B.Tech 3rd Semester Exam., 2021
(New Course)

ANALOG ELECTRONIC CIRCUITS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Answer any *seven* questions from the following : 2×7=14

(a) Differentiate between Zener breakdown and avalanche breakdown mechanism.

(b) How Zener diode works as a voltage regulator?

(c) How BJT works as a switch?

(d) Define early effect in a BJT.

(e) What are the basic conditions of MOSFET to operate in different region of operations?

(f) How the current is copied faithfully in the current mirror circuit?

(g) Name the ideal properties of op-amp.

(h) What is the basic principle of operation of an oscillator?

(i) What happens to the reverse saturation current if the temperature rises by 10 °C?

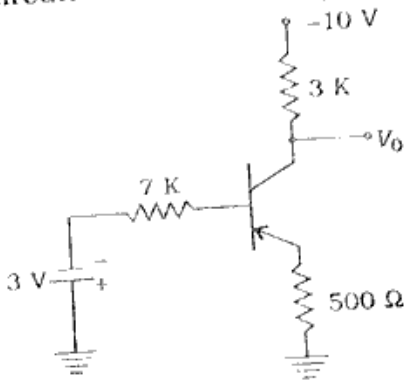
(j) Define CMRR in terms of differential amplifier.

2. (a) Two *p-n* germanium diodes are connected in series opposing. A 5 V battery is impressed upon this series arrangement. Find the voltage across each junction at room temperature. Assume that the magnitude of Zener voltage is greater than 5 V. 10

(b) If the magnitude of Zener voltage is 4·9 V, what will be the current in the circuit? The reverse saturation current is 5μA. 4

3. Explain in brief the working of n-channel enhancement type MOSFET. Also define the threshold voltage of MOS transistor. What are the key parameters that will affect the threshold voltage of MOS transistors? 14

4. For the circuit shown, assume $\beta = 100 = h_{fe}$.



(a) Find if the silicon transistor is in cutoff, saturation or in the active region.

(b) Find V_0.

(c) Find the minimum value for emitter resistor R, for which the transistor operates in the active region. 14

5. (a) Explain the working of Wilson current mirror circuit in detail. 7

(b) Derive an expression for common mode gain of a differential amplifier. 7

(Turn Over)

6. Explain the basic building block diagram of an op-amp. Write short note on input bias current, output bias current, slew rate and output offset voltage of an op-amp. 14

7. (a) Explain the working of op-amp as a difference amplifier. 7

(b) Draw the structure of PID controller with the help of op-amp. Also derive an expression for its gain. 7

8. (a) Derive an expression for differential mode gain of a differential amplifier. 7

(b) With the help of neat and clear sketch, explain the working of a MOS transistor as a switch. 7

9. Write short notes on the following : 14

(a) Precision rectifier

(b) Zero-crossing detector

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