INDIAN INSTITUTE OF TECHNOLOGY

te: __ Feb 2012, FN/AN, Time: 2 Hrs., Full Marks: 60, No. of Students : 660 (Non-ECE branches); Mid Spring Semester,
o. No.: EC21101, Sub. Name: Basic Electronics

tructions

- **All waveform sketches / diagrams must be neatly drawn and clearly labeled.** Answers must be brief and to the point.
- The final answers (numerical values with unit) should be **underlined** or enclosed within box with unit.
- For every Question No., start your answer from a new page.
- Avoid writing answers of the various parts of a single question at different locations in your answer-script.
- For any value related to any device parameter or circuit parameter, which you may find not given with a problem, assume suitable value for such parameter.
- **The choice among 4B and 4B' is given.**

. Multiple choice questions: **(3x2=6 marks)**

The breakdown mechanism in a lightly doped p-n junction under reverse biased condition is called

(a) avalanche breakdown (b) Zener breakdown.
(c) breakdown by tunneling (d) high voltage breakdown.

In an n-type semiconductor, the Fermi-level is

(a) closer to the valence band (b) midway between conduction and valence band
(c) closer to the conduction band (d) within the valence band

. The reverse – saturation current of a silicon diode

(a) doubles for every 10°C increase in temperature (b) does not change with temperature
(c) halves for every 1°C decrease in temperature (d) increases by 1.5 times for every 2°C increment

. Consider a silicon pn junction at T=400K, with doping concentration of N_a=10^{16} cm^{-3} and N_d= 10^{15} cm^{-3}. Calculate rinsic carrier concentration and junction capacitance at V_R=5.2 V. For silicon B= 5.23 x 10^{15}($cm^{-3}K^{-3/2}$), E_g= 1.1 eV and =0.5 pF. Boltzman constant K= 1.38 x 10^{-23} J/K . **(9 marks)**

Assume the circuit shown in Fig.1, and diode parameters of = 10V, R=15 KΩ, V_γ =0.7 V, and v_i=0.2sinωt V. Determine small signal diode diffusion conductance & ac component the output voltage. Draw appropriate circuits for dc and ac alysis.
5 marks)

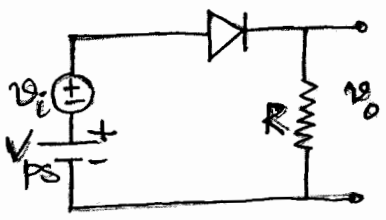


Fig.1

. If $V_\gamma = 0.7\,V$ for the diode in Fig. 2(A), determine V_o.
marks)

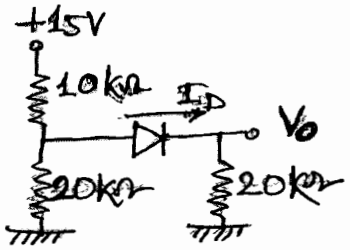


Fig. 2(A)

. Each diode in the circuit in Fig. 2(B) has piecewise linear rameters of V_γ=0 and r_f =0. Plot V_o versus V_I for 0≤V_I≤30 V. dicate the breakpoints and give the state of each diode in the rious regions of the plot.
0 marks)

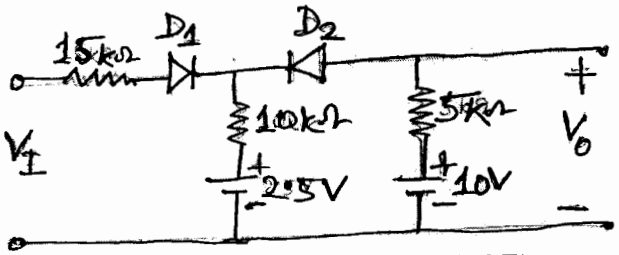
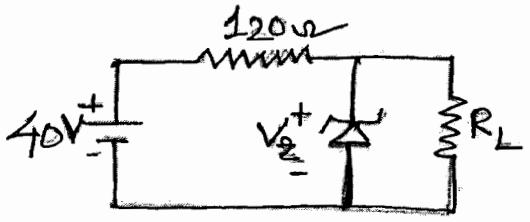


Fig 2(B)

4A. You are given a task to construct a dc power supply from an ac power supply (120V rms) with minimum outpu voltage ripples. What components and circuits would be required to achieve it? Make use of rectifier circuit that use lower peak inverse voltage diode. Explain with the help of suitable circuit diagrams and plot the input and outpu waveforms at each stage. **(10 marks)**

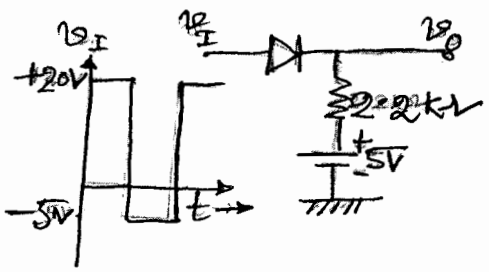
4B. In the Zener diode circuit shown in Fig. 3, assume V_z= 12V and r_z =0. (a) Calculate the Zener diode current and the power dissipated in the Zener diode for R_L=∞, (b) What will be the value of R_L such that the current in the Zener diode is one-tenth of the current supplied by the 40 V source? **(5 marks)**



(Fig. 3)

OR

4B'. Plot v_o for the circuit in Fig. 4 with proper explanations. Assume diode cut-in voltage (V_γ) of 0.6 V. The input pulse varies between +20V to -5V. The resistance in the circuit is 2.2 kΩ. **(5 marks)**



(Fig. 4)