

S.E.Extc - sem 3 (CBAs) . 20/11/14.

A E-I  
(Analog Electronics-I).

QP Code : 14553

(3 Hours)

[ Total Marks : 80 ]

- N.B. : (1) Question No.1 is compulsory.  
 (2) Attempt any three from remaining questions.  
 (3) Assume suitable data if required and mention the same in answer book.

1. Attempt any five :—

20

- (a) The PNP transistor shown in Fig 1a has  $\beta=50$ . Find the value of  $R_C$  to obtain  $V_C = +5V$ . What happens if transistor is replaced with another transistor having  $\beta=100$ .

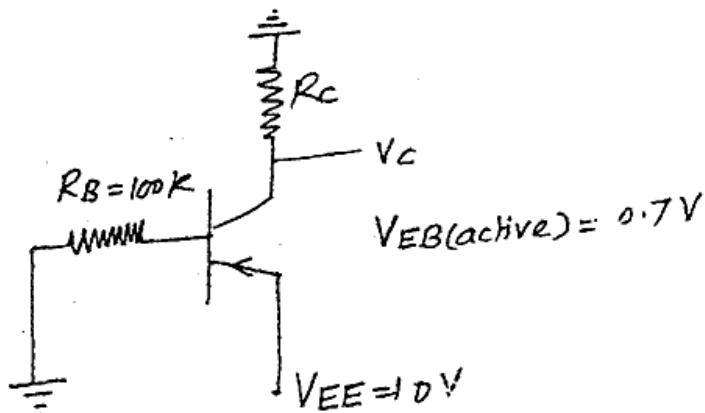


Fig 1a .

- (b) Draw small signal model of JFET and explain significance of each parameter.  
 (c) Why common collector amplifier is used as buffer. Why buffers are required.  
 (d) Write down current equation of diode and explain significance of each parameters.  
 (e) For the circuit shown in Fig 1e. Find  $I_{DS}$  and  $V_{DS}$  if  $V_{RS}=1.5V$ .

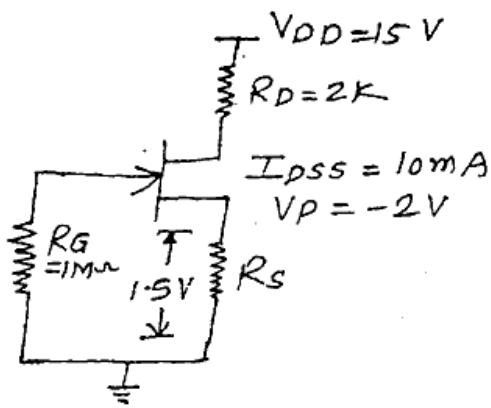


Fig 1e .

GN-Con: 6460-14.

[ TURN OVER ]

54

- (f) Compare Collpit's and Clapp's oscillator. 10
2. (a) Explain working of n-channel EMOSFET with the help output characteristics, showing clearly effect of channel length modulation. Given equation of drain current in linear and saturation current along with conditions. 10
- (b) Design JFET circuit with voltage divider biasing as shown in Fig 2b with JFET parameters  $I_{DSS} = 12\text{mA}$ ,  $V_p = -3.5\text{V}$  and  $\lambda = 0$ . Let  $R_1 + R_2 = 100\text{K}$ ,  $I_{DSQ} = 5\text{mA}$  and  $V_{DSQ} = 5\text{V}$ . 10

