

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

**Course Code: EC461**

**Course Name: MICROWAVE DEVICES AND CIRCUITS**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any two full questions, each carries 15 marks.*

Marks

- |   |   |      |
|---|---|------|
| 1 | a) With a graph explain the characteristics of Gunn diode.  | (5)  |
|   | b) What does IMPATT diode stand for and with neat diagram mention construction and working of it and derive power and $\eta$ of the same. | (10) |
| 2 | a) Explain the biasing of microwave bipolar FET   | (5)  |
|   | b) Why are GaAs MESFET's preferred to Si MESFET's?  | (5)  |
|   | c) Discuss briefly the Stability of Amplifier with necessary conditions.  | (5)  |
| 3 | a) An n-type GaAs Gunn diode has the following parameters:  | (10) |
|   | Threshold field $E_{th}=2600\text{V/cm}$  |      |
|   | Applied field $E=3200\text{V/cm}$   |      |
|   | Device length $L=6\mu\text{m}$  |      |
|   | Doping concentration $n_0=24*10^{14}\text{ cm}^{-3}$  |      |
|   | Operating frequency $f=12\text{Ghz}$  |      |
|   | a. Compute the electron drift velocity.   |      |
|   | b. Calculate the current density.   |      |
|   | c. Estimate the negative electron mobility  |      |
|   | b) Design a one port negative resistance oscillator   | (5)  |

**PART B**

*Answer any two full questions, each carries 15 marks.*

- |   |  |      |
|---|--|------|
| 4 | a) Explain the importance of impedance matching or tuning.   | (5)  |
|   | b) Discuss the significance of $k-\beta$ diagram in filter characteristics                                     | (5)  |
|   | c) With neat circuit explain the Design procedure of an m-derived LPF section and plot the frequency response. | (5)  |
| 5 | Explain working of Double Stub tuning and Quarter Wave Transformer   | (15) |
| 6 | a) Define wave velocity. Explain in detail.  | (5)  |
|   | b) Discuss in detail about impedance and frequency scaling.  | (10) |

**PART C**

*Answer any two full questions, each carries 20 marks.*

- 7 a) Compare Monolithic MICs with hybrid MICs ( 7)  
b) Explain the fabrication technique involved in hybrid Microwave Integrated Circuits in detail ( 8)  
c) List the characteristics of planar transmission lines? (5)
- 8 a) Explain in detail about thick film and thin film technology? (10)  
b) Classify Switches based on Characteristics (10)
- 9 a) Explain the frequency characteristics of single layer square inductor. (7)  
b) Explain the characteristics and configuration of limiter. (7)  
c) Explain the principle of operation of circulators? (6)

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Reg No.: \_\_\_\_\_

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

**Course Code: EC461**

**Course Name: MICROWAVE DEVICES AND CIRCUITS**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any two full questions, each carries 15 marks.*

Marks

- |   |    |  |      |
|---|----|--|------|
| 1 | a) | What are the limitations of conventional solid state devices at microwave?   | (5)  |
|   | b) | Explain modes of operation of Gunn diode   | (7)  |
|   | c) | State Gunn effect.   | (3)  |
| 2 | a) | Design a one port negative resistance oscillator.  | (5)  |
|   | b) | Design a single stage Transistor Amplifier used in microwave circuits  | (10) |
| 3 | a) | What is MESFET ? Mention its structure and operation.  | (10) |
|   | b) | An IMPATT diode has carrier drift velocity $V_d = 3 \times 10^7$ cm/s, Drift region length $L = 6\mu\text{m}$ , Maximum operating voltage $V_{0\text{max}} = 100\text{V}$ , Maximum operating current $I_{0\text{max}} = 200\text{mA}$ , Efficiency $\eta = 15\%$ , Breakdown voltage $V_{\text{bd}} = 90\text{V}$ . Find maximum CW output power in watts and the resonant frequency in gigahertz | (5)  |

**PART B**

*Answer any two full questions, each carries 15 marks.*

- |   |    |  |      |
|---|----|--|------|
| 4 | a) | For a microwave circuit , discuss the equivalent voltage and currents .  | (10) |
|   | b) | Derive expressions for S parameters in terms of Z parameters for a 2-port network.   | (5)  |
| 5 | a) | Explain the principle of double stub matching  | (5)  |
|   | b) | What are the steps required to transfer a LPF from HPF .explain.   | (10) |
| 6 | a) | List the Kuroda's identity.  | (5)  |
|   | b) | Design a low-pass composite filter with a cut-off frequency of 2MHz and impedances of $75\Omega$ . Place the infinite attenuation pole at 2.05MHz. | (10) |

