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[4757]-142**S.E. (Electronics/E&TC) (First Semester) EXAMINATION, 2015****SOLID STATE DEVICES AND CIRCUITS****(2008 PATTERN)****Time : Three Hours****Maximum Marks : 100**

N.B. :— (i) Answers to the *two* sections should be written in separate answer books.

(ii) Answer any *three* questions from each Section.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of calculator is allowed.

(vi) Assume suitable data, if necessary.

SECTION I

1. (a) What are the features of switching diodes ? Draw the characteristics of switching diode and mention application of switching diode. [8]

P.T.O.

- (b) Calculate I_F for the Si diode circuit shown in Fig. 1 for $r_d = 0$ and then recalculate the current taking $r_d = 0.25 \Omega$. [4]

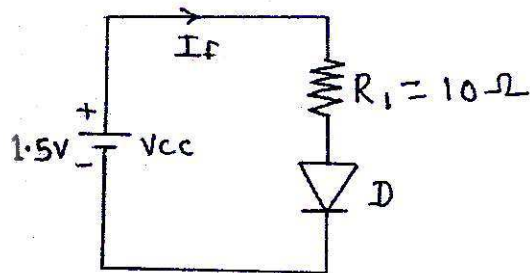


Fig. 1

- (c) Define D.C. load line and Q point of diode circuit and list the factors which affect Q point on D.C. load line. [4]

Or

2. (a) The n channel E-MOSFET has the following parameters : [8]
 $V_{GS} = 3 \text{ V}$, $V_T = 1 \text{ V}$, $\lambda = 0.03/\text{V}$, $K = 0.15 \text{ mA/V}^2$,
 $V_{DS} = 8 \text{ V}$.

Calculate :

- (i) Drain current
(ii) The output resistance.
- (b) Why are MOSFETs used as VLSI device ? [4]
- (c) While handling CMOS devices, what precaution should be taken ? [4]

3. (a) Compare between transistor BJT and MOSFET. [8]
 (b) Determine I_{DQ} , V_{GSQ} and V_{DSQ} for the circuit shown in Fig. 2 with $V_{GS(TH)} = 5\text{ V}$, $I_{D(ON)} = 3\text{ mA}$ and $V_{GS(ON)} = 10\text{ V}$. [10]

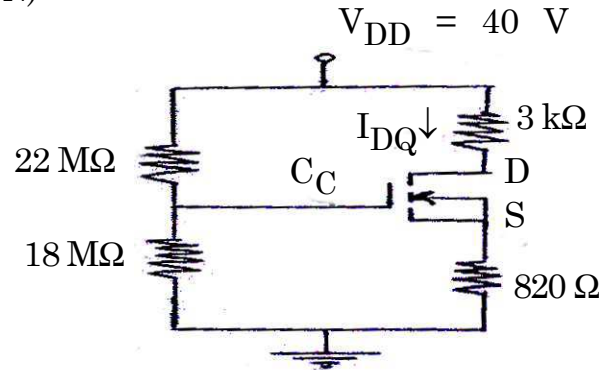


Fig. 2

Or

4. (a) For Common Source Amplifier circuit shown in Fig. 3. Determine g_m , r_o , A_v , R_i , R_o . Given $V_T = 1.2\text{ V}$, $K = 0.48\text{ mA/V}^2$, $\lambda = 0.012/\text{V}$. [10]

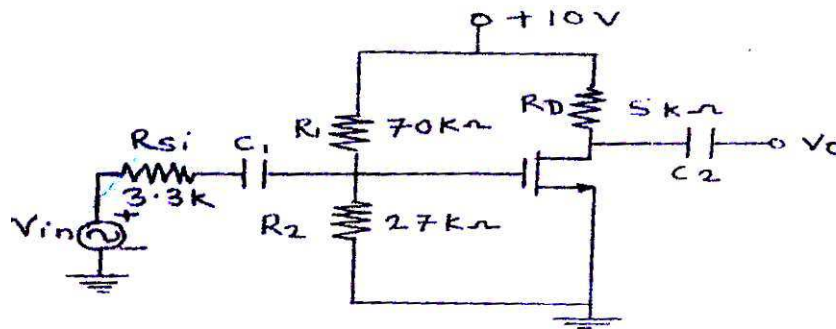


Fig. 3

- (b) Define : [8]
 (i) Threshold voltage
 (ii) Trans-conductance
 (iii) Drain resistance
 (iv) Conduction parameter.

