VIT®

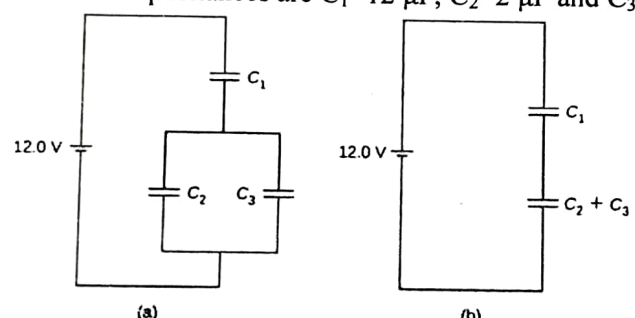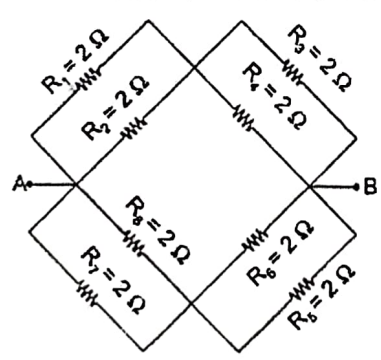## Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test I – January 2023

Programme	:	B.Tech		Semester	:	WS 2022-23
Course	:			Code	:	BECE101L
		Basic Electronics		Class Nbr	:	CH2022235002756 CH2022235002712 CH2022235001341
Faculty	:	Dr B Lakshmi, Dr A Prathiba, Mr Premanand S		Slot	:	B2
Time	:	90 Minutes		Max. Marks	:	50

Answer ALL the questions

Q.No.	Sub-division	Question Text	Marks
1.	i)	Determine the net capacitance C of the capacitor combination shown in Figure 1 a & b when the capacitances are C_1=12 µF, C_2=2 µF and C_3=4 µF.	[3] + [3]

(a)   (b)

Figure 1

| | ii) | Find the equivalent resistance across the two ends A and B of this circuit | [4] |

Figure 2

	iii)	Explain the necessity of evolution of electronics since the vacuum tube age to till date.	[5]
	iv)	Compare and contrast between electro-mechanical and solid-state relays.	[5]
2.	i)	Discuss the energy-band gap of a semiconductor with a neat diagram.	[5]

ii) Silicon is doped with 5×10^{16} arsenic donor atoms cm^{-3}. [2]

(a) State whether the material n- or p-type? +

(b) Calculate the electron and hole concentrations at T = 300 K. Assume the n_i of silicon as 1.5×10^{10} cm^{-3} [3]

iii) A junction diode that has $I_D = 0.3$ mA for $V_D = 0.4$ V. Assume that $\eta = 2$ and $V_T = 0.026$ V. Use the diode equation to compute the diode current at $V_D = 0.65$ V and at $V_D = 0.70$ V [5]

3. i) Plot the voltage transfer characteristics v_O versus v_I for a half wave rectifier within the range of $-10 \le v_I \le 10$ V. Also sketch v_O versus time for the sinusoidal input. Assume $v_I = 10 \sin\omega t$ (V) and R= 1kΩ. [4]

ii) A full-wave rectifier uses two diodes, the internal resistance of each diode may be assumed constant at 20 Ω. The transformer rms secondary voltage from centre tap to each end of secondary is 50 V and load resistance is 980 Ω. Compute (i) mean load current (ii) rms value of load current (iii) peak inverse voltage [6]

iii) Justify how a Zener diode act as a voltage regulator with an appropriate circuit diagram and characteristics [5]

Total Marks [50]

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Continuous Assessment Test II – March 2023

Programme	: B.Tech	Semester	:	WS 2022-23
Course	:	Code	:	BECE101L
	Basic Electronics	Class Nbr	:	CH2022235002756 CH2022235002712 CH2022235001341
Faculty	: Dr B Lakshmi, Dr A Prathiba, Mr S Premanand	Slot	:	B2
Time	: 90 Minutes	Max. Marks	:	50

