U.G. 4th Semester Examination 2022

PHYSICS (Honours)

Paper Code : DC - 10

(Analog Systems and Application)

Full Marks : 25 Time : Two Hours

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

1. Answer any *five* questions : 2×5=10

   (a) What is meant by Zener breakdown ?

   (b) What are the fundamental differences among Class A, Class B and Class C amplifiers ?

   (c) How are the input and output resistances modified in voltage shunt feedback ?

   (d) An *n*-channel JFET has $I_{DSS} = 12$ mA and 'pinch off' voltage $V_p = -4V$. Find the drain current for $V_{GS} = -2V$.

   (e) Write the differences in characteristics of an ideal OP-AMP and real OP-AMP.

   (f) A ramp voltage of 1.5 V/ms is applied to an OP-AMP differentiator with $R = 2k\Omega$ and $C = 0.01\,\mu F$. Find the output voltage and the waveform.

   (g) What is solar cell ? Sketch its characteristic curve.

2. Answer any *three* questions : 5×3=15

   (a) What is mobility ? Establish a relation between conductivity and mobility in an extrinsic semiconductor containing both electrons and holes. 2+3

   (b) (i) Show (in connection with D/A converters) a four stage $R-2R$ ladder network using $15\,k\Omega$ and $30\,k\Omega$ resistors.

   (ii) For a reference voltage of 16 V, calculate the output voltage for input state of 1010.

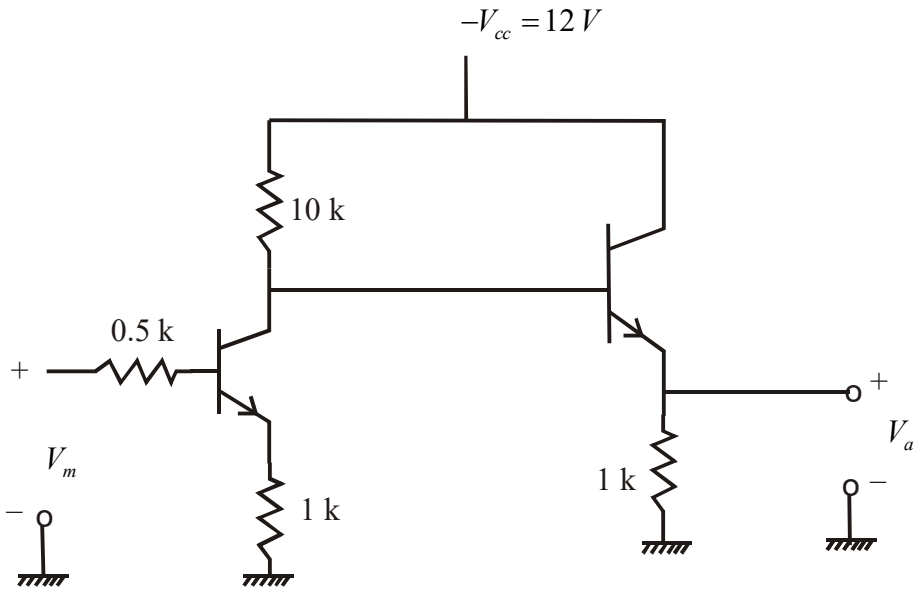
   (iii) What voltage resolution is possible using the above network ? 2+2+1

(c) (i) Deduce the expression for the voltage gain and phase difference for a lead-lag network. Show that the output is in the same phase with the input at resonance.

(ii) Calculate the resistance required to get resonance at 1 kHz with $c = 0.1\,\mu F$ in a lead-lag network. 3+2

(d) Draw the circuit diagram for an emitter follower and its *h*-parameter equivalent circuit for small signals. Find the input impedance and voltage gain. 1+2+2

(e) Find the voltage gain of the amplifier shown below, where two transistors are identical.



$h_{ie} = 1\,k\Omega$, $h_{re} = 10^{-4}$, $h_{fe} = 50$ and $h_{oe} = 10^{-4}\ A/V$.