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Question Paper Code : 20923

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Third Semester

Electrical and Electronics Engineering

EC 3301 – ELECTRON DEVICES AND CIRCUITS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define the term transition capacitance C_T and diffusion capacitance C_D of a diode.

2. Calculate the space charge width in a silicon PN junction at $T = 300\,K$ with doping concentrations of $N_a = 10^{16}$ cm^{-3} and $N_d = 10^{15}$ cm^{-3}. Given $V_{bi} = 0.635\,V$, $\varepsilon si = 11.7$.

3. What is early effect? Mention its consequences.

4. In a CB transistor circuit, the emitter current $I_e = 6\,mA$ and the collector current $Ic = 5.5m\,A$. Determine the CB dc current gain.

5. A CE amplifier has the h parameters given by $h_{ie} = 1050\,\Omega$, $hre = 2.5 \times 10^{-4}$, $h_{fe} = 50$ and $h_{oe} = 25\,\mu mho$. If both the load and source resistance are $1K\Omega$, find the current gain.

6. Mention the non ideal effects of BJT.

7. Sketch the circuit diagram of BiMOS cacode amplifier.

8. What is neutralization? How can it be achieved?

9. Mention the advantages of negative feedback.

10. What are the conditions for oscillation?

PART B — (5 × 13 = 65 marks)

11. (a) (i) What is barrier potential and explain how it is developed at the PN junction? (6)

(ii) Explain the V-I characteristics of a PN diode. (7)

Or

(b) (i) With neat diagram explain a full wave rectifier circuit. (6)

(ii) Explain about the series and shunt clipping circuit. (7)

12. (a) Explain the construction, operation and V-I characteristics of enhancement and depletion MoSFET.

Or

(b) With neat diagram explain the operation and V-I characteristics of UJT and thyristors.

13. (a) Draw the equivalent circuit of a CE amplifier using hybrid TT model and derive the expression for input impedance, output impedance, voltage gain and current gain.

Or

(b) Explain the circuit diagram and relevant characteristics of MOSFET common source amplifier and hence derive the expression for voltage gain, input impedance and output impedance.

14. (a) (i) Draw the circuit diagram of BJT differential amplifier and explain the operation. (8)

(ii) Derive the expression for voltage gain input and output impedances for differential amplifier. (5)

Or

(b) Explain the operation of series fed class A power amplifier. Derive the expression for its maximum efficiency.

15. (a) With neat diagram explain voltage shunt feedback amplifier. Derive the expression for transresistance gain, i/p resistance, o/p resistance and the voltage gain.

Or

(b) (i) Draw the circuit diagram of Wien-bridge oscillator and briefly explain its working principle and also derive the expression for its gain. (8)

(ii) Design a Wien-bridge oscillator, that oscillates at 25 kHz. (5)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Explain the operation and V-I characteristics of Zener diode. (9)

(ii) From the circuit shown in Fig. 16 (a) (ii), Vs vary between 20 V to 30 V. Find

(1) The minimum and maximum currents in the Zener diode.

(2) The minimum and maximum power dissipated in the diode.(6)

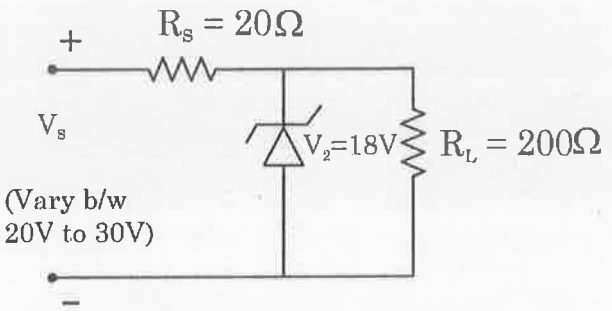

Fig 16 (a) (ii)

Or

(b) (i) Draw the circuit of a Colpits oscillator and explains its working principle. (9)

(ii) An amplifier has a midband gain of 125 and bandwidth of 250 kHz. If 5% of negative feedback is introduced, find the new bandwidth and gain. (6)

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