Answer ALL the questions

Q.No.	Sub-division	Question Text	Marks
1.	i)	A npn transistor with $\beta = 80$ is connected in a common-base configuration as shown in Figure 1 (a) The emitter is driven by a constant-current source with $I_E = 1.2$ mA. Determine I_B, I_C, α, and V_C. (b) Repeat part (a) for $I_E = 0.80$ mA. (c) Repeat parts (a) and (b) for $\beta = 120$.	10

Figure 1

	ii)	Calculate the drain current in an NMOS transistor with parameters $V_{TN} = 0.4$ V, $k'_n = 120$ $\mu A/V^2$, $W = 10$ μm, $L = 0.8$ μm, and with applied voltages of $V_{DS} = 0.1$ V and (a) $V_{GS} = 0$, (b) $V_{GS} = 1$ V, (c) $V_{GS} = 2$ V, and (d) $V_{GS} = 3$ V.	5
2.	i)	With a neat circuit diagram and waveform, discuss an electronic circuit which uses positive feedback to produces oscillations at low and medium frequencies. Also mention its frequency of operation	5
	ii)	The tuned oscillator used in the Hartley oscillator of a radio receiver makes use of a LC tuned circuit with L1=50 μH, L2=75 μH and C=380 pF. Calculate the frequency of oscillation.	5
	iii)	Calculate the drain current and drain-to-source voltage of a common source circuit with an n-channel enhancement-mode MOSFET for Figure 2 if $R_1 = 3$ kΩ, $R_2 = 2$ kΩ, $R_D = 2\Omega$, $V_{DD} = 4.7$ V, $V_{TN} = 0.8$ V, and $K_n = 0.2$ mA/V^2.	5

V_{DD}

R_1

I_D R_D

0

V_G

V_{DS} +

−

V_{GS}

R_2

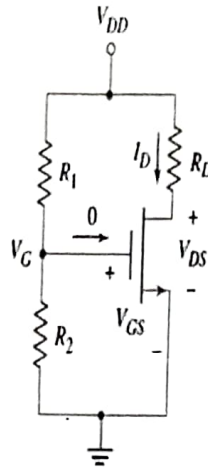**Figure 2**

(25)   i)   Convert $(1110101.1101)_2$ to decimal.   **2**

(8) 2   ii)   Realize the functionality of OR, AND and NOT gates using NAND gate only   **3**

(6)   iii)   Simplify the Boolean expression to a minimum number of literals and implement the same using basic logic gates.   **5**

F= a'bc + abc' + abc + a'bc'

(10)   iv)   Implement the Boolean function and also verify the truth table, F = xy + x'y'+ y'z using (a) With AND and inverter gates and (b) With OR and inverter gates.   **10**

Total Marks **[50]**

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bc (a+a') + bc'(a+a')

Final Assessment Test (FAT) - APRIL/MAY 2023

Programme	B.Tech	Semester	Winter Semester 2022-23
Course Title	BASIC ELECTRONICS	Course Code	BECE101L
Faculty Name	Prof. PREMANAND S	Slot	B2
		Class Nbr	CH2022235001341
Time	3 Hours	Max. Marks	100

SECTION 1 (2 X 4 Marks)
Answer All questions

01. In a common base connection, current amplification factor is 0.9. If the emitter current is 1mA, determine the value of base current. [4]

02. In a common base connection, the emitter current is 1mA. If the emitter circuit is open, the collector current is 50 µA. Find the total collector current. Given that $\alpha = 0.92$. [4]

SECTION 2 (10 X 5 Marks)
Answer All questions

03. Calculate the forward bias current of a Si diode when forward bias voltage of 0.4V is applied, the reverse saturation current is 1.17×10^{-9}A and the thermal voltage is 25.2 mV. [5]

04. Explain the working of PN junction under these three operating conditions: [5]
    i)   No bias
    ii) Forward bias
    iii) Reverse bias

