WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 4th Semester Examination, 2021

PHSACOR10T-PHYSICS (CC10)

Time Allotted: 2 Hours | Full Marks: 40

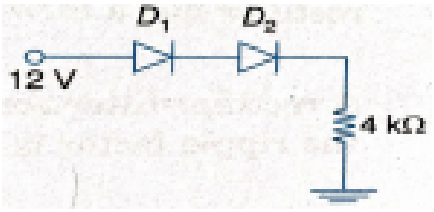
The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

Question No. 1 is compulsory and answer any *two* from the rest

1. Answer any ***ten*** questions from the following: 2×10 = 20

(a) The forbidden energy gap in a direct band gap semiconductor is 1.43 eV. Determine the wavelength of radiation emitted when a conduction band electron makes a direct recombination with a valance band hole.

(b) A current of 2.75 mA flows through the circuit given below:



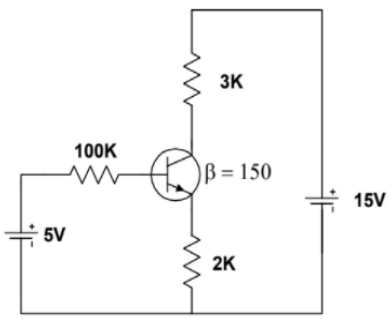
If the power dissipation of D_1 is 0.825 mW then find the voltage drop and power dissipation of D_2.

(c) Why do Si or Ge diode not emit light but GaAs diodes do?

(d) Establish the relation $I_D = \left(\frac{g_m^2 V_P^2}{4 I_{DSS}}\right)$ for a FET. Where I_D is drain current, V_P is pinch-off voltage, and g_m is trans-conductance of the FET, I_{DSS} is shorted-gate drain current.

(e) Write down the advantages and disadvantages of Bridge rectifier over centre-tap rectifier.

(f) Silicon transistor with β = 150, V_{BE} = 0.7 V, I_{CO} = 30 nA is shown in the figure below. Find the values of I_C, I_E, I_B, V_{CE}.



(g) On which factors does biasing of a transistor depend?

(h) What are the leakage currents of a transistor and how they are related?

(i) Write an n channel FET has the ratio of drain current and I_{DSS} is 1:4 and $V_{GS} = -3$ Volt. Find the pinch-off voltage (V_p).

(j) Draw input-output characteristics of an OPAMP. Explain why it saturates after a certain voltage?

(k) A 4-bit R-2R D/A converter have its output voltage 5 V. Find its resolution percentage.

(l) Find the maximum frequency of operation of an OPAMP if the peak input voltage is 1.5 V and slew rate 0.89 V/μs.

(m) Oscillators are not given any ac input then where from ac comes at the output? Explain how it is achieved?

(n) What is positive feedback in an amplifier? Write two advantages of positive feedback.

2. (a) The effective barrier voltage of a abrupt p-n junction is given by $V_T = \frac{eN_d}{2\varepsilon}W^2$ 3

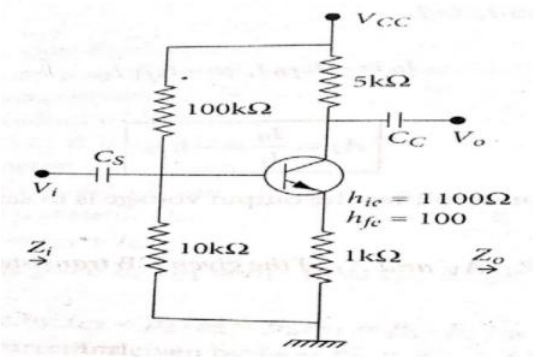
where N_d is the donor concentration and W the junction width. Find the transition capacitance of the junction if junction area is A.

(b) Draw the bridge rectifier with c-filter circuit and output voltage waveform. Explain it. 2+2

(c) How negative feedback improves bandwidth of an R-C coupled amplifier? 3

3. (a) Explain with circuit diagram the self or emitter bias of transistor amplifier. Determine the stability factor for this type of transistor biasing. 2+2

(b) Given a CE amplifier. Find Current gain, Voltage gain, Input impedance and Output impedance. 4



(c) Draw the frequency response of a practical OPAMP integrator and explain it. 2

4. (a) Why an offset voltage appears at the output of an OPAMP? How it can be eliminated? 4

(b) Derive an expression to show the effect of negative feedback on voltage gain in an amplifier. 3

(c) An amplifier with negative feedback has a voltage gain of 50. It is found that without feedback, an input signal of 60 mV is required to produce a given output; whereas with feedback, the input signal must be 0.3 V for the same output. Calculate the open-loop voltage gain (A) and feedback factor (β). 1+2

5. (a) Briefly describe the working principle of Schmidt trigger circuit using OP-AMP. Calculate the hysteresis voltage and draw the transfer characteristics for increasing and decreasing of output voltage. 1+2+2

(b) What do you mean by 3dB frequencies of an R-C coupled amplifier and why they are so called? Show that Gain Bandwidth product of the amplifier is constant. 2+3

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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