Reg. No. : E N G G T R E E . C O M

Question Paper Code : 50956

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Third Semester

Electrical and Electronics Engineering

EC 3301 — ELECTRON DEVICES AND CIRCUITS

(Regulations 2021)

(Common to PTEC 3301 – Electron Devices and Circuits for B.E. (Part – Time) Second Semester — Electrical and Electronics Engineering – Regulations 2023)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Determine V_0 for the network shown in Fig (1).

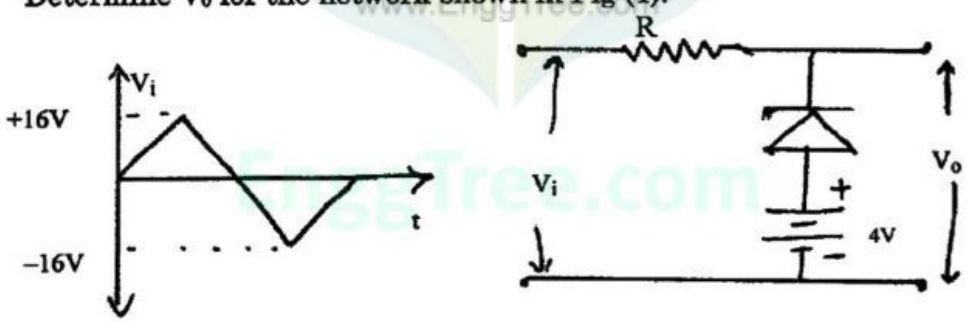

Fig (1)

2. What is the condition for Laser Action?
3. Define α, β and γ of the transistor and mention the relationship of the terms.
4. Differentiate between Enhancement and Depletion MOSFET.
5. Why are bypass and coupling capacitors used in amplifier circuits?
6. Why harmonic distortion occurs in amplifier and how can it be reduced?
7. State two advantages and two disadvantages of single tuned amplifiers.
8. What are the coupling schemes used in multistage amplifiers?

9. State Barkhausen criterion for sustained oscillation. What will happen to the oscillation, if the magnitude of the loop gain is greater than unity?

10. What is meant by positive feedback and negative feedback?

PART B — (5 × 13 = 65 marks)

11. (a) (i) With necessary diagrams explain the structure and operation of PN junction diode. (8)

(ii) Briefly explain about the PN junction capacitances. (5)

Or

(b) (i) Explain the operation of Zener diode and its VI characteristics. (8)

(ii) Explain how Zener diode acts as a voltage regulator. (5)

12. (a) Explain the structure, operation and V-I characteristics of BJT.

Or

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

13. (a) (i) Explain and derive the voltage and current gain expressions for CB configuration using hybrid models. (9)

(ii) Analyze and determine I_C, I_B and dc voltage at the collector of the transistor amplifier circuit shown in fig. 13. a (ii) (4)

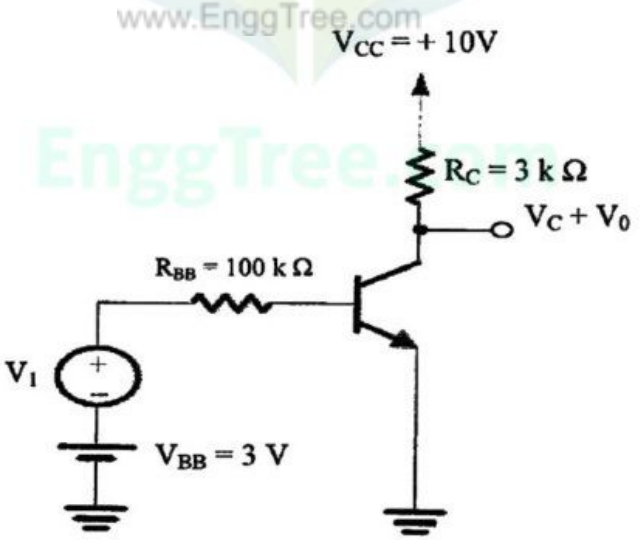

Fig. 13. a (ii)

Or

(b) (i) Draw the small signal equivalent circuit of MOSFET common drain amplifier and derive the expressions for voltage gain, input impedance and output impedance. (9)