05. Find the equivalent resistance, R_{EQ} for the following resistor combination circuit shown in Figure 1. [5]
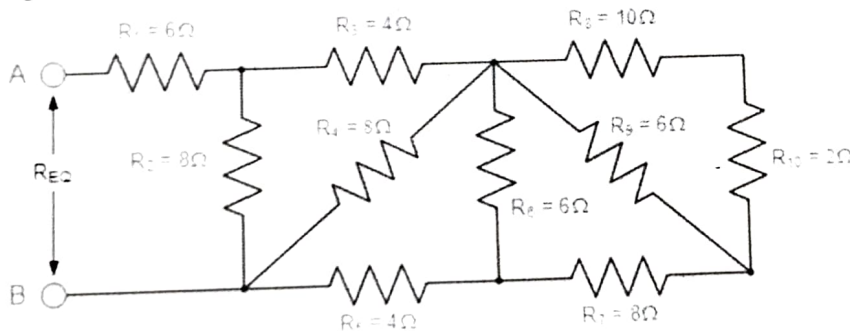

Figure 1

06. Find the total capacitance of the combination of capacitors shown in the figure 2 [5]
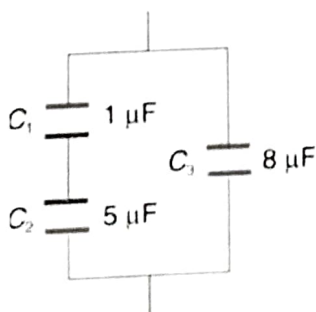

Figure 2

07. Consider an n-channel depletion-mode MOSFET with parameters [5]
$V_{TN} = -1.2$ V and $k'_n = 120$ μA/V². The drain current is $I_D = 0.5$ mA at $V_{GS} = 0$ and $V_{DS} = 2$ V. Determine the W/L aspect ratio.

08. Determine the (i) operating frequency and (ii) feedback fraction for Colpitt's oscillator shown in [5] the below Figure 3

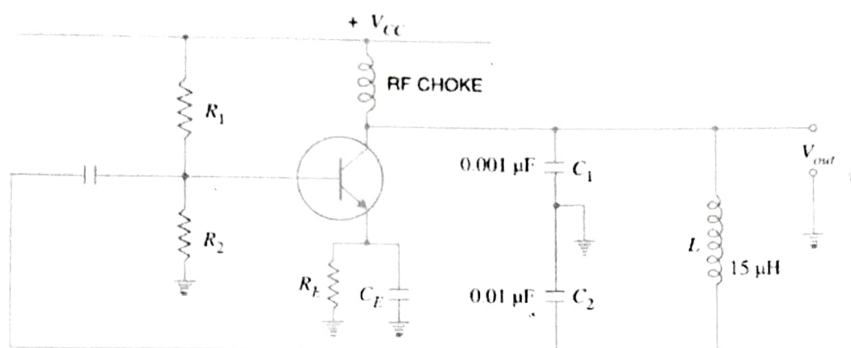Figure 3

09. In the phase shift oscillator shown for the below figure 4, $R_1 = R_2 = R_3 = 1$MΩ and $C_1 = C_2 = C_3$ [5] = 68 pF. At what frequency does the circuit oscillate?
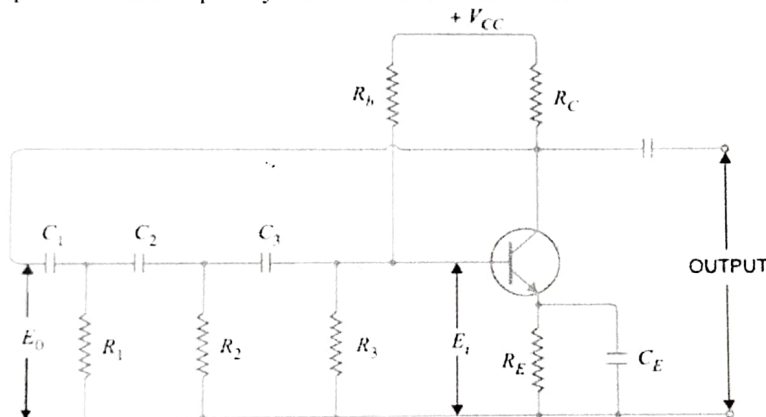

Figure 4

10. A garden contains 39 plants. The following plants were chosen at random, and their heights were [5] recorded in cm: 38, 51, 46, 79, and 57. Calculate their heights' standard deviation.

