U.G. 3rd Semester Examination - 2020

PHYSICS

Course Code : BPHSCCHC303

Course Title : Analog Systems and Applications

Full Marks : 30 Time : 2 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **ten** questions: 1×10=10

a) What is virtual ground of an operational amplifier?

b) Calculate the concentration of acceptor atoms that have to be added to an intrinsic semiconductor to produce a p-type semiconductor of conducting $0.05\ \Omega^{-1}m^{-1}$. The mobility of holes in p-type semiconductor is 0.4 $m^2V^{-1}s^{-1}$.

c) What is meant by the PIV rating of a p-n junction diode?

[Turn Over]

d) If the input frequency is 50Hz then what is the ripple frequency of a center tapped full wave rectifier?

e) Define static and dynamic resistance.

f) Define direct band gap semiconductor with an example.

g) Give the full form of BJT. Why it is called bipolar?

h) A transistor having $\alpha = 0.975$. What will be the value of β in C-E configuration with this transistor?

i) Mention two examples of sinusoidal oscillators?

j) What is avalanche breakdown?

k) What is Q-Point of a transistor?

l) Write down the biasing conditions for Photo diode and LED.

m) What do you mean by positive feedback?

n) An amplifier has a voltage gain of 500. The gain is reduced to 100 when negative feedback is applied. Find the fraction of the output that is fed back to the input.

o) What do you mean by virtual ground?

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

a) If the output voltage of a center tap full wave rectifier is 100 V, determine the peak inverse voltage.

b) "BJT is a current controlled device, but JFET is a voltage controlled device"– explain.

c) What are the merits of silicon over germanium as a semiconducting material?

d) Calculate the collector current for a fixed bias circuit if V_{CC} = 9V, R_B = 300 $k\Omega$, R_C = 2 $k\Omega$ and $\beta = 50$ of a transistor.

e) Given that CMRR of an OP-AMP is 100dB. Input common-mode voltage is 12 V. Differential voltage gain is 4000. Calculate the output common-mode voltage.

f) An amplifier has a voltage gain of –100. The feedback ratio is –0.04. Find

i) the voltage gain with feedback.

ii) the output voltage of the feedback amplifier for an input voltage of 40 mV.

g) What are the advantages of negative feedback?

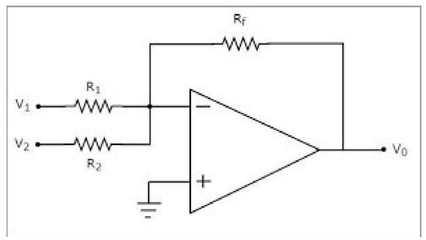
h) A certain Colpitts oscillator uses a tank circuit with L = 20 mH, C_1 = 200pF, and C_2 = 300pF, What is the frequency of oscillation?

3. Answer any **two** questions: 5×2=10

a) Explain with a circuit diagram the use of a Zener diode as a voltage regulator with variation of load resistance. A Zener diode of breakdown voltage 4.7V is connected in series with a resistance $100\,\Omega$. and a power supply of 10 V. The Zener is connected in such a way that it is in reverse bias. Calculate the current through Zener. 3+2

b) Draw a neat circuit diagram of a CE transistor amplifier having a voltage divider type of biasing arrangement with an emitter resistor. Obtain an expression of ac voltage gain of this amplifier in terms of circuit and device parameters. 2+3

c) Find the expression for the output voltage of the circuit given below. Calculate it if V_a=–V_2=1 V and R_i=5R_2=R_f=100 $k\Omega$.



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