



UNIVERSITY EXAMINATIONS

FIRST SEMESTER 2025/2026 ACADEMIC YEAR

**SECOND YEAR EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN COMPUTER SCIENCE**

PHYS 223: BASIC ELECTRONICS

STREAMS: R

TIME: 2 HRS

DAY: FRIDAY [8.30 – 10.30 A.M]

DATE: 30/01/2026

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.

INSTRUCTIONS TO CANDIDATES

- Answer question **ONE** and any **TWO** questions
- Question **ONE** carries **40 marks** while all other carry **15 marks**

QUESTION ONE (40 MARKS)

- (a) (i) Define the term Doping as used in Basic Electronics. (1 Mark)
- (ii) State how P-type semiconductor is formed. (2 Marks)
- (b) (i) Explain how the depletion layer is formed in a P-N junction (3 Marks)
- (ii) Differentiate between Forward and reverse biasing of a PN junction. (2 Marks)
- (iii) On the same graph draw forward and reverse characteristics of a diode and identify on the curve the forward region, reverse region, cut in voltage, breakdown voltage, (3 Marks)
- (c) (i) State **two** uses of Zener diode (2 Marks)
- (ii) Differentiate between Zener and Avalanche breakdown. (4 Marks)
- (d) (i) Distinguish between Unipolar and Bipolar transistor (2 Marks)
- (ii) Using a well labelled diagram distinguish between common base transistor and common emitter transistor. (4 Marks)
- (e) (i) Derive the relationship between the parameters α and β (3 Marks)
- (ii) A BJT has a base current of 250 μA and emitter current of 15mA Determine the collector current and β . (3 Marks)
- (f) (i) Briefly explain why negative feedback is preferred to the positive feedback amplifiers (2 Marks)
- (ii) A negative feedback of $\beta = 2.5 \times 10^{-3}$ is applied to an amplifier of open loop gain 1000. Calculate the change in overall gain of the feedback amplifier if the gain of the internal amplifier is reduce by 20%. (4 Marks)

- (g) (i) Draw the symbol for Operational Amplifier and label it. (2 marks)
- (ii) State **three** characteristics of an ideal Operational-Amplifier. (3 Marks)

QUESTION TWO (15MKS)

- (a) With aid of a diagram, discuss the difference between a conductor, semiconductor and insulator using the energy band theory. (6 Marks)
- (b) Give three applications of a PN junction (3 Marks)
- (c) Explain what happen to the depletion layer when a diode is forward biased and when Reverse biased (2 Marks)
- (d) With the aid of a diagram explain the working of a full-wave bridge rectifier (4 Marks)

QUESTION THREE (15 MARKS)

- (a) Discuss the construction of bipolar junction transistors (4 Marks)
- (b) Draw and label the schematic diagram of each type of bipolar transistor (4 Marks)
- (c) Give three applications of a bipolar junction transistor. (3 Marks)
- (d) A transistor has $\beta=150$. Calculate the approximate collector and base currents if the emitter current is 10 mA. (4 Marks)

QUESTION FOUR (15 MARKS)

- (a) For a transistor connected in the common-emitter configuration, Sketch
- (i) Possible circuit for investigating its characteristics (3 Marks)
- (ii) The input, output and transfer characteristics (3 Marks)

(b) (i) What is a load line, Draw a figure to show the output V-I characteristic curves of a BJT in CE configuration. Indicate thereon, the saturation, active and cut off regions **(5 Marks)**

(ii) A BJT has a base current of $10\ \mu\text{A}$ and collector current of 1mA . Determine the emitter current α and β . **(4 Marks)**

QUESTION FIVE (15 MARKS)

(a) Briefly explain why negative feedback is preferred to the positive feedback in Amplifiers. **(3 Marks)**

(b) Derive a general relationship between open loop gain and closed loop gains of an negative feedback Amplifier **(3 Marks)**

(c) The gain of an amplifier without feedback is 50 whereas with negative voltage feedback, it falls to 25. If due to ageing, the amplifier gain falls to 40, find the percentage reduction in stage gain

(i) without feedback and

(ii) with negative feedback. **(6 Marks)**

(d) Differentiate between Input impedance and Output impedance as used in operational amplifiers. **(3 Marks)**