11. With a suitable and neat sketch, briefly explain a sensor which is used to measure displacement [5]

12. For a certain thermistor β= 3100 K and its resistance at 20°C is known to be 1050 Ω.   The [5] thermistor is used for temperature measurement and the resistance measured is 2300 Ω. Find the measured temperature if the temperature resistance characteristics of the thermistor is given by

$$R = R_0 \exp[\beta((1/T)-(1/T_0))]$$

where T is in Kelvin.

SECTION 3 (2 X 6 Marks)
Answer All questions

13. Describe a simple common-emitter circuit with an npn bipolar transistor and also discuss the [6] relation between collector-emitter voltage and input base current

14. Explain the working of an enhancement n-channel MOSFET with neat schematic for different [6] gate bias and drain bias conditions. Draw the current voltage characteristics and mark the region of operation.

[10]

15. Simplify the following Boolean equations

a) F= A`B`C`+A`BC`+A`BC+ABC`+ABC

b) $\overline{(A + B)\bar{C}\bar{D} + E + \bar{F}}$

[10]

16. Represent the output Boolean expression for the logic circuit shown in below figure 5 and simplify the same using Boolean algebra
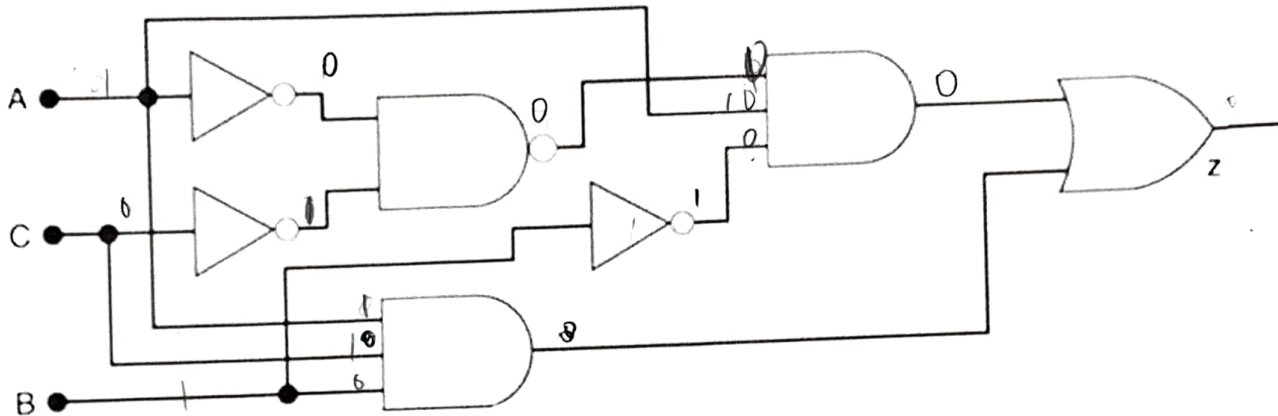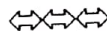

Figure 5

[10]

17. Elaborate the functional elements required to complete the task for an instrumentation system using a typical example

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Final Assessment Test (FAT) – June 2022

| Programme	B.Tech / M.Tech(Int)	Semester	Winter Semester 2021-22
Course Title	BASIC ELECTRONICS	Course Code	BECE101L
Faculty Name	Prof. S Selvendran	Slot	E2
		Class Nbr	CH2021222300398
Time	3 Hours	Max. Marks	100

