

B.Sc. V Semester Examination, 2021

Subject: Physics

Paper Code: BPH-E501

Paper Name: Digital and Analog Circuits and Instrumentation

Time: Three Hours

M.M.: 70

Min. Pass: 40%

Note: The question paper is divided into two sections A and B. Attempt both sections. Answer questions as per instruction given.

Section –A

(Short Answer Type Question)

Note: Attempt any five questions in about 150 words each. Each question carries 6 marks. (5X6=30)

- Q1. What is a p-n junction? Draw and explain V-I characteristics of a p-n junction.
- Q2. A half wave rectifier is used to supply 22 V d.c. to a resistive load of 100Ω. The diode has a resistance of 25Ω. Calculate a.c voltage required.
- Q3. Give the simplified Boolean expression for Y of the 3-variable in the following truth table.

Input			Output
A	B	C	Y
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

- Q4. (a) State De-Morgan's theorems.
(b) Simplify this expression:
$$Y = AB + A(B+C) + B(B+C)$$
- Q5. Explain how OP-AMP can be used as differentiator and integrator.

- Q6. What is LED? Explain the working of a LED.
- Q7. What do you understand by class A, class B and class C power amplifiers? Show that the maximum collector efficiency of a class B power amplifier is 78.5%.
- Q8. Explain DC, AC load line and Q-point with appropriate diagram.
- Q9. (a) Define and explain with circuit diagram, the operation of NAND gate.
 (b) Using Boolean algebra, verify:
 (i) $A + \bar{A}B = A + B$ (ii) $(A + B)(\bar{A} + C)(A + B) = AC$
 (c) Find the complement of the function:
 $Y = A(\bar{B}\bar{C} + BC)H$
 (d) Convert 1745_8 in to its hexadecimal equivalent.
- Q10. Deduce hybrid parameter of a transistor in a common emitter configuration.

Section-B

(Long Answer Type Questions)

Note: Attempt any four questions in detail. Each question carries 10 marks.

(4X10=40)

- Q1. Construct the POS and SOP expression for the following K-Map:

		CD			
		00	01	11	10
AB	00			1	
	01	x	x	1	x
	11		1	1	
	10		1	1	

(SOP)

		WX			
		00	01	11	10
YZ	00	0	x	0	x
	01				
	11	0			0
	10	0			0

(POS)

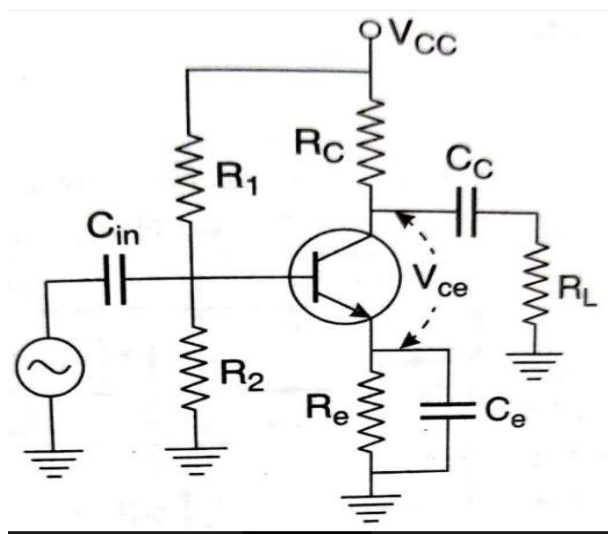
- Q2. Describe the RC coupled amplifier. Discuss its equivalent circuit in the different frequency region. Write the expression for its voltage gain in mid and high-frequency regions.

A transistor amplifier employs a $4\text{ K}\Omega$ as collector load. If the input resistance is $1\text{ K}\Omega$, determine the voltage gain. (Given, $\beta = 100$, $g_m = 10\text{ mA/volt}$ and signal voltage = 50 mV).

- Q3. What is Zener diode? Draw the equivalent circuit of an ideal Zener. How does Zener diode maintain constant voltage across load?

A Zener is used to regulate output voltage for which the load current varies from 12 mA to 100 mA . Find the value of the series resistance to maintain a voltage of 7.2 V across the load. The input voltage is constant at 12 V and the minimum Zener current is 10 mA .

- Q4. The collector and base currents of a certain transistor are measured as,
 $I_c = 10.202\text{mA}$, $I_b = 100\mu\text{A}$ and $I_{cbo} = 5\mu\text{A}$.
 (a) Calculate α , β and I_e .
 (b) Determine the new level of I_b required to make $I_c = 20\text{mA}$
- Q5. What are the essentials of transistor biasing circuits? Discuss voltage divider bias method in detail. How stabilization of operating point is achieved by this method.
- Q6. In the transistor amplifier shown in figure, $R_c = 10\text{k}\Omega$, $R_L = 30\text{k}\Omega$ and $V_{cc} = 20\text{V}$. The values R_1 and R_2 are so as to fix the operating point at 10V , 1mA . Draw the d.c. and a.c. load lines. Assume R_e as negligible.



- Q7. Write short on the following:
 (i) CRO
 (ii) Solar cell
 (iii) Filter circuits
- Q8. What is an operational amplifier (OP-Amp)? Give the block diagram of an operational amplifier. Draw the basic circuit of a differential amplifier. What are common-mode signals? What do you by CMRR?