B. Tech.

(SEM. II) EXAMINATION, 2008-09
ELECTRONICS ENGINEERING

Time : 3 Hours] [Total Marks : 100

Note : (1) Attempt all questions.
(2) All questions carry equal marks.
(3) In case of numerical problems assume data wherever not provided
(4) Be precise in your answer.

1. Attempt any four parts:

(a) The mobility of free electrons and holes in pure germinium are 3800 and 1800 cm²/V-s respectively. The corresponding values for the pure silicon are 1300 and 500 cm²/V-s respectively. Determine the values of intrinsic conductivity for both germanium and silicon. Assume \( n_i = 2.5 \times 10^{13} \) cm\(^{-3}\) for germanium and \( n_i = 1.5 \times 10^{10} \) cm\(^{-3}\) for silicon at room temperature.

(b) Describe the difference between majority and minority carriers. How the minority carriers vary with temperature.

(c) Define the static and dynamic resistance of the diode, how these resistances are measured?
(d) Discuss the difference between diffusion and transition capacitances.

(e) Draw the reverse characteristics of a diode, define avalanche and Zener breakdown regions.

(f) Define the reverse recovery time of a diode.

2 Attempt any four parts of the following:
(a) Sketch $V_o$ for the circuit shown in fig. 1.

![Fig. 1](image)

(b) For the circuit shown in fig. 2 sketch $C_R$ and $V_o$

![Fig. 2](image)

$D_1$ and $D_2$ are Si diodes
(c) Determine $V_L$, $I_L$, $I_Z$ and $I_R$ for the circuit. $R_L$ is 470 $\Omega$.

![Circuit Diagram](image)

$$V_Z = 9.1 \text{V} \quad P_{z_{\text{max}}} = 400 \text{mW}$$

**Fig. 3**

(d) For the clamping circuits shown in fig. 4, sketch for $V_o$.

![Clamping Circuits](image)

**Fig. 4**

(e) Draw the circuit diagram of a bridge rectifier. Discuss the operation and find dc and rms output voltage, regulation and efficiency of the circuit.

(f) With the help of the circuit diagram explain the working of voltage tripler.
Attempt any four parts of the following:

(a) For a voltage divider biasing circuit, find $I_C$, $V_{CE}$, $I_B$, $V_E$ and $V_B$.

(b) For an emitter follower circuit device the expression for $Z_i$, $Z_0$, $A_\nu$ and $A_i$ in terms of common emitter parameters.

(c) Compare the $Z_i$, $Z_0$, $A_i$ and $A_\nu$ for $C_E$, $C_B$, $C_C$ amplifiers and comment on their uses.

(d) For the circuit shown in fig. 6 find $A_\nu$, $A_1$, $Z_0$ and $Z_i (h)$ parameters are $h_{ie} = 1 \, \text{k} \, \Omega \, \, h_{re} \simeq 0$, $h_{fe} = 50$, $h_{oe} \simeq 0$. 

Fig. 5

Fig. 6
(e) What is the operating point? How is it selected? How do you define bias stability?

(f) Derive the expression for input impedance and voltage gain for a CE amp shown in fig. 7 using simplified (approximate) equivalent circuit i.e. \( h_{re} \approx h_{oe} = 0 \).

![Fig. 7](image)

4 Attempt two parts of the following:

(a) Define trans conductance \( (I_m) \) output resistance \( (r_p) \) and gain of an FET. How these parameters are determined from graphically?

(b) For common source FET amplifier with source resistance \( R_s \), derive the expression for voltage gain input impedance and output impedance.

(c) For a circuit shown in fig. 8 calculate \( V_o \), \( Z_i \) and \( Z_o \) input \( V_i = 0.2 \text{ V(rms)} \) \( I_{DSS} = 9 \text{ mA} \) \( V_p = -4.5 \text{ V} \).

![Fig. 8](image)
5 Attempt any two parts of the following:

(a) (i) Define CMRR of a differential amplifier.
(ii) For the circuit shown in fig. 9, find out voltage $V_o$.

![Diagram of differential amplifier circuit](image)

(iii) Draw a differential amplifier circuit using op. amp. and find the output voltage in terms of different input voltage.

(b) (i) Convert the following numbers:

(a) \((2D6)_{16} = (\ \ \ )_2\)
(b) \((011010110)_{16} = (\ \ \ )_2\)

(ii) Convert the following function into canonical forms.

\[ Y = AB + AC + AD + BCD \]

(iii) Complete the following $a + i$ operations.

(a) \(8_{16} + F_{16} = (\ \ \ )_{16}\)
(b) \(00010100 + 00101001 = (\ \ \ )_2\)
\(01001111 - 00000101 = (\ \ \ )_2\)
(iv) Minimize the following function using Boolean algebra

\[ Y = \overline{A}BCD + AB\overline{C}D + AB\overline{C}D + ABCD + ABC\overline{D} + A\overline{B}\overline{C}D + \overline{A}\overline{B}CD + A\overline{B}C\overline{D} \]

(e) (i) Draw the circuit diagram of inverting and non-inverting amplifier and find the expression for output voltage.

(ii) Draw the circuit diagram of integrator using OPAMP and find the expression for output voltage.