বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

Question Paper

B.Sc. Honours Examinations 2022

(Under CBCS Pattern)

Semester - IV

Subject : PHYSICS

Paper : C 10 - T

Analog Systems and Applications

Full Marks : 40

Time : 2 Hours

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

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Group - A

Answer any ***four*** questions : 5×4=20

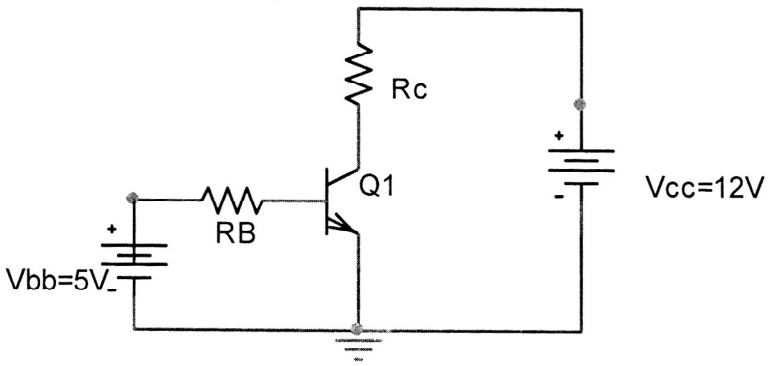
1. (a) Draw the energy band diagram of an open circuited p-n junction with fermi level at T = 0K.

   (b) "The barrier potential across a p-n junction diode can't be measured by placing a voltmeter across the diode terminals."—Explain.

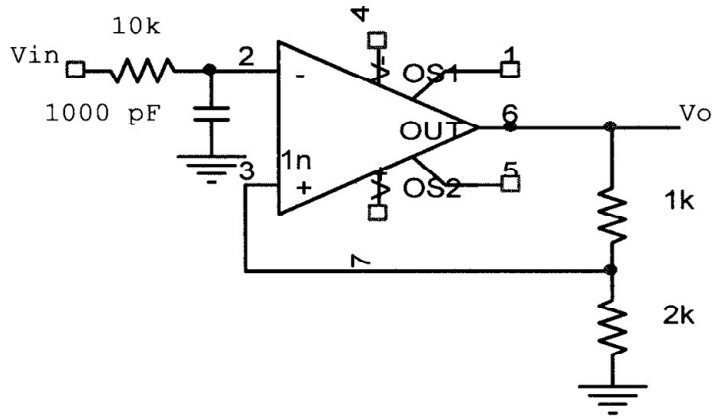
   (c) Why Si and Ge are not used to fabricate LED? 2+1+2

2. (a) Why is the width of collector largest compare to base and emitter?

(b) A Silicon n-p-n transistor having $\beta = 100$ and $I_{CO} = 22nA$ is operated in CE configuration shown in figure below. Assuming $V_{BE} = 0.7V$, determine the transistor currents and the region of operation of the transistor. Given : $R_B = 220K\Omega$ and $R_C = 3.3k\Omega$. 1+4



3. (a) Determine the output voltage of the given figure below :

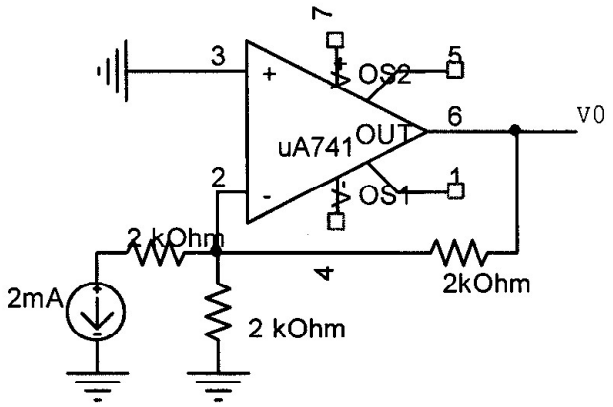


(b) Design a ckt using OPAMPs to solve simultaneous equations $2x + 3y = 5$ and $3x - 5y = 6$.

4. (a) Define slew rate. In OP-AMP the maximum current charging the corresponding capacitance of 30 pF is 200 μA. What will be the slew rate of OP-AMP?

