IAT 3 Solution

5.

i) $Z_i = R_G = 1\ M\Omega$

ii) $Z_o = r_d \,||\, R_D = 50\ K \,||\, 5.1\ K = 4628\ \Omega$

iii) Voltage Gain A_v : We have

$$A_v = -g_m\ (r_d \,||\, R_D)$$

$$= -2\ mS\ (50\ K \,||\, 5.1\ K)$$

$$= -2\ mS\ (4628)$$

$$= -9.256$$

6.

a) $A_{V_1} = \frac{Z_{i2}}{Z_{o1} + Z_{i2}}$ $A_{VNL} = \frac{1k\Omega}{3.5k\Omega + 1k\Omega} \times -430$

$= -95.56.$

$A_{V_2} = \frac{R_L}{Z_o + R_L} = \frac{2.7}{2.7 + 3.5} \times -430$

$= -187$

$A_{I1} = -A_{V1}\frac{Z_i}{Z_{i2}} = 95.56 \times \frac{1}{1} = 95.56.$

$A_{I2} = -A_{V2}\frac{Z_{i2}}{R_L} = 187\frac{1}{2.7} = 69.26$

b) $A_{VT} = A_{V1} \cdot A_{V2} = 17.869 \times 10^3$. (or)

17869.72

$A_{IT} = A_{I1} \cdot A_{I2} = 6618.4856$ (or)

6.618×10^3.

7.

i) g_m : We have,

$$g_{mo} = \frac{2I_{DSS}}{|V_p|} = \frac{2(8\times 10^{-3})}{8\text{ V}} = 2\text{ mS}$$

Also we have,

$$g_m = g_{mo}\left(1-\frac{V_{GSQ}}{V_p}\right) = 2\text{ mS}\left(1-\frac{(-2\text{ V})}{(-8\text{ V})}\right) = 1.5\text{ mS}$$

ii) r_d : $$r_d = \frac{1}{Y_{os}} = \frac{1}{20\,\mu\text{S}} = 50\text{ k}\Omega$$

iii) Z_i : We have,

$$Z_i = R_G = 1\text{ M}\Omega$$

iv) Z_o : We have,

$$Z_o = r_d \,||\, R_D = 50\ K \,||\, 5.1\ K = 4628\ \Omega$$

v) A_v : We have,

$$A_v = \frac{V_o}{V_i} = -g_m\,(r_d \,||\, R_D) = -1.5\ mS\ (50\ K \,||\, 5.1\ K) = -1.5\ mS\ (4628)$$

$$= -6.942$$