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Question Paper Code : 90979

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

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. List the differences between PN diode and zener diode.
2. Determine the output voltage V_{out} for the circuit shown in figure. 2.

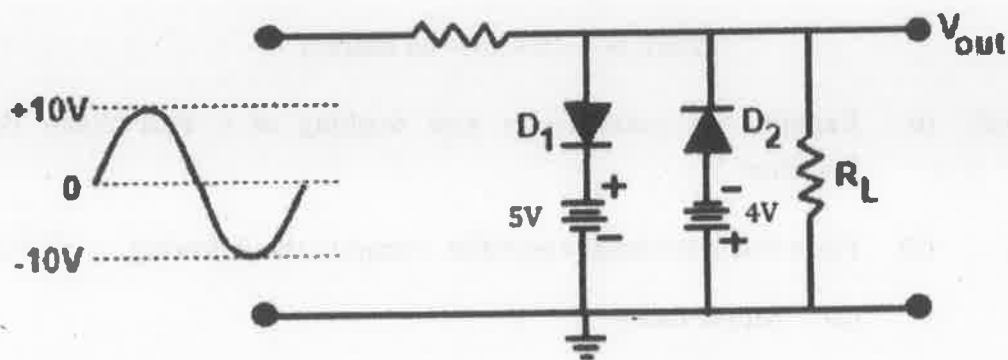


Figure 2

3. Draw the two transistor equivalent model of a silicon controlled rectifier.
4. For a JFET with $V_p = -10$ V and $I_{DSS} = 8$ mA, compute the value of drain current (I_D) when $V_{GS} = -3$ V.
5. Define unity gain.

6. Sketch the small signal ac equivalent circuit of the amplifier given in figure. 6.
Use h-parameter model of the transistor.

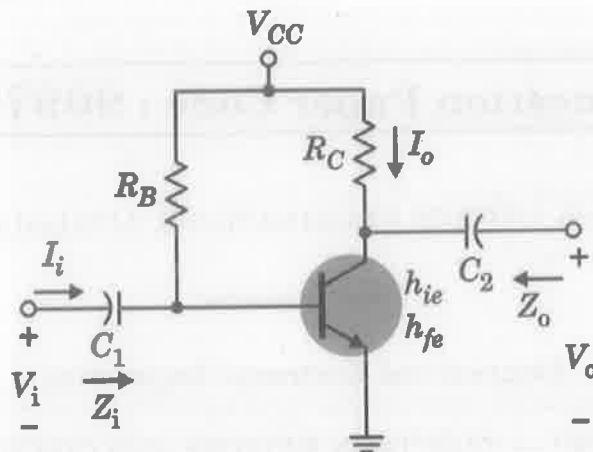


Figure 6

7. State the advantages of differential amplifiers.
8. Classify power amplifiers based on the conduction angle.
9. Find the voltage gain for a voltage series feedback having $A = -100$ and $\beta = -0.5$.
10. Determine the cut-off frequency of a Hartley oscillator with $L_1 = L_2 = 2\text{H}$ and $C = 0.01\text{ }\mu\text{F}$.

PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) Explain the construction and working of a Full Wave Bridge Rectifier. (6)
- (ii) For a full wave bridge rectifier, compute the following (2 + 3 + 2)
- (1) Ripple factor
 - (2) Efficiency
 - (3) Peak Inverse Voltage.
- Or
- (b) (i) Explain how a Zener diode can be used as a voltage regulator and determine the range of input voltage that will maintain the Zener diode in ON state. (7)

- (ii) Determine the output voltage of the circuit shown in figure 11 (b) (ii) (6)

