Indian Institute of Technology, Bhubaneswar
School of Electrical Sciences

Introduction to Electronics (EC2L001)

Autumn Mid-Semester Examination 2022

Time: 2 hours Maximum Marks:30

1. Derive the Following expressions of a *pn* junction:

   a) Built in potential of a *pn* junction in equilibrium condition.(2 marks)

   b) Diode characteristic equation and expression of I_s. (4 marks)

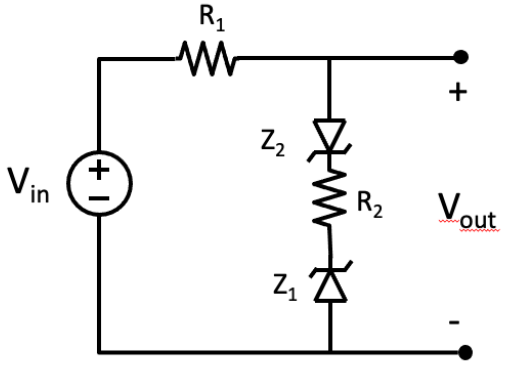
2. Answer the following questions:

   a) What is the difference between drift and diffusion current? Explain briefly which one of them is dominant when a *pn* junction is in forward biased region and reverse biased region? (3 marks)

   b) In a *npn* transistor, the are two *pn* junctions. Explain which one of them will have higher built in potential and why? (2 marks)

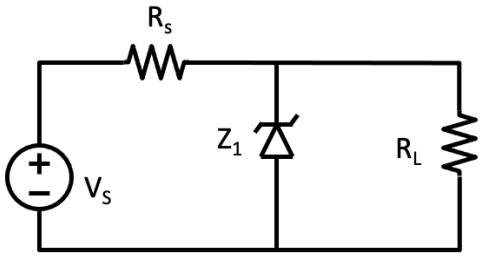
3. In the following circuit, the two zener diodes Z_1 and Z_2 have a breakdown voltage of 3 V and 4 V, respectively. Find the voltage transfer characteristic of the circuit if $R_1 = R_2 = 1$ kΩ. Draw the output waveform if the input is a sinwave with an amplitue of 5 V. (Note: in forward bias condition, both the zener diodes have a $V_{D(on)}$ =0.7 V and assume r_z to be negligible.)

   (4 marks)



4. Draw a center-tap full-wave rectifier with capacitor filter and derive the expression of its ripple voltage. (3 marks)

5. The zener diode shown in the figure has V_{Z0}=15 V, knee current I_{ZK} = 0.2 mA and r_z= 8 Ω. If the maximum reverse bias current allowed across the zener diode is I_{ZM}= 50 mA and the supply V_s is fixed at 20 V. The engineer who has designed it has R_S between 80 Ω and 200 Ω and forgotten the exact value he has used. What range of load resistance R_L value would you suggest to your customer such the zener is not spoilt but at the same time it is in breakdown region. (6 marks)



6. For the amplifier shown below, if V_{OUT}= 5 V, find R_{B1}. Draw the small-signal model of it, derive the expression of the gain and calculate its value if R_S = 2 KΩ. Given: β= 100 and $V_{D(on)}$ = $V_{BE(on)}$= 0.7 V. (6 marks)