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Printed Pages—4

TEC—301

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3073

Roll No. 0309613031

B.Tech.

THIRD SEMESTER EXAMINATION, 2005-2006

SOLID STATE DEVICES AND CIRCUITS

Time : 3 Hours

Total Marks : 100

- Note :**
- (i) Attempt ALL questions.
 - (ii) All questions carry equal marks.
 - (iii) In case of numerical problems assume data wherever not provided.
 - (iv) Be precise in your answer.

1. Attempt any four parts of the following : (5x4=20)
- (a) Which device produces voltage variable capacitor ? How the voltage variable capacitance varies with change in voltage across it ? Enumerate its special features.
 - (b) Which diode is called majority carrier device ? Draw and explain its layout and VI-characteristics.
 - (c) Explain the working principle of seven-LED segment display. How LED works ? Explain.
 - (d) What is the significance of negative resistance in a tunnel diode ? Explain it.

- (e) The emitter - base junction saturation current of a BJT having $\alpha_F = 1$ and $\alpha_R = 0.1$ is 10^{-14} A. What would be the value of its collector - base junction saturation current ? What is the relative size of the collector junction with respect to the emitter junction ? How much is the value of β_R ?
- (f) Explain the higher and lower frequency response of a RC coupled amplifier using only one resistance and a capacitance.

2. Attempt *any four* parts of the following : (5x4=20)

- (a) How joint current and the conventional current of a photo diode vary w.r.t. voltage applied across it ? Draw the circuit used for its explanation.
- (b) Why the name hybrid parameter was given to a set of parameters of a BJT ? Draw the equivalent circuit of a BJT in CB configuration using hybrid parameter.
- (c) Obtain output resistance of a CE amplifier taking into the consideration of the load and source resistance.
- (d) What is Early effect ? Obtain a relationship between the output resistance and Early voltage of a BJT.
- (e) Determine the 3dB frequency of the low frequency response of an amplifier characterized by the transfer function.

$$f_L(s) = \frac{S(S+10)}{(S+100)(S+25)}$$

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- (f) Calculate V_O in the circuit of Fig. 1. Assume h_{fe} to be very large and $V_{BE} = 0.7V$.

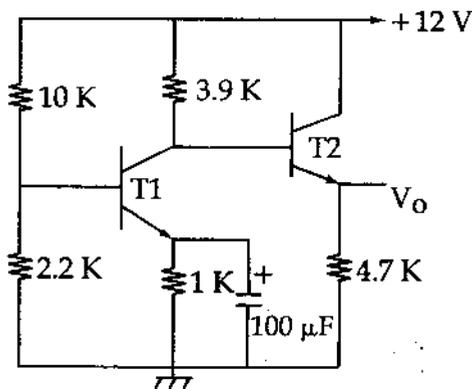


Figure-1

3. Attempt *any two* parts of the following : (10x2=20)
- Draw the structures of enhancement mode and depletion mode MOSFET. Show the formation of channel in these two modes.
 - Why biasing is needed at all? Draw the circuit diagram of self bias circuit and explain its working with mathematical expressions.
 - An n-channel JFET has channel length $L = 10\mu m$, channel width $W = 100\mu m$, channel height without any depletion $a = 2.5\mu m$. The donor level of the channel is $N_D = 10^{22}/m^3$ and mobility of the electron $\mu_n = 0.15m^2/Vs$. The depletion width from each side of the gate junction is $0.25\mu m$. How does this semiconductor bar behave without forward biasing of the gate junction between two ends of the channel length?

4. Attempt *any two* parts of the following : (10x2=20)
- Derive expression for the effective input and output resistances of current series feedback. Topology.
 - What type of feedback is the emitter follower an example of? How much negative feedback is used?
 - Draw and explain a circuit that uses both current and voltage feedback. What happens to its input resistance with and without feedback?
5. Attempt *any two* parts of the following : (10x2=20)
- How does the circuit of a Clap oscillator differs from that of a Colpitt's oscillator? Derive frequency of oscillation of any one of them.
 - Why do we use a crystal in an oscillator circuit? Obtain the expression of the impedance and show its plot w.r.t. the frequency.
 - Obtain the loop gain of circuit shown in Fig. 2. Also obtain frequency for zero loop-phase and R_F/R_1 for oscillation.

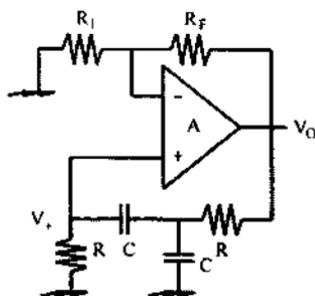


Figure 2

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