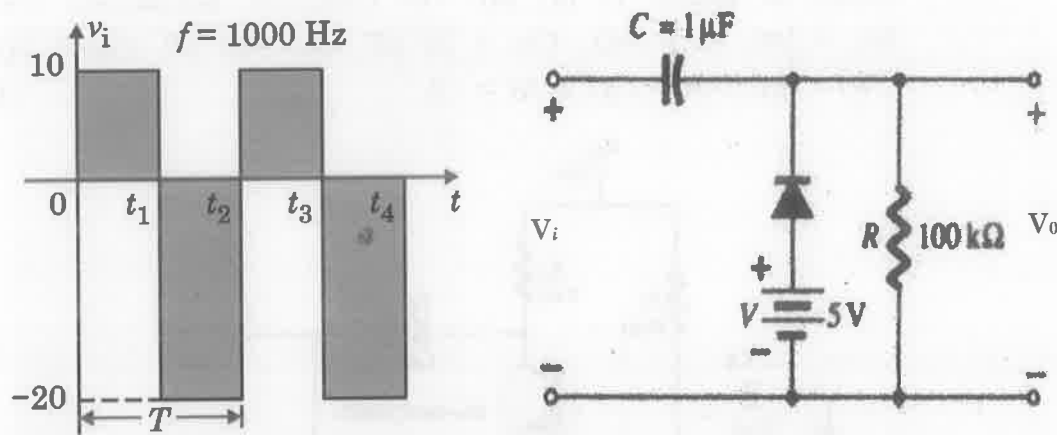


figure 11 (b) (ii)

12. (a) (i) Explain the construction and characteristics of a unijunction transistor (UJT). (6)

- (ii) Illustrate the operating principle of IGBT with the input and output characteristics. (7)

Or

- (b) (i) Compare the common base, common emitter and common collector configurations of BJT with respect to the following parameters. (5)

- Input resistance
- Voltage Gain
- Output resistance
- Current gain
- Phase shift between input and output

- (ii) Illustrate the construction and working of a depletion type MOSFET. (8)

13. (a) (i) Draw the circuit diagram of a common emitter amplifier with fixed bias and determine the input impedance, output impedance, voltage gain using h -parameter model of the transistor. (8)

- (ii) Make use of the high frequency model of the transistor; determine the higher cut - off frequency of the common emitter amplifier shown in figure. 13 (a) (ii). The transistor parameters are : $h_{fe} = 100$, $r_o = \infty \Omega$, $C_{be} = 30 \text{ pF}$, $C_{bc} = 10 \text{ pF}$, $C_{ce} = 1 \text{ pF}$, $C_{Wi} = 2 \text{ pF}$, $C_{Wo} = 6 \text{ pF}$ & $A_v = -3$. (5)

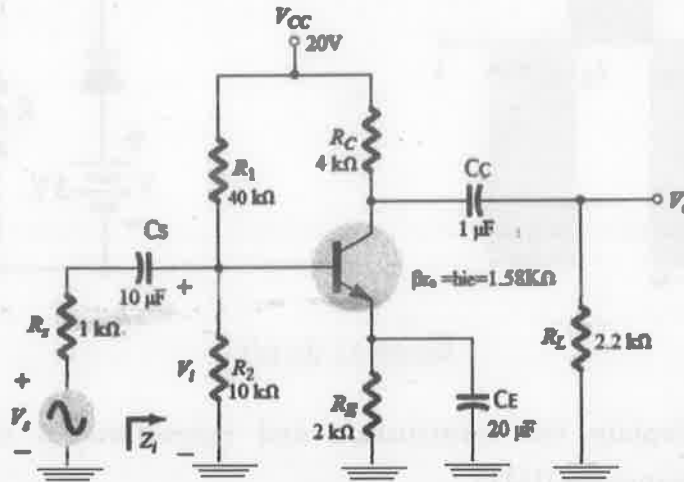


figure. 13 (a) (ii)

Or

- (b) (i) Draw the circuit diagram of source follower and determine the input impedance, output impedance, voltage gain. Use the small signal model of the transistor. (8)
- (ii) For the circuit shown in figure 13 (b) (ii) apply suitable circuit analysis method to $r_d = 40 \text{ k}\Omega$. (5)

