

# Thapar Institute of Engineering & Technology, Patiala

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Code: UEC 301; Course Name: Analog Electronic Circuits

B.E (ECE/ENC) (IV-Sem), "Tutorial Sheet No. - 6"

- Q1. With  $g_m = 50\text{mA/V}$ ,  $r_{b'e} = 1\text{K}$ ,  $C_e = 1\text{ pF}$  and  $C_c = 0.2\text{ pF}$ , determine the values of  $f_\beta$  and  $f_T$ .
- Q2. The following low frequency parameters are known for a given transistor at room temperature (300 K) at  $I_C = 10\text{ mA}$  and  $V_{CE} = 8\text{ volts}$ :  $h_{ie} = 500\ \Omega$ ,  $h_{oe} = 2 \times 10^{-4}\ \mu\text{S}$ ,  $h_{fe} = 100$  and  $h_{re} = 10^{-4}$ . At the same operating point,  $f_T = 50\text{ MHz}$  and  $C_{ob} (= C_c) = 3\text{ pF}$ . Calculate the values of hybrid –  $\pi$  parameters.
- Q3. The following results were obtained on transistor measurements made at  $I_C = 8\text{ mA}$ ,  $V_{CE} = 10\text{ volts}$  and at room temperature (300 K):  $h_{fe} = 100$ ,  $h_{ie} = 800\ \Omega$ , short circuit current gain  $A_{IS} = 14$  at 8 MHz,  $C_c = 4\text{ pF}$ . Calculate  $r_{b'e}$ ,  $r_{bb'}$ ,  $f_\beta$ ,  $f_T$  and  $C_e$ .
- Q4. A germanium pnp transistor operating in the active region has base width of  $2.5 \times 10^{-4}\text{cm}$ . At room temperature (300 K) and for dc emitter current of 4 mA find (a) the emitter junction diffusion capacitance  $C_{De}$  and (b) frequency  $f_T$ . Given that the diffusion constant  $D_B$  for holes in n-type base region is  $50\text{ cm}^2/\text{second}$ .
- Q5. When a step input of amplitude V is applied to a low – pass RC circuit. What will be the output voltage? Draw it. Also discuss the rise time in terms of  $f_H$  (upper 3 dB frequency).
- Q6. When a step input of amplitude V is applied to high – pass RC circuit. What will be the output voltage? Draw it. Also discuss the tilt or sag in terms of  $f_L$  (lower 3 dB frequency).