

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

00745

**Term-End Examination
June, 2014**

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

Time : 3 hours

Maximum Marks : 70

Note : *Attempt any seven questions. All questions carry equal marks. Missing data may be suitably assumed. Calculators are permitted.*

1. The transistor shown in the circuit of figure 1 has $\beta = 100$ and exhibits a V_{BE} of 0.7 V at $i_C = 1\text{ mA}$. Design the circuit (R_C and R_E) so that a current of 2 A flows through the collector and a voltage of $+5\text{ V}$ appears at the collector. 10

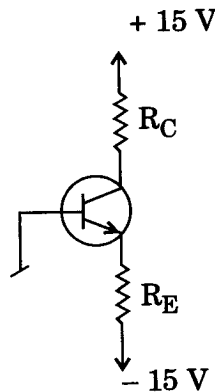


Figure 1

2. (a)

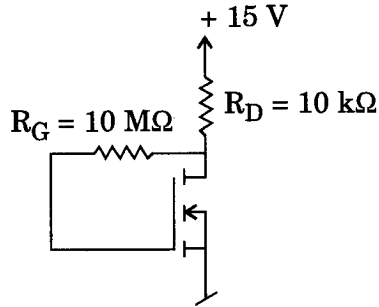


Figure 2

For the circuit shown in figure 2, the transistor has $V_t = 1.5$ V, $K_n' (W/L) = 0.25$ mA/V² and $V_A = 50$ V. Calculate I_D , V_{DS} and V_{GS} .

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- (b) An E-MOSFET with $V_t = 0.7$ V conducts a current $i_D = 100$ μ A when $V_{GS} = V_{DS} = 1.2$ V. Find i_D for $V_{GS} = 1.5$ V and $V_{DS} = 3$ V. Also calculate r_{DS} for small V_{DS} and $V_{GS} = 3.2$ V.

3. With the help of a suitable example explain the principle and the objectives of circuit simulation. 10

4. Give the model statement in SPICE for the following: 2×5=10

- (i) Op-Amp
- (ii) Diode
- (iii) BJT
- (iv) MOSFET
- (v) FET

5. What do we understand by the term SPICE ?
Explain how will we carry out the AC and Transient analysis of the circuit. $3+3\frac{1}{2}+3\frac{1}{2}$
6. Discuss the small-signal model of a diode in detail with the help of suitable mathematical expressions. 10
7. Explain in brief the various noise models of MOSFETs. 10
8. What are the differences between LEVEL-1 and LEVEL-2 large signal MOSFET models ? 10
9. Explain in brief the operation of following with the help of neat sketch : 5+5
- (i) Heterojunction Bipolar Transistors (HBTs).
 - (ii) High-Electron Mobility Transistor (HEMT).
10. Write short notes on any *two* of the following : 5+5
- (i) Short-Channel Effects in MOSFETs
 - (ii) MESFETs
 - (iii) Principle of heterojunction device
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