

**Answer all the following questions:****Question (4) (10 Marks)**

Choose the correct answer:

- 1- When forward-biased, a diode ....  
(a) blocks current (b) conducts current (c) has a high resistance (d) drops a large voltage
- 2- FM is one type of ..... modulation. (a) Analog (b) Digital
- 3- A 2x1 multiplexer is an example of ..... logic circuit. (a) Combinational (b) Sequential
- 4- The  $\beta_{DC}$  of a transistor is its .... (a) current gain (b) voltage gain (c) power gain (d) internal resistance
- 5- An optocoupler usually consists of .....  
(a) two LEDs (b) an LED and a photodiode (c) an LED and a phototransistor (d) both (b) and (c)

**Question (5) (20 Marks)**

- 1- What are the different configurations of BJT transistor circuits?

**Common Emitter, Common Base & Common Collector.****Depending on the input and output terminals.**

- 2- For the circuit shown in **Fig. 1**:

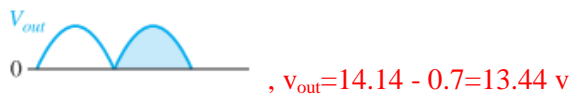
- a. What is the name of this circuit?

**Center-tapped Full-wave Rectifier**

- b. Find the peak voltage across each half of the transformer secondary terminals.

$$V_p = V_{sec}/2 = (V_{prim}/5)/2 = 14.14\text{v}$$

- c. Sketch the voltage waveform across  $R_L$ .



- d. What is the peak current through each diode?

**Assuming zero internal resistor of diodes,  $I_p = 13.44/330 = 40.7\text{ mA}$** 

- e. What is the PIV for each diode?

$$\text{PIV} = 2V_{p(out)} + 0.7\text{ V} = 2 * 13.44 + 0.7 = 27.58\text{ V}$$

- 3- For the circuit shown in **Fig. 2**:

- a. Perform the DC analysis.

$$V_B = 5.5 * (4.7 / (10 + 4.7)) = 1.76\text{ V}$$

$$V_E = V_B - 0.7 = 1.06\text{ v}$$

$$I_E = V_E / R_E = 1.06 / 1\text{K} = 1.06\text{ mA}$$

$$I_C = I_E = 1.06\text{ mA}$$

$$I_B = I_C / \beta_{DC} = 1.06\text{mA} / 100 = 10.6\text{ }\mu\text{A}$$

$$V_C = 5.5 - I_C * R_C = 0.2\text{V}$$

- b. Calculate the voltage gain.

$$A_v = -R_C / r_e$$

$$r_e = 26\text{mV} / I_E = 24.5\text{ }\Omega$$

$$A_v = -5\text{K} / 24.5 = 204$$

c. If  $V_{in} = 1\text{mV}$ , Calculate  $V_{out}$ .

$$V_{out} = A_v * V_{in} = 204 \text{ mV}$$

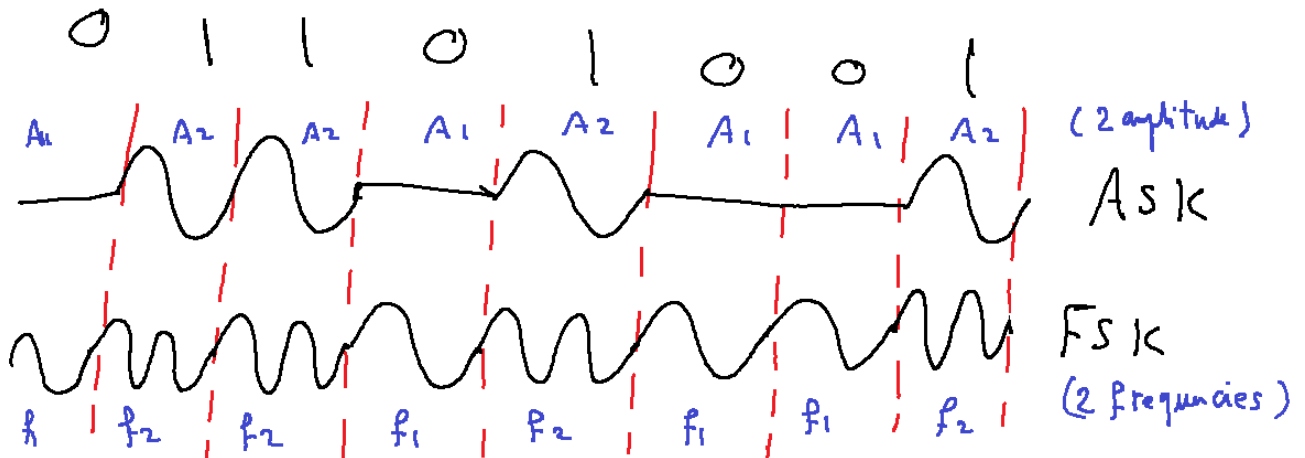
d. Calculate  $R_{in(\text{base})}$  &  $R_{out}$