Section-A (2 X 10 Marks)
Answer All questions

1. A voltage divider circuit supplies reference voltages to various instruments. From Figure 1. [10]

(i) Obtain the voltage drop across AB, voltage drop across R_1, voltage drop across R_2, voltage drop across BC, voltage drop across R_3, voltage drop across R_4, voltage drop across R_5.
(ii) Determine the total current through the circuit.
(iii) What would be the equivalent resistance of the circuit?
(iv) What would be the colour coding for R_3 ?
[10 Marks]
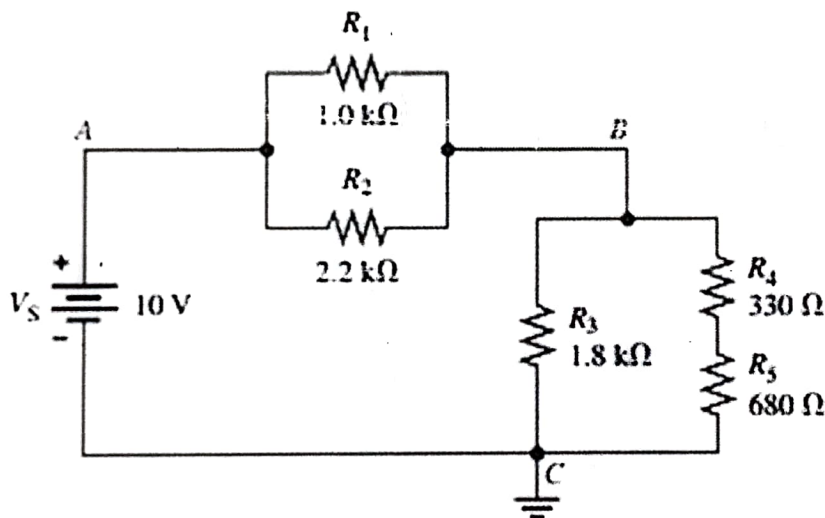
Figure 1

2. a) Discuss in detail about the types of errors that are likely to occur in measuring instruments. [6 Marks] [10]
   b) Consider an analog voltmeter to measure a voltage drop of about 75 V across a resistor. The reading value in the meter is about 73 V. Find i) Absolute Error ii) Relative Error iii) Accuracy iv) Precision value when the mean of measured value is 74.8V. [4 Marks]

Section-B (4 X 15 Marks)
Answer All questions

3. (a) How is the 230V AC input used to charge your mobile phones? What is the type of output? Explain the functionality involved using a suitable diagram. [12 Marks] [15]
   (b) How can a diode be used as a rectifier and as a voltage regulator? Give an example for each. [3 Marks]

4. (a) For the MOSFET amplifier in common source configuration assume $V_{DD} = 16V$, $V_D = 6$ V. **[15]** $V_{DS} = 8$ V, $I_D = 5$ mA and $V_{in} = 40V$ with 1 KHz. **[10 Marks]**

Determine

(i) The value of R_D and R_S.

(ii) The value of R_2 if $R_1 = 150$ KΩ and $V_G = 12$ V.

(iii) The value of coupling capacitor whose capacitive impedance should be less than 2 KΩ.

(iv) Draw the circuit diagram.

