

Reg. No:  
Date: 30-11-2020

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27  
B.Sc. PHYSICS -V SEMESTER  
SEMESTER EXAMINATION-NOVEMBER 2020  
PH 5118: ELECTRONICS AND RELATIVITY.

Time: 2 ½ hrs.

Max.Marks:70

This question paper has **two** printed pages and **three** parts

**PART-A**

Answer any **Four** of the following: (4x10=40)

1. a). What is meant by biasing of a transistor? Give its importance.  
b). With the circuit diagram explain the action of transistor (CE) as an amplifier (3+7)
2. a) Define the parameters of a JFET. Mention the relation between them.  
b) With a circuit diagram, explain the drain characteristics of JFET. (3+7)
3. a) What is meant by positive and negative feedback? State the Barkhausen's criterion for sustained oscillations  
b) Explain the working of an operational amplifier as a subtractor with a circuit. (4+6)
4. a) What is a logic gate? Explain the basic logic gates with symbol and truth table.  
b) Explain a half adder with truth table and a logic circuit. (5+5)
5. Describe Michelson-Morley experiment and discuss the negative result. (10)
6. a) State the postulates of special theory of relativity.  
b) Define Proper length. Obtain an expression for Lorentz contraction of a moving rod. (3+7).

**PART-B**

Answer any **Four** of the following: (4x5=20)

7. A transistor has  $\beta = 150$  and the emitter current is 10mA. Calculate the collector current, base current and the ratio of  $\beta$  and  $\alpha$ .
8. The input to the differentiator circuit is a sinusoidal voltage of peak value 5 mV and a frequency 2 KHz. Find the output if  $R = 100 \text{ K}\Omega$  and  $C = 1\mu\text{F}$

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9. A silicon transistor with  $\beta = 100$  is biased by a base resistor method. Given the value  $R_C = 2 \text{ k } \Omega$ ,  $R_B = 530 \text{ k } \Omega$  and  $V_{CC} = 6 \text{ V}$ . Draw the dc load line and determine the operating point.
10. Calculate the kinetic energy of an electron moving with a velocity of 0.98 times the velocity of light in the laboratory system.
11. The length of the spaceship is measured to be exactly half its actual length. Calculate (i) Speed of the spaceship and (ii) the time dilation corresponding to one second on the spaceship.
12. In a Hartley Oscillator  $L_1 = 0.2 \text{ mH}$ ,  $L_2 = 20 \text{ } \mu\text{H}$  and  $M = 40 \text{ } \mu\text{H}$ . Find the value of capacitor of the oscillatory circuit to obtain a frequency of 4.1 MHz

### PART-C

Answer any **Five** of the following:

(5x2=10)

- 13.a) Why is the CC amplifier called as an emitter follower? Give reason.
- b) The Wien bridge oscillator uses both positive and negative feedback. Justify.
- c) What are the input and output impedances of an ideal op-amp?
- d) Explain why the ideas of relativity seems strange in day to day life?
- e) A moving clock runs slower than a stationary clock. Explain.
- f) Why is FET being a unipolar device and BJT is a bipolar device.?