5. (a) Draw the small signal equivalent circuit of BJT using h -parameters for common emitter configuration. Explain the significance of each parameter with formulae. State benefit of h -parameter. [8]
- (b) For the circuit shown in Fig. 4, find I_{BQ} , I_{CQ} and V_{CEQ} , for $\beta = 150$. [8]

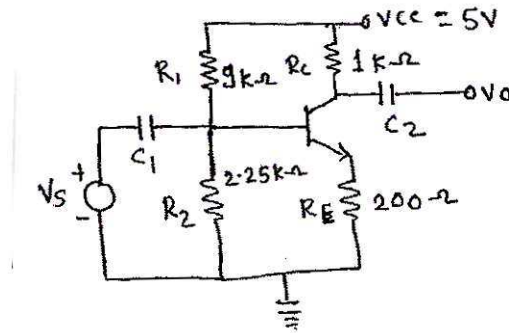


Fig. 4

Or

6. (a) For the circuit shown in Fig. 5, calculate the A_i , A_v , A_{vS} , R_i and R_o . The h -parameters are $h_{ie} = 1.1 \text{ k}\Omega$, $h_{fe} = 50$, $h_{re} = 2.5 \times 10^{-4}$ and $h_{oe} = 25 \text{ }\mu\text{A/V}$. [10]

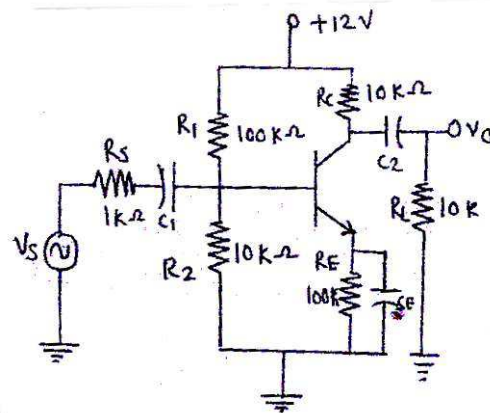


Fig. 5

- (b) What is thermal runaway in BJT ? Derive the condition for thermal stability. [6]

SECTION II

7. (a) What is significance of frequency response ? Explain the effect of various capacitor listed below on frequency response of an amplifier. [8]
- (i) Coupling capacitor
 - (ii) Bypass capacitor
 - (iii) Junction capacitor.
- (b) Draw hybrid Π CE amplifier model at high frequency. Explain the significance of each parameter. [8]

Or

8. (a) The following low frequency parameter are known for a given transistor at $I_C = 10$ mA, $V_{CE} = 10$ V at room temperature, $h_{fe} = 100$, $h_{ie} = 500 \Omega$, $h_{re} = 10^{-4}$, $h_{oe} = 10^{-5}$ A/V at same operating point $F_T = 50$ MHz, $C_c = 3$ pF. Compute the value of all the hybrid Π parameters and value of C_e . Draw the equivalent circuit. [10]
- (b) Explain the following term : [6]
- (i) Gain—BW product
 - (ii) Effect of multistage amplifier on the BW
 - (iii) Need of multistage amplifier.

9. (a) What are the *four* basic amplifier types ? Explain with the help of a block diagram in detail. What are the desirable characteristics of four basic amplifiers ? [10]
- (b) Explain Colpitt oscillator and calculate frequency of oscillations of Colpitt oscillator with $C_1 = C_2 = 600 \text{ Pf}$ and $L = 2 \text{ MHz}$. [8]

Or

10. (a) The circuit shown in Fig. 6, has the following parameters :
 $R_C = 4 \text{ k}\Omega$, $R_f = 40 \text{ k}\Omega$, $R_S = 10 \text{ k}\Omega$. [12]
 $h_{ie} = 1.1 \text{ k}$, $h_{fe} = 50$, $h_{re} = h_{oe} = 0$.

Find :

- (i) β
(ii) R_M
(iii) R_{MF}
(iv) A_{Vf}
(v) R_{if}
(vi) R'_{of}

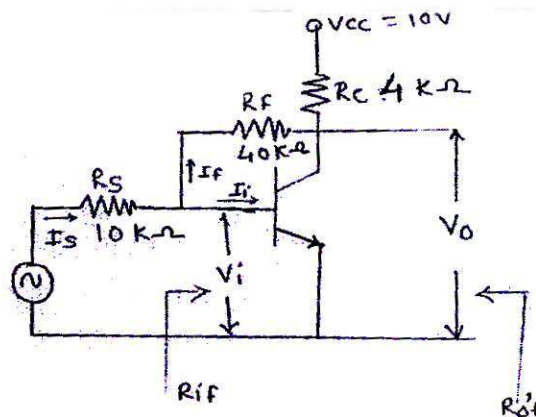


Fig. 6

- (b) State the criteria to be satisfied which makes the amplifier to be used as oscillator. [6]
11. (a) Explain the construction of power BJT. Draw and explain I-V characteristics of power BJT in different modes. [8]
- (b) The power amplifier delivers 50 watts output at 50% efficiency. The ambient temperature of 25°C. If the maximum allowable junction temperature is 150°C, then calculate : [8]
- (i) Power dissipation
- (ii) Maximum thermal resistance.

Or

12. (a) Explain in brief : [8]
- (i) Why impedance matching is required in power amplifier ?
- (ii) Why can h -parameters not be used for the analysis of power amplifier ?
- (b) A power transistor operating in class A transformer coupled circuit is to be delivered 4 watts of power into 4 Ω load. The Q point is adjusted for symmetrical current swing

$V_{cc} = 18 \text{ V}$, assume ideal characteristic and $V_{min} = 0$,
calculate : [8]

- (i) Turns ratio of output transformer
- (ii) Peak collector current
- (iii) Q-point coordinates
- (iv) Collector circuit efficiency.

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