

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Eighth Semester B.Tech Degree Regular Examination June 2023 (2019 Scheme)

Course Code: ECT446**Course Name: MICROWAVE DEVICES AND CIRCUITS****Max. Marks: 100****Duration: 3 Hours****PART A***Answer all questions, each carries 3 marks.*

Marks

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| 1 | Calculate the operating frequency of silicon based IMPATT diode with drift length of $3 \mu\text{m}$ and drift velocity of 10^7cm/s | (3) |
| 2 | State Gunn effect. | (3) |
| 3 | Briefly explain about the biasing of FETs. | (3) |
| 4 | Explain the working of one port negative resistance oscillator. | (3) |
| 5 | Explain the importance of impedance matching. | (3) |
| 6 | List the ABCD matrix coefficient of a transmission line section with characteristic impedance ' Z_0 ' propagation constant ' β ' and length ' l ' | (3) |
| 7 | Explain the importance of k- β diagram in microwave filters. | (3) |
| 8 | What do you mean by Bloch impedance? | (3) |
| 9 | Calculate the resistance of a planar resistor film with the following parameters:
Film thickness is $0.2 \mu\text{m}$, film length is 12mm , film width is 10mm , and sheet resistivity of gold film is $2.44 \times 10^{-8} \text{ohm-meter}$. | (3) |
| 10 | List down the advantages of planar transmission line. | (3) |

PART B*Answer any one full question from each module, each carries 14 marks.***Module I**

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| 11 | a) A typical n-type GaAs GUNN diode has the following parameters
Threshold field $E_{th} = 2800 \text{V/cm}$
Applied field $E = 3300 \text{V/cm}$
Device length $L = 10 \mu\text{m}$
Doping concentration $n_0 = 2 \times 10^{14} / \text{cm}^3$
Operating frequency = 12GHz
a) Compute the electron drift velocity | (7) |
|----|---|-----|

- b) Calculate the Current density
- c) Estimate the Negative electron mobility
- b) Explain the principle of operation of TRAPATT diode with neat diagram. (7)

OR

- 12 a) Explain Ridley–Watkins–Hilsum theory with the help of two valley model. (8)
- b) Derive expressions for Power output and Efficiency (η) of an IMPATT diode (6)

Module II

- 13 a) Explain the structure and principle of operation of MESFET. (7)
- b) Define Available Power Gain of a microwave amplifier. Derive expressions. (7)

OR

- 14 a) Explain the steps involved in the design of a single stage Transistor Amplifier. (8)
- b) Explain active biasing circuits for microwave bipolar transistors. (6)

Module III

- 15 a) Explain how equivalent voltages and currents are defined for rectangular waveguides. (8)
- b) Explain in detail the concept of impedance matching using lumped elements. (6)

OR

- 16 a) Explain Single Stub tuning and Double stub tuning. (10)
- b) List the important properties of Scattering Matrix. (4)

Module IV

- 17 a) Analyse an infinite periodic structure and derive expressions for the propagation constant. (8)
- b) Explain impedance scaling and frequency scaling with respect to filter implementation. (6)

OR

- 18 a) Design a 4 stage composite low-pass filter with a cut-off frequency of 2MHz and impedance of 50Ω . Place the infinite attenuation pole at 2.1MHz. (7)
- b) Explain the steps involved in the design of a filter using insertion loss technique. (7)

Module V

- 19 a) Compare Monolithic MICs with hybrid MICs. (6)
- b) Explain about the various discontinuities in Microwave Integrated circuits. (8)

OR

- 20 a) Explain the different configurations of inductors used in MICs. (7)
- b) Describe about Microwave resonators with neat diagrams. (7)