**PART C**

*Answer any two full questions, each carries 20 marks.*

- |   |    |  |      |
|---|----|--|------|
| 7 | a) | Analyse the hybrid MMICs   | ( 8) |
|   | b) | Discuss Stripline in planar transmission and also find the Quality factor. | ( 8) |
|   | c) | What is Monolithic MICs and Discuss its construction.                      | (4)  |

- 8 a) What are limiters? Explain different types of limiters (8)  
b) Explain the working and applications of Circulators and Isolators. (8)  
c) Explain the working of diode switches and attenuators? (4)
- 9 a) Explain the configuration of Planar capacitor film (5)  
b) Discuss Microwave resonators with neat diagram (8)  
c) Classify the losses in Microstrip lines (7)

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

**Course Code: EC461**

**Course Name: MICROWAVE DEVICES AND CIRCUITS**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any two full questions, each carries 15 marks.*

Marks

- |   |  |      |
|---|--|------|
| 1 | a) What are the limitations of conventional solid state devices at microwaves ?  | (5)  |
|   | b) What does IMPATT diode stands for and with neat diagram explain the construction and working of it and derive power and efficiency of the same. ? | (10) |
| 2 | a) Explain GaAs MESFET with structure and principle of operation? Why GaAs MESFETs are preferred over Si MESFETs ?                                   | (10) |
|   | b) Discuss different biasing techniques used for microwave bipolar transistor ?  | (5)  |
| 3 | a) Explain one port negative resistance oscillator ?   | (5)  |
|   | b) A typical n-type GaAs GUNN diode has the following parameters   | (10) |
|   | Threshold field $E_{th}$ = 2800 V/cm   |      |
|   | Applied field $E$ = 3200 V/cm  |      |
|   | Device length $L$ = 10 $\mu$ m   |      |
|   | Doping concentration $n_o$ = $2 \times 10^{14}/\text{cm}^3$  |      |
|   | Operating frequency = 10 GHz   |      |
|   | a) Compute the electron drift velocity   |      |
|   | b) Current density   |      |
|   | c) Negative electron mobility  |      |

**PART B**

*Answer any two full questions, each carries 15 marks.*

- |   |  |     |
|---|--|-----|
| 4 | a) Find the ABCD matrix coefficient computation of a transmission line section with characteristic impedance ' $Z_o$ ' propagation constant ' $\beta$ ' and length ' $l$ ' ? | (7) |
|   | b) Discuss the working of quarter wave transformer and halfwave  | (8) |
| 5 | a) Explain the working of single stub tuning ?   | (6) |
|   | b) Discuss in detail about impedance and frequency scaling   | (9) |
| 6 | a) List the Kuroda's identity.   | (5) |

- b) Design a low pass filter for fabrication using microstrip line. The specifications (10)  
 are cut-off frequency of 4 GHz, third order, impedance of  $50 \Omega$  and a 3 dB equi-  
 ripple characteristics. The normalized low pass proto-type values are  $g_1 = 3.3487$   
 $= L_1$ ,  $g_3 = 3.3487 = L_3$ ,  $g_2 = 0.7117 = C_2$ ,  $g_4 = 1.000 = R_L$ .

**PART C**

*Answer any two full questions, each carries 20 marks.*

- 7 a) Compare Monolithic MICs with hybrid MICs (7)  
 b) Explain stripline in detail. (8)
- c) The stripline designed with a dielectric material with  $b = h = 3.1 \text{ mm}$ ,  $w = 2.5 \text{ mm}$  (5)  
 Find characteristic impedance  $Z_0$ ?  $\sqrt{\epsilon_r} = \sqrt{10.5}$ .
- 8 a) Discuss different configurations of capacitors in MICs. (10)  
 b) Compare short circuit and open circuit resonator. (5)  
 c) Discuss discontinuities in MICs. (5)
- 9 a) Explain the classifications of switches. (7)  
 b) Write notes on 1) Attenuators 2) Slotlines (7)  
 c) Classify the losses in Microstrip lines (6)

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Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Seventh semester B.Tech examinations (S), September 2020

**Course Code: EC461****Course Name: MICROWAVE DEVICES AND CIRCUITS**

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer any two full questions, each carries 15 marks.*

