

B. Ins. & Elec. Engg. 2nd Year 1st Sem. Supplementary Exam 2023
Electronic Circuits

Time: 3 hours

Full Marks: 100

Attempt all questions from the following

1. Draw the current-voltage characteristics of a diode which follows constant-voltage model. What do you understand by dynamic resistance of diode? Draw and explain the working principle of a bridge rectifier circuit.

3+2+5

2. Define line regulation and load regulation. For the circuit in **Fig. 1**, determine the output voltage at minimum and maximum zener current. Calculate the value of R that should be used. What is the minimum value of R_L that can be used? Given $V_Z = 15\text{ V}$ @ $I_Z = 17\text{ mA}$, $I_{ZK} = 0.25\text{ mA}$, $Z_Z = 14\ \Omega$ and $P_{\max} = 1\text{ W}$.

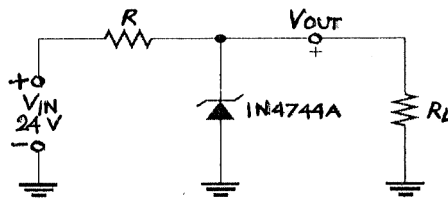


Fig. 1

3+7

3. Neatly draw the diagrams of a fixed (self) bias circuit and a voltage divider bias circuit. Make a comparative study between them in terms of stability of bias. Calculate the terminal voltages of the BJT in **Fig. 2**.

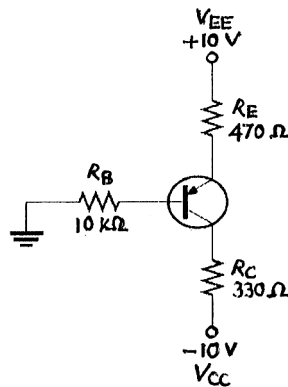


Fig. 2

[Turn over

3+2+5

4. Draw the ac equivalent circuit for the unloaded amplifier in **Fig. 3**. Determine the quiescent collector current and collector-emitter voltage of the transistor. Calculate the small signal voltage gain of the amplifier. You may specifically neglect the impact of capacitors.

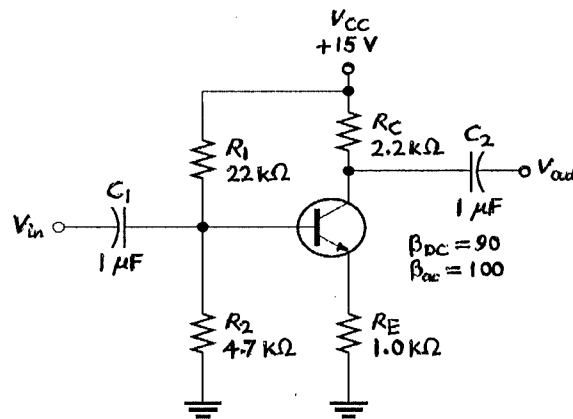


Fig. 3

10

5. Draw one single-stage common-base amplifier circuit. Hence, show that the small-signal voltage gain of such an amplifier is given by

$$A_v = g_m \left(\frac{R_C \parallel R_L}{R_S} \right) \left[\left(\frac{r_\pi}{1 + \beta} \right) \parallel R_E \parallel R_S \right]$$

, where the symbols enjoy their usual significances

2+8

6. Find out the input resistance of a common-collector amplifier. What is the advantage of cascode amplifier over a common-emitter amplifier? Draw the circuit of a differential amplifier and explain its operation.

4+2+4

7. Explain Miller effect in connection with the operation of BJT as an amplifier. What is the effect of coupling capacitor in controlling the bandwidth of an RC coupled amplifier? Discuss with the help of appropriate mathematical illustration.

3+7

8. What are the advantages associated with feedback amplifier? Consider a feedback amplifier with an open-loop low-frequency gain of $A_0 = 10^4$, an open-loop bandwidth of $\omega_H = 200\pi \text{ rad/sec}$, and a closed-loop low-frequency gain of $A_f(0) = 50$. Determine the bandwidth of the feedback amplifier. Determine the type of feedback configuration and hence draw the schematic diagram of a feedback amplifier which should be used in a design to achieve high input and low output resistance.

3+3+4

9. "A single-stage common-emitter amplifier with un-bypassed emitter resistance exhibits current-series feedback". Justify the statement with suitable explanation. Hence, find out the expression for voltage gain with and without feedback.

10

10. How does an oscillator differ from an amplifier? Draw the waveform for under-damped and sustained oscillation. Develop the generic condition for sustained oscillation in an LC oscillator.

2+2+6

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