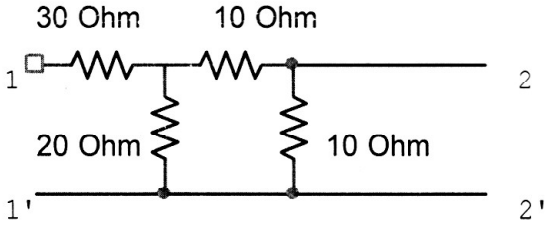
P.T.O.

(b) Determine the output voltage of the given figure below : 3+2



5. (a) What are the necessacity of h parameters?

(b) Find the values of h parameters of the given circuit. 1+4



6. (a) "Negative feedback reduces the gain of the gain of an amplifier. Still this type of feedback is widely used."—Why?

(b) The Voltage gain of a transistor amplifier is 50. Its input and output resistance are 1 kΩ and 40 kΩ respectively. If the amplifier is provided with 10% negative voltage feedback in series with the input, calculate the voltage gain and input and output resistances. 2+3

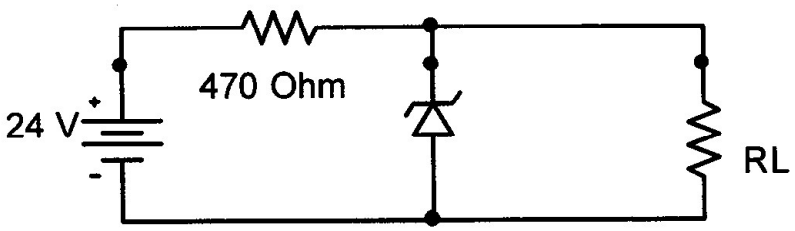
P.T.O.

Group - B

Answer any ***two*** questions : 10×2=20

7. (a) An 8.2 V Zener diode (8.2 V at 25ºC) has a positive temperature coefficient of 0.05%/ºC. What is Zener voltage at 60ºC?

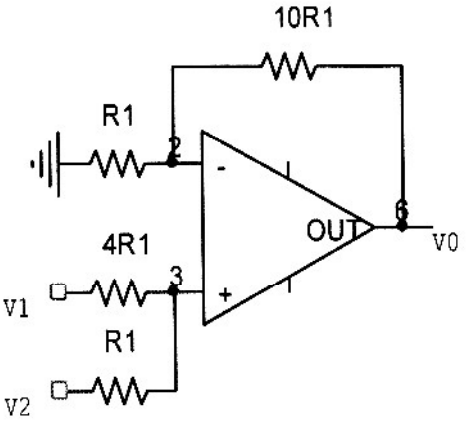
   (b) Determine the minimum and the maximum load currents for which the Zener diode in the given figure below will maintain regulation. What is the minimum value of R_L that can be used? Assume Zener voltage, V_Z = 12V, minimum Zener current, I_{ZK} = 1mA and maximum Zener current, I_{ZM} = 50mA.



   (c) What do you mean by photodiode? When the intensity of the incident light (irradiance) on a photodiode increase, what happens to its internal reverse resistance? What is dark current? 3+4+3

8. (a) Show that OP-AMP can be used as a differentiator. Sketch the output voltage of the ideal op-amp differentiator when square wave of V_{max} = +5V and V_{min} = –5V is applied at the input.

   (b) Determine the output voltage of the circuit given below :



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9. (a) Is an external input signal necessary for the output of an oscillator? If not, how are oscillation initiated?

   (b) Explain the action of a wine bridge oscillator using OPAMP. Find the expression of the frequency of oscillation.

   (c) Determine the value of feedback resistance R_f for phase shift oscillator. The resistances and capacitances in phase lead circuits are $R_1 = R_2 = R_3 = 10k\Omega$ and $C_1 = C_2 = C_3 = 0.001\mu F$ respectively. Determine the frequency of the oscillator. 2+5+3

10. Draw a circuit diagram of a transformer-coupled push pull amplifier and explain its operation. Find out the maximum efficiency of an idealised Class B push pull amplifier. How does a class AB differ from a class B amplifier? 2+3+3+2

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