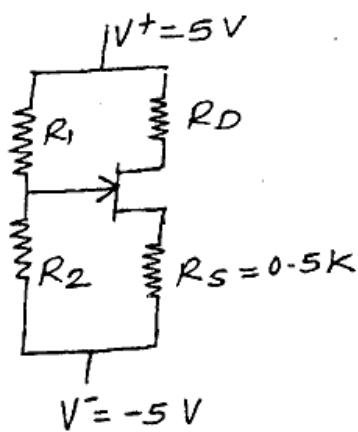


Fig 2b

3. (a) Draw circuit diagram of common emitter amplifier with voltage divider bias with bypassed emitter resistance and derive expression for voltage gain, current gain, input resistance, output resistance using hybrid- $\pi$  model which includes early effect. 10
- (b) In n-channel E-MOSFET 10
- (i) Substrate doping  $N_A = 10^{16} \text{ cm}^{-3}$
  - (ii) Polysilicon Gae doping  $N_D = 10^{20} \text{ cm}^{-3}$
  - (iii) Gate oxide thickness  $t_{ox} = 0.5 \mu\text{m}$
  - (iv) Oxide positive charge interface density  $= 4 \times 10^{10} \text{ cm}^{-2}$
  - (v) Charge of electron  $= 1.6 \times 10^{-19} \text{ col}$
  - (vi) Permittivity of free space  $\epsilon_0 = 8.85 \times 10^{-14} \text{ F/cm}$ .
  - (vii) Dielectric constant of Si  $= 11.9$
  - (viii) Dielectric constant of  $\text{SiO}_2 = 3.9$
- Find zero bias threshold voltage ( $V_{TO}$ )

3

QP Code : 14553

4. (a) Explain the working of Wien-Bridge Oscillator. Derive the expression for frequency of Oscillation and the value of gain required for sustained oscillation. 10
- (b) For the circuit shown in Fig 4b, assume  $\beta=100$ . 10
- Find thevenin's equivalent voltage  $V_{TH}$  and resistance  $R_{TH}$  for base circuit.
  - Determine  $I_{CQ}$  and  $V_{CEQ}$

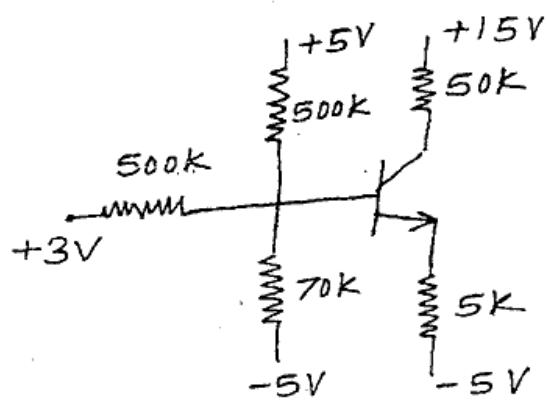


Fig 4b .

5. (a) Draw a required diode clamper circuit to generate the output  $v_o$  to from the input  $v_i$  as shown in Fig 5a if 10
- $V_\gamma = 0V$
  - $V_\gamma = 0.7V$ . Where  $V_\gamma$  is cutin voltage of diode.

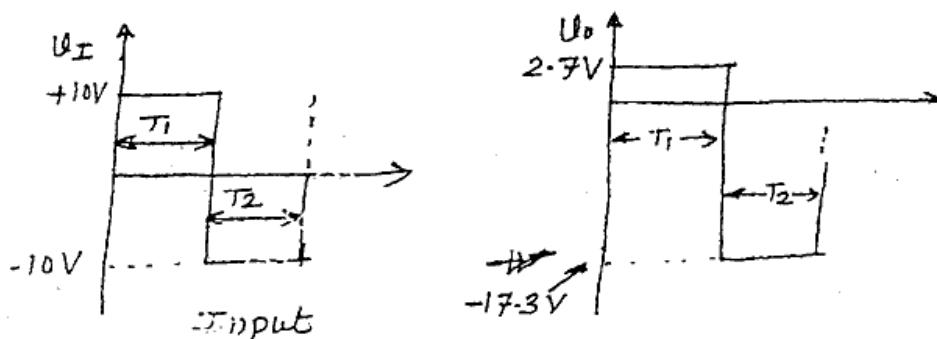


Fig.5a .

GN-Con: 6460-14.

[ TURN OVER 56

4

QP Code : **14553**

- (b) What are different biasing techniques used to bias D-MOSFET and E-MOSFET. 10  
Explain with the help of appropriate circuit diagrams.
6. Write short notes on any four :— 20
- (i) Hybrid- $\pi$  model of BJT
  - (ii) Twin-T oscillator
  - (iii) AC and DC load line.
  - (iv) Construction and operation of photodiode.
  - (v) MOS capacitor.
-