



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.*

**Group - A**

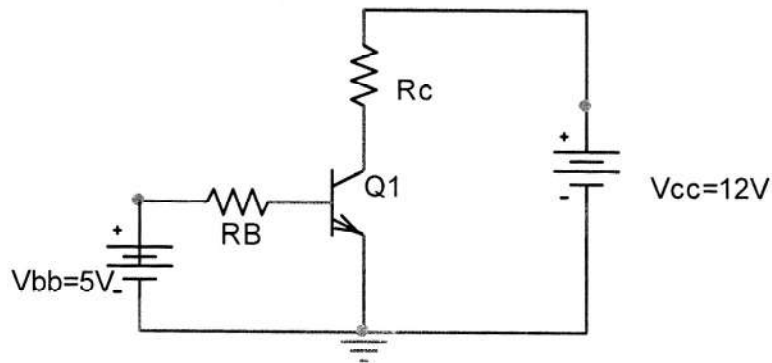
Answer any **four** questions :

5×4=20

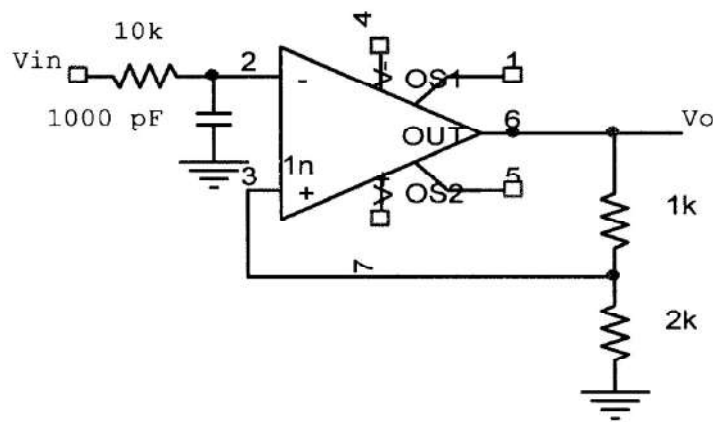
1. (a) Draw the energy band diagram of an open circuited p-n junction with fermi level at  $T = 0K$ .
- (b) “The barrier potential across a p-n junction diode can’t be measured by placing a voltmeter across the diode terminals.”—Explain.
- (c) Why Si and Ge are not used to fabricate LED? 2+1+2
2. (a) Why is the width of collector largest compare to base and emitter?

P.T.O.

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



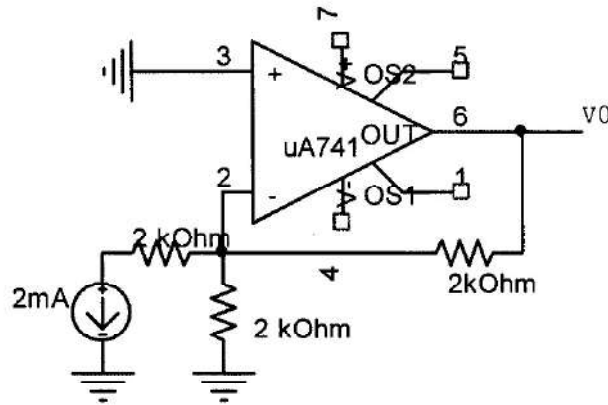
3. (a) Determine the output voltage of the given figure below :



- (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  $30\text{pF}$  is  $200\text{ }\mu\text{A}$ . What will be the slew rate of OP-AMP?

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

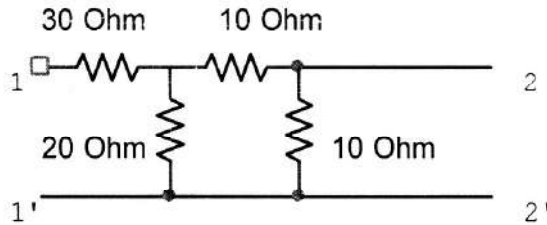
3+2



5. (a) What are the necessity 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  $1\text{ k}\Omega$  and  $40\text{ k}\Omega$  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.

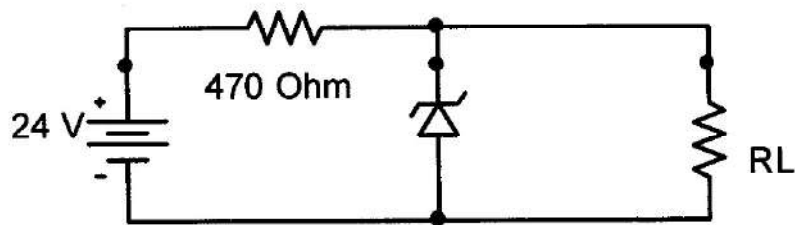
2+3

**Group - B**

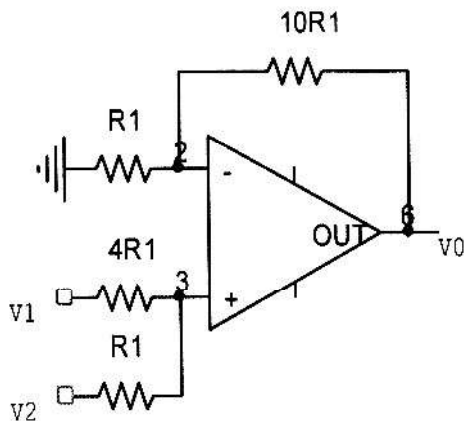
Answer any *two* questions :

10×2=20

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



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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