Marks

- |   |   |      |
|---|---|------|
| 1 | a) What are TRAPATT diodes? Explain elaborately their principle of operation with neat diagram. | (10) |
|   | b) What are the limitations of conventional solid state devices at microwaves                   | (5)  |
| 2 | a) Discuss in detail the physical structure of MESFET and explain its principle of operation.   | (10) |
|   | b) Write a short note on one port negative resistance oscillator                                | (5)  |
| 3 | a) Explain in detail Various modes of operation of Gunn Oscillators                             | (8)  |
|   | b) Derive the expression for available power gain of microwave amplifier                        | (7)  |

**PART B***Answer any two full questions, each carries 15 marks.*

- |   |   |      |
|---|---|------|
| 4 | a) Explain in detail the concept of matching with lumped elements.  | (10) |
|   | b) Write a short note on S matrix   | (5)  |
| 5 | a) Explain the steps in designing a composite filter. Also write down the equations and draw the circuit for designing a composite low pass filter. | (10) |
|   | b) Discuss the significance of $k-\beta$ diagram in filter characteristics  | (5)  |
| 6 | a) Explain the principle of single stub tuning  | (7)  |
|   | b) Design a low pass constant K filter using image parameter method.  | (8)  |

**PART C***Answer any two full questions, each carries 20 marks.*

- |   |   |      |
|---|---|------|
| 7 | a) Explain the fabrication technique involved in Monolithic Microwave Integrated circuits.            | (10) |
|   | b) Discuss briefly about slot line.   | (6)  |
|   | c) List down the advantages of planar transmission line.  | (4)  |
| 8 | a) Classify switches based on characteristics. Explain the basic configuration of PIN diode switches. | (12) |

- b) Explain the configuration of distributed ferrite circulators. (4)
- c) Write a short note on inductors. (4)
- 9 a) Differentiate strip line and microstrip line. (6)
- b) Explain attenuators with neat diagram. (10)
- c) Write a short note on hybrid MIC. (4)

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Seventh Semester B.Tech Degree Examination (Regular and Supplementary), December 2020

**Course Code: EC461****Course Name: MICROWAVE DEVICES AND CIRCUITS**

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer any two full questions, each carries 15 marks.*

Marks

- |   |    |   |      |
|---|----|---|------|
| 1 | a) | With neat diagram explain Two-Valley model theory of Gunn Diode.          | (10) |
|   | b) | What are the Characteristics and advantages of microwaves?                | (5)  |
| 2 | a) | Discuss in detail the term stability with respect to microwave amplifier. | (10) |
|   | b) | Explain the biasing of microwave bipolar transistor.                      | (5)  |
| 3 | a) | Classify the modes of operation of Microwave Bipolar transistor.          | (8)  |
|   | b) | Derive an expression for power output and efficiency of IMPATT diode.     | (7)  |

**PART B***Answer any two full questions, each carries 15 marks.*

- |   |    |   |      |
|---|----|---|------|
| 4 | a) | Explain the concept of signal flow graph of a two port network. What are the rules to decompose a signal flow graph?  | (8)  |
|   | b) | Write a short note on Impedance and Admittance Matrices.  | (7)  |
| 5 | a) | A five element maximally flat Butterworth low pass filter is to be designed for use in $50 \Omega$ circuit. Its 3 dB point is 500 MHz. Calculate its component value. | (10) |
|   | b) | What are terminated periodic structure? Explain.  | (5)  |
| 6 | a) | With neat diagrams and relevant equations, explain about the theory of small reflections.   | (8)  |
|   | b) | Explain Richard's Transformation and Kuroda's identities.   | (7)  |

**PART C***Answer any two full questions, each carries 20 marks.*

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|---|----|---|-----|
| 7 | a) | Explain about the materials used in Monolithic MIC. | (8) |
|---|----|---|-----|

- b) Differentiate strip line and microstrip line. (6)
- c) Discuss in detail about the various losses in microstrip lines. (6)
- 8 a) Explain attenuators with neat diagram. (10)
- b) Discuss briefly about capacitors. (5)
- c) Explain switched line phase shifters with neat diagrams. (5)
- 9 a) Compare Monolithic MICs with Hybrid MICs. (10)
- b) With neat diagram explain SPDT Transmit – Receive switch. (6)
- c) Explain the configuration of ferrite circulators. (4)

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