BPHET-143

ASSIGNMENT BOOKLET

BACHELOR'S DEGREE PROGRAMME

(BSCG)

DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION

Valid from 1st January, 2022 to 31st December, 2022

School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068
(2022)

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 will not be accepted.**

   We strongly suggest that you retain a copy of your answer sheets.

7) This assignment is **valid from 1st January, 2022 to 31st December, 2022**. If you have failed in this assignment or fail to submit it by 31st December, 2022, then you need to get the assignment for the year 2023, 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 or vijayashri@ignou.ac.in. We wish you good luck.

Tutor Marked Assignment
DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION

Course Code: BPHET-143
Assignment Code: BPHET-143/TMA/2022
Max. Marks: 100

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

PART A

1. a) Explain the effect of doping on the energy band diagram of a semiconductor. (5)

   b) Describe the formation of depletion layer in a *p-n* junction diode. Explain the *I-V* characteristics of *p-n* junction in forward and reversed biased conditions. (5)

2. a) In the universal bias circuit shown in Fig. 4.11 of your course material, a silicon *n-p-n* transistor is used. Calculate the dc voltages (base voltage, emitter voltage, collector voltage and collector to emitter voltage) and collector and emitter currents. It is given that $R_1 = 40\,\text{k}\Omega, R_2 = 5.0\,\text{k}\Omega, R_C = 5.0\,\text{k}\Omega, V_{CC} = 15\,\text{V}$ and $R_E = 1.0\,\text{k}\Omega$. Take $V_{BE} = 0.6\,\text{V}$. Hence, locate the *Q* point. (5)

   b) State the biasing conditions for *E-B* and *C-B* junctions in a BJT for its proper operation. Explain the output characteristics of a CE configuration of an amplifier. (1+4)

   c) *h*-parameters of a single stage *CE* amplifier are given as h_i = 1 kΩ , $h_r = 3 \times 10^{-4}$, h_f = 60 and h_o = 25 μAV^{-1}. Calculate A_i, A_v and Z_{out} with r_s =10 kΩ and Z_{in} = 856 Ω. (5)

3. a) Convert FF_H to its binary equivalent. Add it to 10001_2. Express the result in its decimal and BCD equivalent. (5)

   b) Draw the circuit to obtain a 2-input NAND gate using diodes, transistor and resistors. (5)

4 a) Design a binary adder circuit to add 4-bit binary numbers corresponding to the decimal numbers 12 and 8. (5)

   b) Simplify the expression $Y = \overline{AB}C + \overline{A}BC + AB\overline{C} + A\overline{BC}$ to its MSP form. Draw the logic gate circuit to implement this MSP. (5)

   c) Subtract 00001110_2 from 00011001_2 using 2's complement binary adder-subtractor. Draw the appropriate diagram. (5)

PART B

5. a) Class AB amplifier is used for audio signal amplification whereas class C amplifier is used for single frequency sine wave amplification (used as carrier wave in communication systems). Explain this statement on the basis of Fig. 10.3 in your study material. (5)

   b) Why is it necessary in the case of cascade amplifier to use coupling network between the two stages? What are the advantages of transformer coupling? (2+3)

6. a) State the Barkhausen criterion for sustained oscillation. Explain the operation of Hartley Oscillator. A Hartley oscillator oscillates with 10 MHz frequency. Determine the total inductance, *L* forming the tank circuit with 5 pF capacitor. (1+2+2)

   b) Draw the circuit of a phase shift oscillator using an *n-p-n* transistor. In this oscillator with three identical *RC* sections let R = 10 kΩ. To generate frequencies in the range from 1 kHz to 100 kHz, determine the range of *C*. (5)

7. a) The turns ratio of a transformer used in half wave rectifier is 20:1. The primary is connected to the power mains: 220 V, 50 Hz. If the diode resistance in forward bias is 20 Ω and the load resistance, R_L is 500 Ω, determine

      i) the peak value, the dc value and the rms value of current;

      ii) the ripple factor; and

      iii) the rectification efficiency. (3+1+1)

   b) Design and draw a zener regulated power supply for 5V and 100 mA maximum load current output. Assume the input unregulated voltage to be 10 V and minimum zener operation current to be 5 mA. Specify the voltage, power rating of zener, value and power rating of resistor used. (5)

8. a) You want to amplify an input signal with 10 mV amplitude and 50 MHz frequency. Which characteristics of op-amp will be significant in this case? What will be the value of these parameters? Why? (2+2+2)

   b) Design and draw a circuit using an op-amp to get + 8 V at output for input less than +4 V and −8 V at output for input greater than +4 V. (4)

9. a) What are the different modes of operating a dual trace CRO? Why is alternate mode preferred at high frequencies? Why does it cause flicker at lower frequencies? (1+2+2)

   b) Design an astable multivibrator using IC 555 to generate a rectangular wave of 40% duty cycle at 10 kHz frequency. (5)

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