

# City College

Internal Examination 2021  
 Physics (Hons.) CBCS Semester 4  
 Paper: PHSA CC9  
 Topic: Analog Electronics  
 Full Marks: 20; Time: 1 Hour

Answer any ten questions from the following:

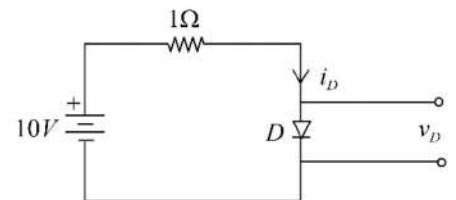
[ 2 × 10 = 20 ]

1. What is thermal runaway?
2. What is Q point and Load line?
3. Derive the relationship between  $\alpha$  and  $\beta$ .
4. What do you mean by 'virtual ground' of an OP AMP?
5. What is Barkhausen criterion? What are the primary requirements to obtain steady oscillation at a fixed frequency?
6. An amplifier with mid gain  $|A| = 400$  has negative feedback  $|\beta| = 0.02$ . If the upper cut off frequency without feedback was at 50kHz, then calculate its value with feedback.
7. An RC network produces a phase-shift of  $30^\circ$ . How many such RC networks should be cascaded together and connected to a Common Emitter amplifier so that the final circuit behaves as an oscillator?

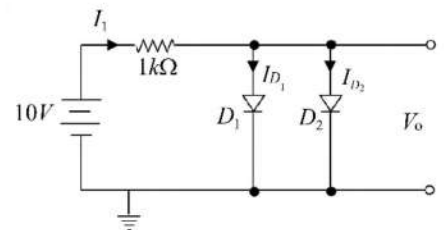
8. A diode D as shown in the circuit has an  $i - v$  relation that can be approximated by

$$i_D = \begin{cases} v_D^2 + 2v_D & \text{for } v_D \geq 0 \\ 0 & \text{for } v_D \leq 0 \end{cases}$$

Calculate  $v_D$  in the circuit.

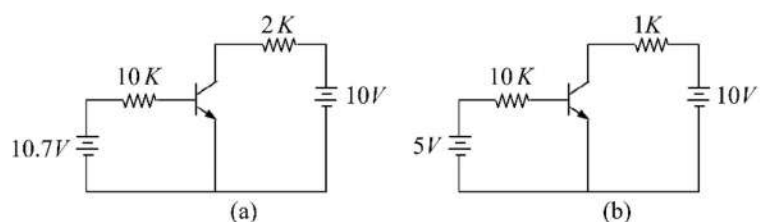


9. In the circuit,  $D_1$  and  $D_2$  are two silicon diodes with the same characteristics. If the forward voltage drop of a silicon diode is 0.7 V then the value of the current  $I_1 + I_{D_1}$  is

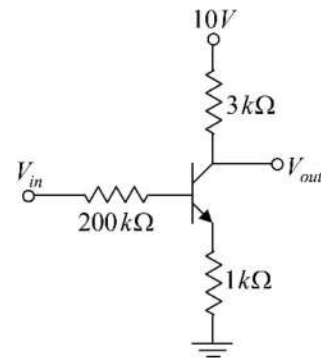


10. If the transistors in Figures (a) and (b) have current gain ( $\beta_{dc}$ ) of 100 and 10 respectively, then they operate in the

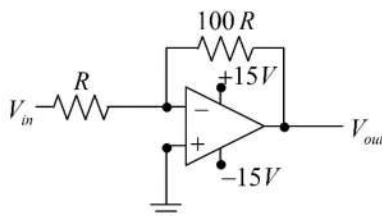
- (a) active region and saturation region respectively
- (b) saturation region and active region respectively
- (c) saturation region in both cases
- (d) active region in both cases



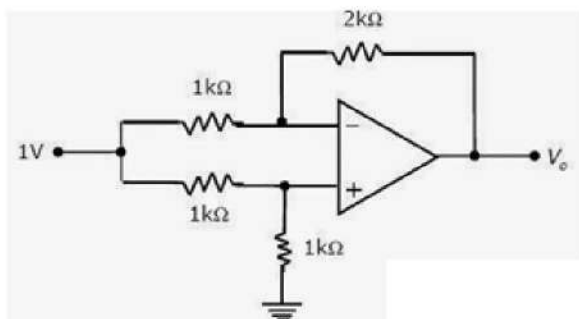
11. For the transistor shown in the figure, assume  $V_{BE} = 0.7V$  and  $\beta_{dc} = 100$ . Calculate the output voltage ( $V_{out}$ ) if  $V_{in} = 5V$ .



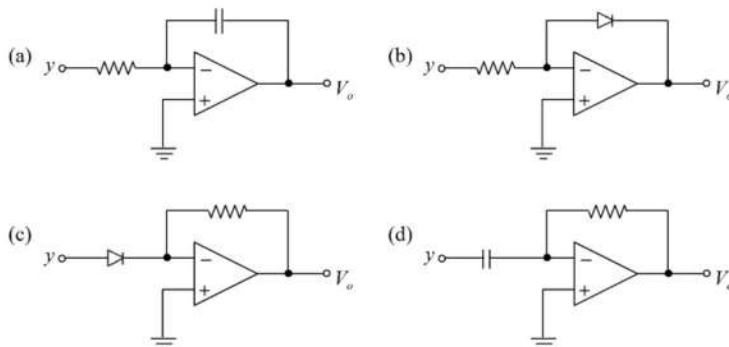
12. For the following circuit, what is the magnitude of  $V_{out}$  if  $V_{in} = 1.5V$



13. Calculate the output voltage for the OP-AMP circuit shown in the figure.



14. If the parameters  $y$  and  $x$  are related by  $y = \log x$ , then the circuit that can be used to produce an output voltage  $V_0$  varying linearly with  $x$  is



15. The transistor in the given circuit has  $h_{fe} = 35$  and  $h_{ie} = 1000\Omega$ . If the load resistance  $R_L = 1000\Omega$ , calculate the voltage and current gain.