(ii) Consider the amplifier circuit shown in Fig 13. b (ii) The FET is specified to have $V_t=0.4V$, $k_n'=0.4mA/V^2$, $W/L=10$ and $\lambda=0$. Also, let $V_{DD}=1.8V$, $R_D=17.5k\Omega$ and $V_{GS}=0.6V$. Find I_D and V_{DS}. (4)

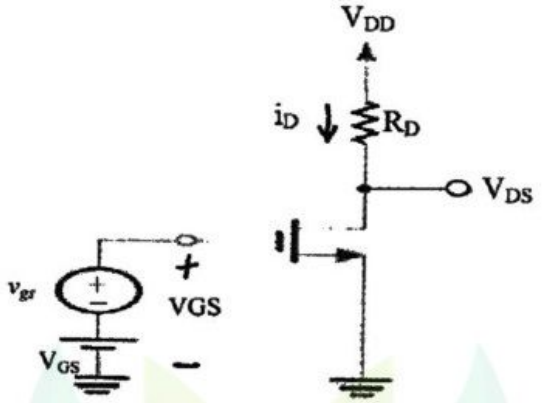

Fig. 13. b (ii)

14. (a) What is a differential amplifier? Draw the circuit diagram and explain the working principle of BJT differential amplifier. Explain the circuit operation of common mode and differential mode.

Or

(b) Explain the basic principle of tuned amplifiers using MOSFET and derive the expression for its center frequency gain. Also discuss their characteristics and losses.

15. (a) With neat diagram explain voltage series and current series 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 RC phase shift oscillator and briefly explain its working principle. Also derive the expression for its gain. (8)

(ii) Design a phase shift oscillator, to oscillate at 1 KHz. (5)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Explain the structure, operation and V-I characteristics of JFET. (8)

(ii) The parameters of the transistor in the circuit in Figure 16.a (ii) are $\beta=150$ and $V_A=\infty$.

(1) Determine R_1 and R_2 to obtain a bias-stable circuit with the Q-point in the center of the load line.

(2) Determine the small-signal voltage gain $AV=V_O/V_S$. (7)

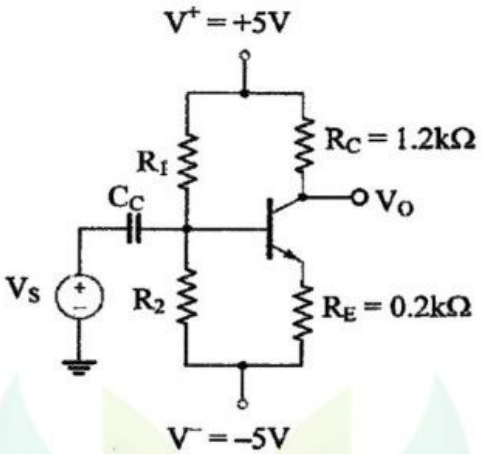

Figure 16. a (ii)

Or

(b) (i) Draw the circuit of a Colpitt oscillator and explain its working principle. (8)

(ii) Consider the MOSFET feedback amplifier shown in figure 16.b (ii). The transistor parameters are $V_{TN}=0.5V, K_n=0.5mA/V^2$ and $\lambda=0$. Determine the small-signal voltage gain Av = Vo/Vi. (7)

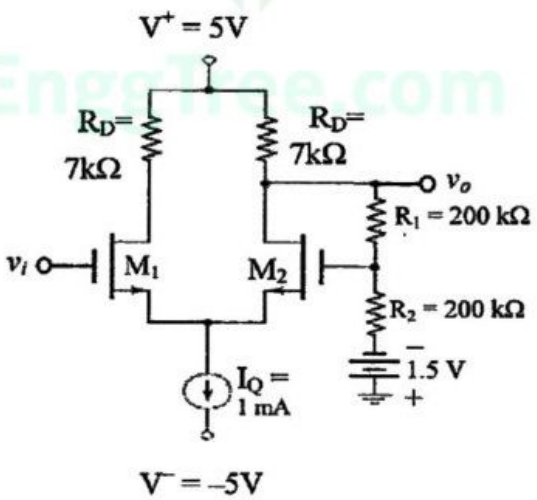

Figure – 16.b (ii)