



Registration Number:

Date & Session

**ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU -27**  
**B.Sc. PHYSICS V SEMESTER**  
**SEMESTER EXAMINATION: OCTOBER 2022**  
(Examination conducted in December 2022)  
**PH 5118: ELECTRONICS AND RELATIVITY**

**Time: 2 ½ Hours**

**Max Marks: 70**

**This paper contains 2 printed pages and 3 parts**

**PART – A**

Answer any **four** of the following:

[4x10=40]

1. a) With a neat circuit diagram explain the working of CE transistor amplifier.  
Draw the frequency response curve and define bandwidth.  
b) Distinguish between active, saturation and cut off regions of the transistor in CE mode. (7+3)
2. a) Discuss the construction and working of **n** – channel FET.  
b) What is meant by biasing of a transistor? Write the advantages of using voltage divider bias. (7+3)
3. a) With a circuit diagram describe how an OP-AMP functions as a subtractor.  
b) Distinguish between positive and negative feedback. State the Barkhausen criterion for sustained oscillations. (6+4)
4. a) Explain the working of Phase shift oscillator with a circuit diagram.  
b) Discuss the construction and working of OR and AND gate using diodes.  
Verify it with a truth table. (5+5)
5. a) Deduce Galilean transformation equations. Hence discuss Galilean Principle of relativity.  
b) Prove velocity addition theorem and explain its significance. (5+5)
6. a) State the postulates of special theory of relativity.  
b) Derive mass energy relation  $E = mc^2$  (2+8)

**PART-B**

Answer any **four** of the following:

[4x5=20]

7. Draw the DC load line and determine the operating point of a silicon transistor in a base bias circuit. Given  $V_{CC} = 25\text{ V}$ ,  $V_{BB} = 15\text{ V}$ ,  $R_C = 5\text{ k}\Omega$ ,  $R_B = 2\text{ M}\Omega$  and  $\beta = 125$
8. The parameters for FET are: Maximum drain current  $I_{DSS} = 15\text{ mA}$ , Pinch off voltage  $V_P = -3\text{ V}$ . Calculate the drain current for **a)**  $V_{GS} = 0\text{ V}$  **b)**  $V_{GS} = -1\text{ V}$  **c)**  $V_{GS} = -3\text{ V}$
9. The input to the differentiator circuit is a sinusoidal voltage of peak value  $5\text{ mV}$  and frequency  $1\text{ KHz}$ . Find the output voltage if  $R_f = 100\text{ K}\Omega$ ,  $C = 1\mu\text{F}$

PH 5118-A-22



10. The frequency of the Hartley oscillator is 20 kHz. The capacitor used in the feedback network has a value of 576 pF. If one of the inductor values is 100 mH, calculate the value of the other inductor. Also calculate the amplifier gain.
11. At what speed should a clock be moved so that it may appear to lose one minute in each hour?
12. A particle of rest mass  $m_0$  moves with a speed  $0.6c$ . Calculate its mass, momentum total energy and kinetic energy.

### PART- C

Answer any **five** of the following.

[5x2=10]

13. a) A bipolar junction transistor is a current controlled device. Explain
- b) A common collector amplifier is called an emitter follower. Justify.
- c) What is the significance of virtual ground in an OP-AMP?
- d) Can we realize an AND gate from a NOR gate? Discuss.
- e) A sphere moving parallel to its diameter with a velocity appears elliptical. Explain.
- f) What is the significance of the negative result of Michelson – Morley experiment?