

**End Semester Examination, 2022****Semester - IV****Physics****PAPER - CC10T***Full Marks : 40**Time : 2 Hours***Group - A**

1. **Answer any 5 out of 8 questions : 5x2=10**
- a) Draw the system of a square wave generator using one OP-AMP comparator. 2
  - b) A differential amplifier has difference mode gain  $A_q = 5000$  and  $CMRR = 1000$ . Find the output voltage for inputs  $v_1 = 200\mu V$  and  $v_2 = 190\mu V$  2
  - c) What is slew rate? How does it limit the high frequency operation of an OPAMP? 1+1=2
  - d) Draw the circuit diagram of a D/A converter using R-2R Ladder (for 3 bits). Find output expression. 2
  - e) What is depletion region in a P-n junction diode? 2
  - f) Why transistor is being used as a amplifier? 2
  - g) Draw the energy band diagram, when a forward voltage  $V_F$  is applied across a P-N junction diode.
  - h) Compare BJT and FET. 2

*(Turn Over)*

**Group - B**

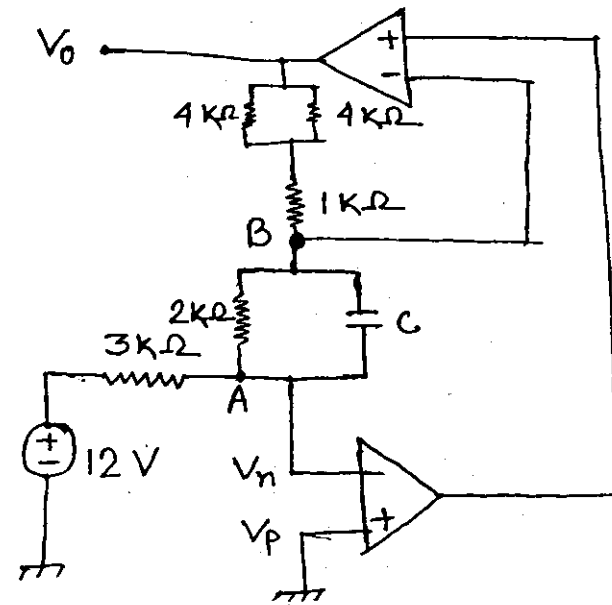
**Answer any 4 out of 6 questions : 4x5=20**

2. Describe 'Early effect'. Draw input and output characteristics of a transistor in CB mode. 3+2=5
3. What is leakage current in a transistor? An n-p-n transistor with  $\alpha = 0.98$  is operated in CB configuration if the emitter current is 3mA and the reverse saturation current is  $I_{co} = 10\mu A$ . What are the base current and the collector current? 1+4=5
4. i) Give a neat circuit diagram of a phase shift oscillator using OP-AMP. Find expression of frequency of oscillation of its.  
ii) Design an OP-AMP circuit whose output would be

$$v_o(t) = 2v_1(t) - 3 \int v_2(t) dt$$

—Where  $v_1(t)$  and  $v_2(t)$  are two input signals to the circuit. 2

5. Justify — "FET is a voltage controlled device and BJT is a current controlled device." Explain zener breakdown mechanism. 3+2
6. i) What is virtual ground in OPAMP. Is there a virtual ground point in non inverting mode of operation of OP-AMP.  
ii) .....In the given circuit find  $V_o = ?$



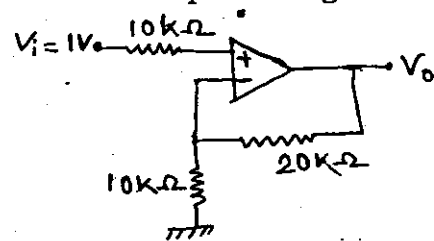
7. What is schmitt trigger? Explain its operation sketch its transfer characteristics and indicate the hysteresis. 5

**Group - C**

**Answer any one out of two questions : 10x1=10**

8. A crystal diode having internal resistance  $r_f = 20\Omega$  is used for half wave rectification. If the applied voltage  $V = 50 \sin \omega t$  and load resistance  $R_L = 800\Omega$ , find :
  - i)  $I_m$ ,  $I_{d.c.}$ ,  $I_{r.m.s.}$  10
  - ii) a.c. power input and d.c. power output.
  - iii) efficiency of rectification.

9. i) Explain weighted-resistor D/A converter 3  
 ii) Find the output voltage for the given circuit 2



- iii) Describe a Hartley Oscillator with a circuit diagram. What is tank circuit? Find an approximate expression for the frequency of Oscillation. Also, obtain the condition for sustained oscillations.

$$1+1+2+1=5$$

$$(3+2+5=10)$$