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BIELE-013

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

00873

Term-End Examination

December, 2016

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. Use of scientific calculator is permitted.*

1. (a) What is the use of device modelling and circuit simulation ? What are the softwares available for circuit simulation ?

(b) Write the SPICE code of a full wave rectifier circuit.

(c) Write the SPICE commands for DC, AC transients and plotting of curves. What is netlist ?

(d) Explain the short channel effect of MOSFET. How is it overcome ?

(e) What is base width modulation effect in a BJT ? *5×2=10*

2. (a) Explain the following of a p-n junction diode : *2+1+2=5*

(i) DC characteristics of the ideal diode

(ii) High-level injection

(iii) Junction breakdown

(b) Enlist the SPICE diode model parameters. *5*

3. (a) What is the difference between Large-signal and Small-signal models of the diode ? Explain with a suitable circuit diagram.

(b) Describe the High frequency and Noise models of diode. *5+5=10*

4. (a) Explain the drain characteristics of a JFET. How is it different from a MESFET ?

(b) How can the model parameters of a MOSFET be extracted ? Enlist all model parameters with their default values. *5+5=10*

5. (a) Explain the operation mechanism of N-channel MOSFET. Derive the expression of drain current in cut-off, linear and saturation regions. Draw its transfer characteristics.

(b) Explain the effect of channel length modulation in MOSFET. *7+3=10*

6. (a) Draw and explain the equivalent circuit structure of N-MOS Level-3 model. Write the drain current equation for linear, saturation and cut-off regions.

   (b) Write the difference between a MOSFET and a MESFET. What are their applications ? *7+3=10*

7. (a) Explain the operation principle of a BJT. Draw its input and output characteristics.

   (b) Enlist all model parameters of BJT with their default values and units. *5+5=10*

8. (a) What is scaling ? What is the role of scaling in today's IC technology ?

   (b) What is mobility ? What are the mobility models available for MOSFET ?

   (c) Explain the role of MOS Capacitor in the operation of a MOSFET. *3+4+3=10*

9. (a) Draw and explain the energy band diagram of heterojunction devices in equilibrium and at applied positive voltages.

   (b) What is built-in voltage of a p-n junction diode ?

   (c) Explain the charge sharing and non-linear effects of MOSFET. *4+2+4=10*

10. Write short notes on any ***two*** of the following : *2×5=10*

(a) DIBL Effect

(b) HEMT

(c) HBT

(d) BSIM Model