SET 3

Department : PHYSICS and ASTROPHYSICS

Name of Course : B.Sc. Prog. _CBCS_DSE

Semester : V- Semester

Name of the Paper : Digital, Analog and Instrumentation

Unique Paper Code : 42227530

Time : 3 Hours
Maximum Marks : 75

Attempt any Four Questions in All. All Questions carry equal Marks

Q1. Explain what are Binary numbers? What is their use? Define Bit and Byte.
Convert 17_{10} to its binary equivalent.
Find the decimal value of 111001_2
List out the basic laws of Boolean algebra. Also write properties (associative, commutative and distributive) of Boolean algebra.

Simplify the following Boolean Expression using Boolean laws

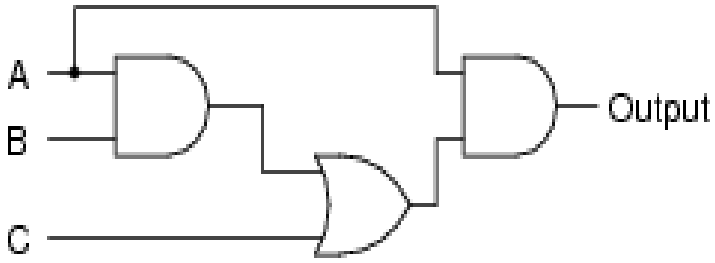
$$F = \overline{A} \cdot B \cdot C + A \cdot \overline{B} \cdot C + A \cdot B \cdot \overline{C} + A \cdot B \cdot C$$

Q2. Use a SOP Karnaugh map (Considering min terms) to generate a simple Boolean for following truth table and draw a logic circuit equivalent to that reduced expression:

A	B	C	D	Output
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1

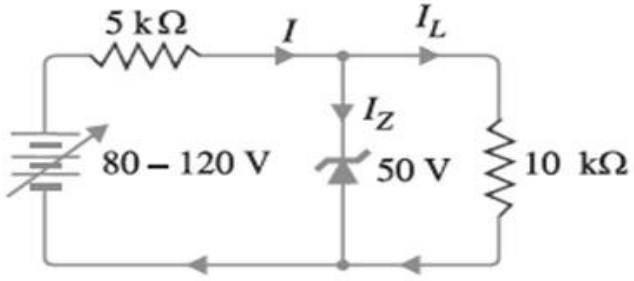
1	1	1	1	0

Simplify the following logic gate circuit:



Q3. Describe the construction of a photodiode. Draw its V -I characteristics for different intensities of illumination. Briefly Explain its working. How does it differ from solar cell?
Give two applications of a photodiode.

For the circuit given in Figure below, find the following quantities :
(i) the output voltage (ii) the voltage drop across series resistance (iii) Maximum current through zener diode (iv) Minimum current through zener diode



Q4. Describe the hybrid parameters for transistor? Give their units also.

. Draw h parameter equivalent circuit of a transistor CE configuration.

For CE amplifier derive the following in terms of h-parameters:

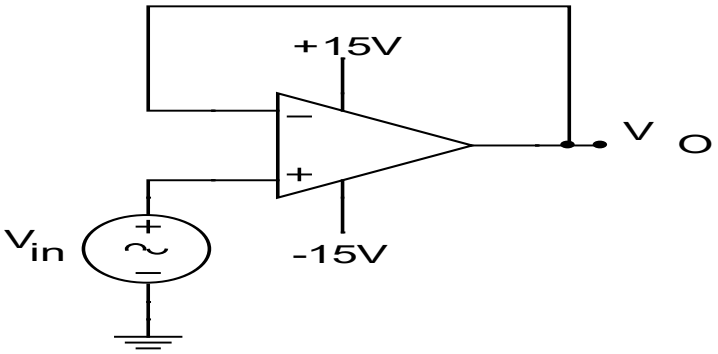
input impedance (ii) current gain and (iii) voltage gain (iv) output impedance

A transistor used in CE configuration has the following set of h parameters when the d.c. operating point is V_{CE} = 5 volts and I_C = 1 mA : h_{ie} = 1700 Ω; $h_{re} = 1.3 \times 10^{-4}$; h_{fe} = 38; $h_{oe} = 6 \times 10^{-6}\ \Omega^{-1}$

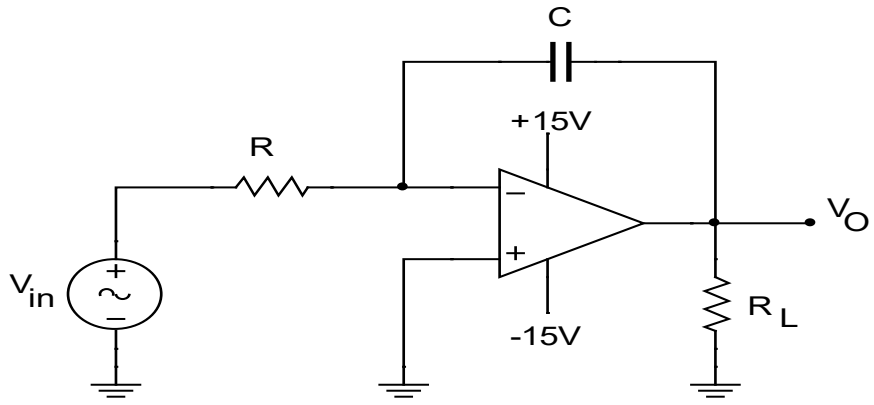
If the a.c. load r_L seen by the transistor is 2 kΩ, find (i) the input impedance (ii) current gain and (iii) voltage gain.

Q5. Draw the circuit of an Op-Amp as a inverting summing amplifier for three voltage input signals, V_1, V_2 and V_3. Also obtain an expression for the output voltage. Under what conditions the circuit will work as an averaging amplifier.

An Op-Amp in an voltage follower circuit has parameters A_{CM}=0.001, A_{OL}=200000 Z_{IN}=1MΩ, Z_{OUT}=80Ω, slew rate =0.5V/μs. Determine the closed loop gain, common mode rejection ratio and maximum operating frequency if the peak to peak input voltage is 6V.



Derive an expression for the output voltage for the circuit below.



Q6. Draw the pin out diagram of IC-555 and explain the function of pin 5 and pin 6. Give any two applications of an IC 555 timer.

What are the two basic modes in which 555 timer can be operated? Describe and differentiate between the two modes.

Explain in detail the working of Centre tap full wave rectifier with the help of circuit

diagrams. Derive its ripple factor and rectification efficiency.