**20EI302**

**Hall Ticket Number:**

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| **II/IV B.Tech (Regular ) DEGREE EXAMINATION** | | | |
| **March, 2022** | **Electronics & Instrumentation Engineering** | | |
| **Third Semester** | **Electronic Devices and 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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|  |  | |  | | BT  Level |  |  |
| 1. | a) | | What is an intrinsic semiconductor? | | L1 | CO1 |  |
|  | b) | | Write Fermi dirac distribution function. | | L1 | CO1 |  |
|  | c) | | What is drift current? | | L2 | CO1 |  |
|  | d) | | What is meant by excess carriers? | | L2 | CO1 |  |
|  | e) | | What is a step graded junction? | | L1 | CO2 |  |
|  | f) | | What are the applications of diode? | | L1 | CO2 |  |
|  | g) | | What are the operating regions of a Bipolar Junction Transistor? | | L1 | CO2 |  |
|  | h) | | Which configuration of BJT has high input resistance? | | L4 | CO2 |  |
|  | i) | | Define threshold voltage of a MOSFET. | | L1 | CO3 |  |
|  | j) | | In the MOSFET small signal model, why gds is used instead of a current source? | | L4 | CO3 |  |
|  | k) | | In which configuration of MOSFET, body effect does not influence the performance. | | L4 | CO3 |  |
|  | l) | | In a current mirror circuit, which device can be used as a copy circuit? | | L3 | CO4 |  |
|  | m) | | What is the advantage of using active load in an amplifier? | | L2 | CO4 |  |
|  | n) | | Define Common Mode Rejection Ratio(CMRR). | | L1 | CO4 |  |
| **Unit - I** | | | | | | | |
| 2. | a) | Derive the expression for location of Fermi level in an intrinsic semiconductor. | | L2 | | CO1 | 7M |
|  | b) | What are the methods of generating excess carriers? Write in detail about any two methods. | | L1 | | CO1 | 7M |
| **(OR)** | | | | | | | |
| 3. | a) | Derive the relation Jdrift = qnµnE + qpµpE using the concept of "Random thermal motion of carriers" | | L2 | | CO1 | 7M |
|  | b) | A particular sample of Germanium has a donor density Nd = 1014 atoms/cm3. Assuming that all donor atoms got ionized, calculate the resistivity of the sample. Given µn = 3900 cm2/ (volt-sec) for Ge at 300 K. | | L3 | | CO1 | 7M |
| **Unit - II** | | | | | | | |
| 4. | a) | Explain qualitatively, the operation of a pn diode. | | L2 | | CO2 | 7M |
|  | b) | A silicon pn junction has a built in potential of 0.65 V and the acceptor concentration on the p-side is 100 times the donor concentration on the n-side. Find the value of depletion capacitance per unit area when a reverse bias of 10V is applies across it. Also find the width of the depletion region. Given  εsi = 11.7, ε0 = 8.854 × 10-14 F/cm, ni = 1.5 × 1010 /cm3. | | L3 | | CO2 | 7M |
| **(OR)** | | | | | | | |
| 5. | a) | Show that a Bipolar Junction transistor is basically a transconductance amplifier. | | L4 | | CO2 | 7M |
|  | b) | Determine the quiescent currents and the collector to emitter voltage for a silicon transistor with β = 50 in the self bias arrangement of the following fig. The circuit component values are VCC = 20 V, RC = 2 KΩ, RE = 0.1 KΩ, R1 = 100 KΩ, R2 = 5 KΩ. Assume VBE = 0.7 V    Fig : Circuit for question 5(b) | | L3 | | CO2 | 7M |
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| **Unit - III** | | | | | | | |
| 6. | a) | Draw the drain characteristics of a MOSFET. Clearly specify the operating regions. Also write the expressions for the drain current in those operating regions. | | L2 | | CO3 | 7M |
|  | b) | An nMOS device carries 1 mA with VGS - VTH = 0.6 V and 1.6 mA with  VGS - VTH = 0.8 V. If the device operates in the triode region, calculate VDS and W/L | | L3 | | CO3 | 7M |
| **(OR)** | | | | | | | |
| 7. | a) | Draw the circuit of common source amplifier and determine its small signal voltage gain, input resistance and output resistance. | | L2 | | CO3 | 7M |
|  | b) | Compute the voltage gain of the circuit shown below if λ = 0 | | L4 | | CO3 | 7M |
| **Unit - IV** | | | | | | | |
| 8. | a) | Explain the design of a basic current mirror. | | L2 | | CO4 | 7M |
|  | b) | In the following circuit, Find the drain current of M4 if all of the transistors are in saturation | | L3 | | CO4 | 7M |
| **(OR)** | | | | | | | |
| 9. | a) | Write in detail about single ended and differential operation | | L1 | | CO4 | 7M |
|  | b) | Derive the expression for differential gain of a differential pair | | L3 | | CO4 | 7M |

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