(b) For the circuit shown in figure 2, find the frequency of oscillation and feedback fraction. **[5 marks]**
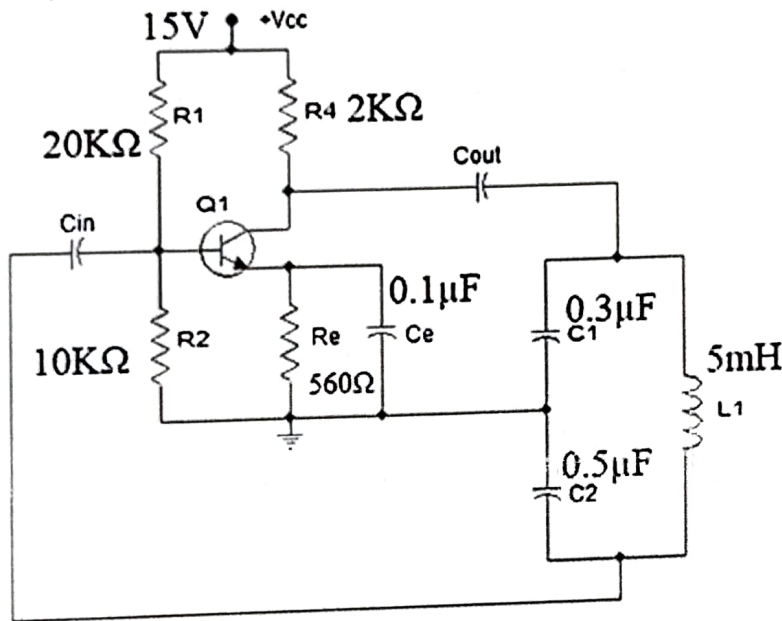

Figure 2

5. a) Convert the decimal number 6781 to Octal and binary number. **[4 Marks]** **[15]**

   b) Draw the truth table for the following logic circuit as depicted in figure 3. **[3 Marks]**
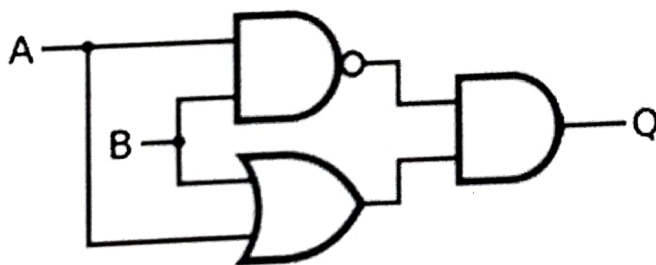

Figure 3

   c) Draw the logic diagram for the Boolean expression $(x+y)(x+y')+((xy')+x')'$. Also, simply this expression to minimum possible literals using Boolean algebra. **[8 Marks]**

6. a) Describe how displacement can be measured using sensor where the displacement variation is **[15]** converted as change in electrostatic potential variation. Explain with a neat sketch. **[8 Marks]**

   b) Explain why LVDT is preferable in position sensing over other sensing measurements. **[7 Marks]**

7. a) Sketch and discuss transistor (BJT) configuration which has a (i) Voltage gain less than or [20] equal to one, (ii) Voltage gain greater than one with 180° phase shift. Mention an application for each. [10 Marks]

b) Calculate I_B, I_C, I_E, V_{BE}, V_{CE}, and V_{CB} in the given circuit as shown in figure 4. The transistor has $\beta_{DC} = 183$. [10 Marks]
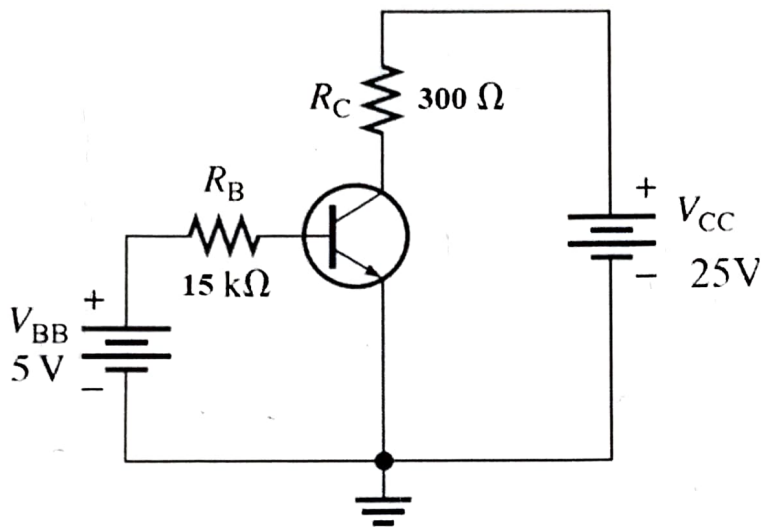

Figure 4