | b) | | As shown in Fig. 2, the load pulls a current of 0.5 mA and determine Vout.    Fig.2 | | CO2 | L3 | 7M |
|  | | **(OR)** | | | | | |
| 5. | a) | | Compare the input and output characteristics of BJT in the three configurations, critically. | | CO2 | L2 | 7M |
|  | b) | | Explain the working principle of a Bipolar junction transistor | | CO2 | L1 | 7M |
|  | | **P.T.O**  **20EI302**  **Unit - III** | | | | | |
| 6. | a) | | Calculate the small-signal voltage gain of the CS stage shown in Fig.4. If ID = 1mA, μnCox = 100 μA/V2, VTH = 0.5 V, and λ = 0. Verify that M1 operates in saturation.    Fig.4 | | CO3 | L3 | 7M |
|  | b) | | Figure 5 shows a PMOS CS stage using an NMOS current source load. Compute the voltage gain of the circuit.    Fig.5 | | CO3 | L3 | 7M |
|  | | **(OR)** | | | | | |
| 7. | a) | | Draw the structure of n-channel MOSFET and Qualitatively explain the static Drain and transfer characteristics of the device. | | CO3 | L1 | 7M |
|  | b) | | Derive the small signal voltage gain of common source amplifier | | CO3 | L2 | 7M |
|  | | **Unit - IV** | | | | | |
| 8. | a) | | Draw the circuit of basic current mirror and explain its operation. | | CO4 | L1 | 7M |
|  | b) | | In the circuit below, the factors A, B, C and D are 3,8,8 and 6 respectively. If *IREF* is 452 micro-amperes, what is *ICOPY*? Give your answer in micro amperes. | | CO4 | L3 | 7M |
|  | | **(OR)** | | | | | |
| 9. | a) | | Neglecting channel-length modulation, compute the small-signal gains Vout=I1 | | CO4 | L3 | 7M |
|  | b) | | Calculate the differential voltage gain of the circuits depicted in Fig.8. Assume perfect symmetry and λ > 0.    Fig.8 | | CO4 | L4 | 7M |

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