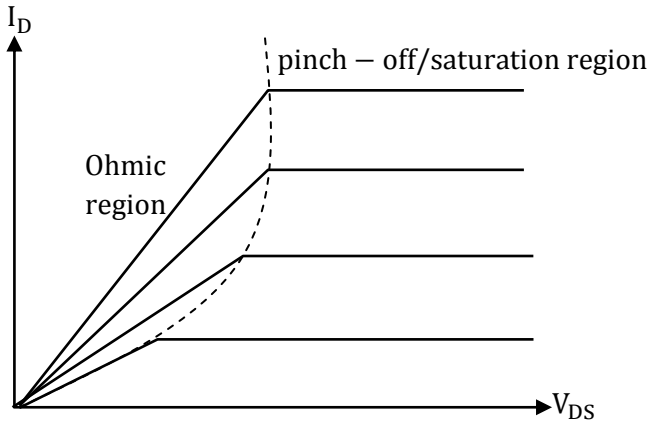
Electronic Device and Circuits

Answer Keys and Explanations

1. **[Ans. C]**
JFET can be used as voltage variable resistor (VVR) in linear (or) Ohmic region which is well below pinch-off.



∴ Option (C)is Correct.

2. **[Ans. D]**
MOS capacitor fabricated on a p-types Semiconductor is NMOS type V_{GS} applied should be positive which implies surface potential is positive and equal to Fermi potential.

3. **[Ans. A]**
As $C_j \propto \frac{1}{\sqrt{V_R}}$
$C_j = K.\frac{1}{\sqrt{V_R}}$
$C_j = 1$ and $V_R = 1$ then $K = 1$
When
For $V_R = 4$ then $C_j = \frac{1}{\sqrt{4}} = 0.5$ PF

4. **[Ans. *] Range: 1.03 to 1.04**
$\lambda = \frac{1.24}{E_g(eV)}(\mu m) = \frac{1.21}{1.2} = 1.03\ \mu m$

5. **[Ans. B]**

6. **[Ans. B]**
Minimum V_{DS} for Saturation $V_{DS_{min}} = V_{GS} - V_P$
$= -2 - (-4) = 2V$

∴ Option (B) is Correct.

7. **[Ans.*] Range 40 to 40**

$C_{Diffusion} = g\tau$

$= \frac{I_D}{\eta V_T} = \tau$

$= \frac{2 \times 10^{-3}}{2 \times 25 \times 10^{-3}} \times 1\mu sec$

$= 40nF$

8. **[Ans. D]**

$p_o = N_A = 1.25 \times 10^{15}\ cm^{-3}$

$n_o = 3 \times 10^{15}\ cm^{-3};\ n_i = 1.5 \times 10^{10}\ cm^{-3}$

$V_S = V_T \ln\left(\frac{N_A N_D}{n_i^2}\right) = 0.612\ V$

9. **[Ans. *] Range 45 to 45**

$V_{Ds} < V_{GS} - V_{th};\quad 0.1 < 0.2$

$I_D = \mu_n C_{ox} \left(\frac{W}{L}\right)\left[(V_{GS} - V_{th})(V_{DS}) - \frac{V_{DS}^2}{2}\right]$

$= 0.003 \times \left[(0.2)(0.1) - \frac{(0.1)^2}{2}\right] = 45 \times 10^{-6}$

10. **[Ans. A]**

Hole Diffusion current at distance of $'x'cm = J_{P_0}\left(e^{\frac{V_D}{V_T}} - 1\right).\exp\left(-\frac{x}{L_P}\right)$

Where $J_{P_0} = \frac{qD_P P_{n_0}}{L_P}$

and $L_P = \sqrt{D\tau} = 2.83 \times 10^{-4}\ cm$

$P_{n_0} = \frac{ni^2}{N_D} = 2.25 \times 10^4$

$J_{P_o} = \frac{1.6 \times 10^{-9} \times 8 \times 2.25 \times 10^4}{2.83 \times 10^{-4}}$

$= 1.017 \times 10^{-10} A/cm^2$

J_P at $x = 3\mu m\ (= 3 \times 10^{-4} cm) = 1.017 \times 10^{-10}\left(e^{0.61/0.0259} - 1\right)e^{-3/2.83}$

$J_p = 0.6\ A/(cm^2)$

∴ Option (A) is Correct