BPHET-143

ASSIGNMENT BOOKLET

BACHELOR'S DEGREE PROGRAMME
(BSCG)

DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION

Valid from 1st January, 2023 to 31st December, 2023

School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068
(2023)

Dear Student,

Please read the section on assignments in the Programme Guide for B.Sc. that we sent you after your enrolment. A weightage of 30 per cent, as you are aware, has been earmarked for continuous evaluation, **which would consist of one tutor-marked assignment** for this course. The assignment is in this booklet, and it consists of two parts: Part A and Part B. The total marks of both parts are 100, of which at least 35% are needed to pass.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully:

1) On top of the first page of your answer sheet, please write the details exactly in the following format:

ROLL NO.: ………………………………………………
NAME: ……………………………………………………
ADDRESS: ………………………………………………
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COURSE CODE:…………………………….
COURSE TITLE: …………………………
ASSIGNMENT CODE: …………………..
STUDY CENTRE: ……………………….. **DATE:** ……………………………………...

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.
3) Leave 4 cm margin on the left, top and bottom of your answer sheet.
4) Your answers should be precise.
5) Solve Part A and Part B of this assignment, and **submit the complete assignment answer sheets containing Parts A and B within the due date.**
6) The assignment answer sheets are to be submitted to your Study Centre as per the schedule. **Answer sheets received after the due date shall not be accepted.**

   We strongly suggest that you retain a copy of your answer sheets.
7) This assignment is **valid from 1st January, 2023 to 31st December, 2023**. If you have failed in this assignment or fail to submit it by 31st December, 2023, then you need to get the assignment for the year 2024, and submit it as per the instructions given in the Programme Guide.
8) **You cannot fill the examination form for this course** until you have submitted this assignment. For any queries, please contact: sgokhale@ignou.ac.in. Please note that, we do not provide answers to Assignment questions.

We wish you good luck.

Tutor Marked Assignment

DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION

Course Code: BPHET-143

Assignment Code: BPHET-143/TMA/2023

Max. Marks: 100

Note: Attempt all questions. The marks for each question are indicated against it.

PART A

1. a) The intrinsic carrier concentration of a semiconductor is $2.4\times10^{18}\,\text{m}^{-3}$. It is doped with a trivalent impurity with dopant atom density of $3.4\times10^{19}\,\text{m}^{-3}$. The electron and hole mobilities are $0.5\ \text{m}^2\,\text{V}^{-1}\text{s}^{-1}$ and $0.3\ \text{m}^2\,\text{V}^{-1}\text{s}^{-1}$ respectively. Calculate its conductivity before and after the doping. (5)

   b) Explain the statement "Bipolar Junction Transistor is a current controlled device while Field Effect Transistor is a voltage controlled device". (5)

2. a) Discuss the three methods of biasing a BJT and compare their relative advantages and disadvantages. (5)

   b) Explain the two types of breakdown mechanisms observed in a zener diode. (5)

   c) *h*-parameters of a single stage *CE* amplifier are given as $h_i = 2\ \text{k}\Omega$, $h_r = 5\times10^{-4}$, $h_f = 75$ and $h_o = 20\ \mu\text{AV}^{-1}$. Calculate A_i, A_v, Z_{in} and Z_{out} with $r_L = 5\ \text{k}\Omega$ and $r_S = 100\ \Omega$. (5)

3. a) Convert 0001010001001001 (BCD) into its binary equivalent and then divide it by 1001_2. Express the result in octal equivalent. (5)

   b) Draw the circuit to obtain a 2-input NOR gate using diodes, transistor and resistors. (5)

4. a) Simplify the following Boolean expression and draw a logic gate circuit to implement the MSP.

$$Y = (A+\overline{B})(B+\overline{C})(\overline{A}+C)$$ (5)

   b) With the help of a suitable diagram, explain the subtraction of binary equivalent of decimal number 7 from binary equivalent of decimal number 12 using a 2's complement binary adder-subtractor. (5)

   c) With the help of an appropriate diagram of a 4-bit binary adder explain the addition of 1110 and 0101. (5)

PART B

5. a) Why is a class *B* amplifier more efficient than class *A* amplifier? (2)

   b) What will be the effect on the output of a push-pull amplifier if unmatched transistors are used? (2)

c) An amplifier has maximum voltage gain of 1000. Express it in dB scale. Calculate the gain at the cut-off frequencies on dB scale. (2+1)

6. a) Why are *LC* oscillators preferred over *RC* oscillators to generate high frequencies? (2)

b) Why is a 2-stage amplifier required in Wien bridge oscillator in contrast to a single stage amplifier in the phase shift oscillator? (3)

c) Draw the circuit of a Colpitts oscillator. Calculate its frequency of oscillation if value of both the capacitors is 1nF and inductor is 10 mH. (3)

7. a) Explain the working of full wave bridge rectifier with the help of an appropriate diagram. (5)

b) Design and draw a circuit of series pass voltage regulator to provide 5 V output voltage and 200 mA maximum load current using a silicon *n-p-n* transistor with β = 100. Assume the input unregulated voltage to be 10 V and minimum zener diode current to be 8 mA. Specify the voltage and power rating of zener diode as well as value and power rating of the resistor used. (5)

8. a) Compare the characteristics of IC 741C with an ideal op amp. (5)

b) Design an op amp comparator to provide + V_{SAT} output for input signal less than + 1V and – V_{SAT} output for input signal more than + 1V. (5)

c) Draw the output waveform indicating proper scales on the time and voltage axes for the given input waveform to the circuit shown in Fig. 1. (5)

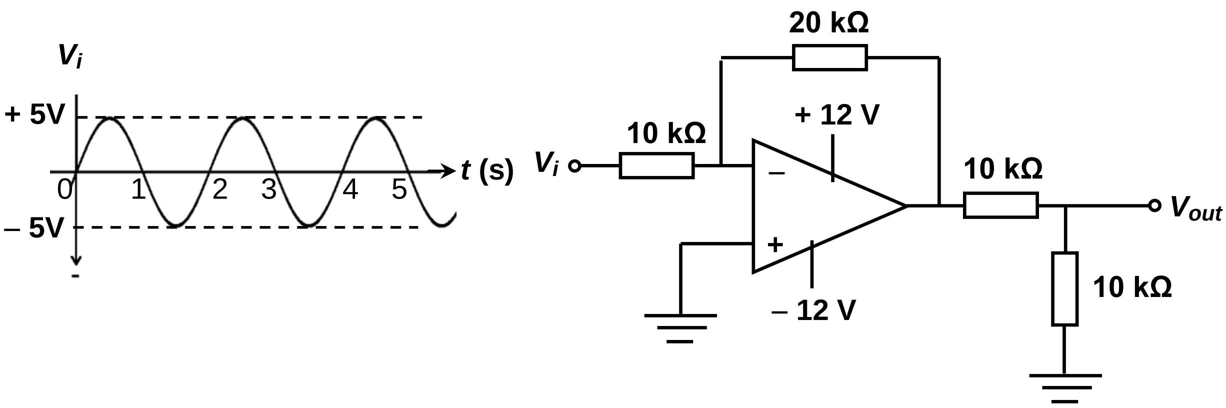

Fig. 1

9. a) Draw the schematic diagram of cathode ray tube showing its major components and explain the functions of these components. (5)

b) Design an astable multivibrator using IC 555 timer to generate a rectangular wave of 75% duty cycle at 20 kHz frequency. (5)

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