$$R_{in(\text{base})} = R_1 // R_2 // \beta R_E =$$

$$R_{out} = R_C = 5\text{K}\Omega$$

**Question (6) (15 Marks)**

1- Draw the ASK and FSK waveforms for the data stream 01101001.



2- Mention the advantages and disadvantages of the digital electronics.

Advantages:

Digital techniques are useful because it is easier to get an electronic device to switch into one of a number of known states than to accurately reproduce a continuous range of values.

Signals represented digitally can be transmitted without degradation due to noise.

Computer-controlled digital systems can be controlled by software, allowing new functions to be added without changing hardware.

Disadvantage:

In some cases, digital circuits use more energy than analog circuits to accomplish the same tasks, thus producing more heat which increases the complexity of the circuits such as the inclusion of heat sinks.

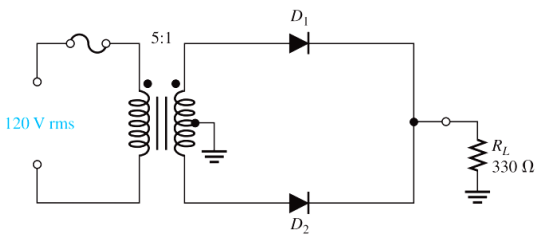
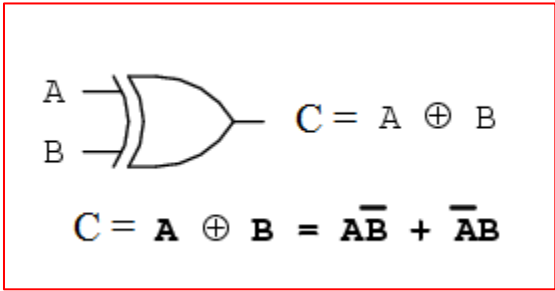
3- For the below logic circuit in **Fig. 3**:

a. Write the Boolean expression and the truth table.

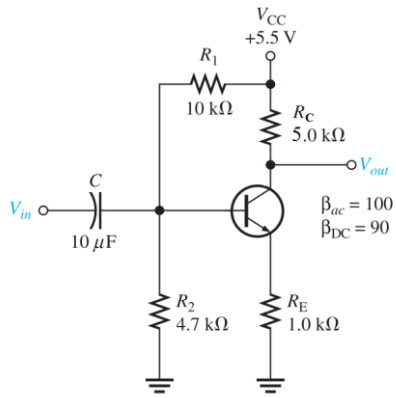
A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

$C = A \oplus B = A\bar{B} + \bar{A}B$

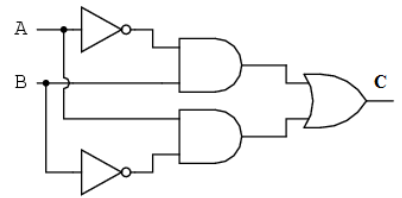
b. Noting the truth table, replace the circuit with only one gate.



**Fig. 1**



**Fig. 2**



**Fig. 3**

*Good Luck,  
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