

2024

## COMPUTER SCIENCE — HONOURS

Paper : CC-4

(Basic Electronic Devices and Circuits)

Full Marks : 50

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*Answer **question no. 1** and **any four** questions from the rest.

1. Answer **any five** questions : 2×5
- (a) Define Norton's theorem.
  - (b) Mention the ideal characteristics of Operational Amplifier.
  - (c) "The barrier potential across a p-n junction diode cannot be measured by placing a voltmeter across a diode terminal". — Explain.
  - (d) Highlight main differences between Zener diode and p-n junction diode.
  - (e) What is LED?
  - (f) What are intrinsic semiconductors? Give examples.
  - (g) Define 'pinch off' voltage with respect to JFET.
  - (h) What are the differences between a bipolar junction transistor (BJT) and a field-effect transistor (FET)?
2. (a) State the maximum power transfer theorem.
- (b) Categorize metals, semiconductors and insulators based on their energy band diagrams.
- (c) Draw the current-voltage characteristics of a p-n junction diode and demonstrate the method for determining the average resistance from the curve. 2+3+(3+2)
3. (a) Describe the operation of a Bridge rectifier using PN junction diodes, and include a suitable illustration to support your explanation.
- (b) Write down the difference between Avalanche and Zener<sup>®</sup> breakdown. 7+3
4. (a) Draw the output characteristic curve of a n-p-n transistor in Common Emitter (CE) mode and explain the various regions of the curve.
- (b) Derive the relationship between  $\alpha$  and  $\beta$  parameter of a transistor.
- (c) Explain the term Thermal Runaway. 5+3+2

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5. (a) Explain the significance of virtual ground with respect to operational amplifier.  
(b) Explain the operation of an OPAMP as an inverting amplifier and derive the expression for its voltage gain. 4+6
6. (a) Explain the construction of an *n*-channel enhancement MOSFET and provide an appropriate illustration.  
(b) Compare and contrast enhancement mode and depletion mode MOSFETs.  
(c) What is VVR? (3+3)+2+2
7. (a) Draw the circuit of an astable multivibrator using OPAMP. Explain its operation.  
(b) What are the basic difference between Astable and Monostable Multivibrator? 7+3
8. (a) Describe the operation of an R-2R ladder network as a digital to analog converter (DAC) and include the corresponding circuit diagram.  
(b) Draw and explain the I-V characteristic of SCR. 5+5
9. (a) What is VCO? Explain with suitable illustrations.  
(b) Describe how a transistor functions as a switch, explain its transfer characteristics, and illustrate how the threshold voltage can be determined. 4+6
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