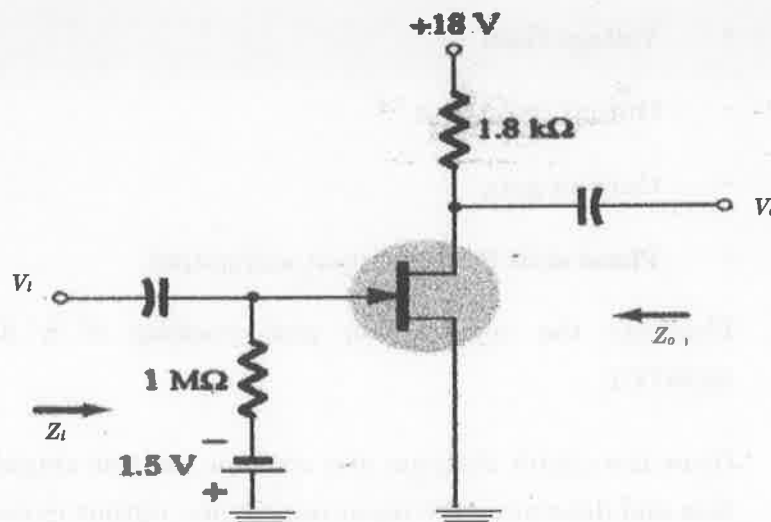


Figure 13 (b) (ii)

14. (a) (i) Explain the construction and working of a class B push pull power amplifier. (5)

(ii) Draw the circuit diagram of a differential amplifier and analyze the effect of differential and common mode signals on the output. (8)

Or

(b) (i) Explain the Hazeltline method of neutralization in used tuned amplifiers. (5)

(ii) Illustrate the operating principle and frequency response characteristics of single tuned amplifiers. (8)

15. (a) (i) Show that the minimum gain required to produce oscillations in Wien bridge oscillator is 3. (7)

(ii) Analyze the effect of voltage series feedback on the amplifier input impedance, output impedance and voltage gain. (6)

Or

(b) (i) Illustrate the principle of operation of a Colpitts oscillator and determine the frequency of oscillation of a Colpitts oscillator if $L = 15 \text{ mH}$, $C_1 = 1 \mu\text{F}$, $C_2 = 0.01 \mu\text{F}$. (4 + 3)

(ii) Analyze the effect of negative feedback on amplifier bandwidth. (6)

PART C — (1 × 15 = 15 marks)

16. (a) (i) For the network shown in Figure. 16(a)(i), sketch the small signal equivalent using approximate h-parameter model of the transistor and apply suitable circuit analysis method to determine the input impedance (Z_i), output impedance (Z_o) and voltage gain (A_v) (8)

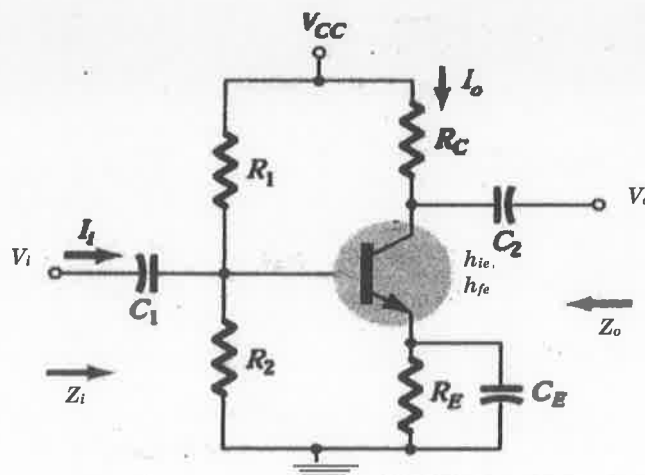


Figure. 16(a)(i)

- (ii) Assume that the transistor amplifier shown in figure 6 is constructed with un-bypassed emitter resistance. Analyze the effect of un-bypassed emitter resistance on the input impedance, output impedance and voltage gain of the amplifier. (7)

Or

- (b) (i) Determine the input impedance, output impedance and voltage gain of a common source amplifier with bypassed source resistance. Use the small signal model of the transistor. (8)
- (ii) Assume that the common source amplifier is constructed with unbypassed source resistance. Analyze the effect of un-bypassed source resistance on the input impedance, output impedance and voltage gain of the amplifier. (7)

