

**B.Tech. - VIEP - ELECTRONICS AND  
COMMUNICATION ENGINEERING  
(BTECVI)**

**Term-End Examination**

00008

**December, 2015**

**BIELE-013 : DEVICE MODELLING FOR  
CIRCUIT SIMULATION**

*Time : 3 hours*

*Maximum Marks : 70*

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**Note :** Attempt any *seven* questions. All questions carry equal marks. Missing data may be suitably assumed. Use of scientific calculator is permitted.

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1. (a) What is the full form of SPICE ? Enlist the various applications of SPICE with a suitable example. 5
- (b) How is d.c. and transient analysis of the circuit done by using SPICE ? Explain with a suitable example. 5
2. What are the applications of junction diodes in modern electronic industries ? How are diode parameters like bulk resistance, junction resistance, forward voltage drop and reverse breakdown voltage measured ? 10
3. Draw and explain the noise models of bipolar junction transistor. 10
4. What is MOS capacitance ? Explain parasitic capacitances, oxide-related capacitances and junction capacitances with suitable diagrams. 10

5. Describe the relationship between the mask channel length ( $L_{\text{mask}}$ ) and the electrical channel length ( $L$ ). Are they identical? If not, how would you express  $L$  in terms of  $L_{\text{mask}}$  and other parameters? 10
6. Why is LEVEL 2 MOSFET model required? Derive the drain current equation and explain the variation of mobility with electric field. 10
7. For a d.c. circuit shown in Figure 1, assume the MOSFET parameters  $V_{\text{TN}} = 2 \text{ V}$ ,  $K'_n = 80 \mu\text{A} / \text{V}^2$  and  $W/L = 4$ . Choose  $R_1$  and  $R_2$  such that the current in the bias resistors is approximately one-tenth of  $I_D$ . Design the circuit such that  $I_D = 0.5 \text{ mA}$ . 10

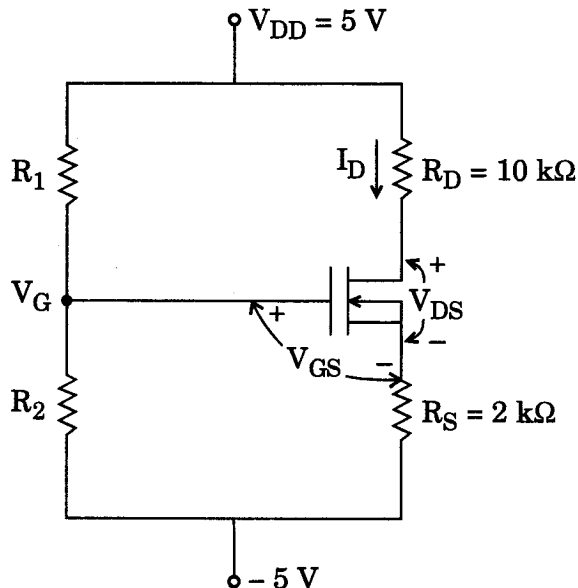


Figure 1

8. Draw and explain the structure of a MESFET and also derive its drain current equation. 10
9. (a) Using the approximate Boltzmann's diode equation, find the change in forward bias for doubling the forward current of a germanium semiconductor diode at 290°K. 5
- (b) What are the advantages and disadvantages of heterojunction devices? Enlist the various applications of it. 5
10. Write short notes on any *two* of the following : 2×5=10
- (a) DIBL (Drain Induced Barrier Lowering)
- (b) HEMT
- (c) Introduction to BSIM Models
- (d) High Frequency Model of BJT
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