

**6E 6051**

Roll No. \_\_\_\_\_

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**6E 6051**

**B.Tech. VI Semester (Main & Back) Examination, April - 2019**  
**Electronics & Communication Engineering**  
**6EC1A Microwave Engineering-II**

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 26

[www.ersahilkagyan.com](http://www.ersahilkagyan.com)**Instructions to Candidates:**

*Attempt any Five questions, selecting One question from each unit. All Questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly). Units of quantities used/calculated must be stated clearly.*

**Unit - I**

1. a) State the various design consideration for fabrication of lumped inductors and capacitors in MIC. What are the additional criteria for fabrication of sandwich-type capacitors? (10)
- b) Determine the capacitance of an interdigitated capacitor fabricated on a substrate  $E_r = 13$ . other parameters are  $n=10$ , substrate height = 0.1 inch, finger length=0.001 inch, finger base width=0.02 inch. (06)

**(OR)**

1. a) Explain the process of L-section matching networks and stub matching of microstrip lines. (08)
- b) What are the required length and impedance of a  $\lambda_g/4$  transformer that will match a  $100\Omega$  load to a  $50\Omega$ , air filled line at 10GHz. Consider both rectangular waveguide (2.286 cm $\times$ 1.016cm) and coaxial line cases. (08)

**Unit - II**

2. a) Describe the principle of working and draw the equivalent circuit of P-I-N (PIN) diode. (06)
- b) How PIN diode can be used as modulator? Explain the use of PIN diode in switches and phase shifter. (06)
- c) The drift velocity of electrons is  $2 \times 10^7$  cm/sec through the active region of length  $10 \times 10^{-4}$  cm. Calculate the natural frequency of the diode and the critical voltage. (04)

(OR)

2. a) Explain the IMPATT diode with following (12)
- DC operating principle
  - Mechanism of oscillation
  - Mounting and equivalent circuit
- b) A  $p^+ - \pi - n^+$  silicon diode with a break down voltage of 1000V. The cutoff frequency is 30GHz. The breakdown electric field for Si is  $3.0 \times 10^5$  V/cm. If Junction Capacitance is 0.3pf then calculate the total series Resistance. (04)

Unit - III

3. a) Draw a schematic of GaAs MESFET and explain its working with various biasing conditions. (12)
- b) A GaAs MESFET has channel height of  $0.12 \mu\text{m}$  electron concentration  $N_d = 8 \times 10^{17} \text{cm}^{-3}$  and the relative dielectric constant 13.2. Calculate the Rinchoff voltage. (04)

(OR)

3. a) Write the various steps for designing a single stage microwave MESFET amplifier. <http://www.rtuonline.com> (08)
- b) A GaAs MESFET amplifier is to be designed at 5GHz with 400MHz bandwidth for maximum power gain. The measured parameters at 5 GHz with a  $50 \Omega$  reference are (08)

$$S_{11} = 0.52 \angle -145^\circ, S_{12} = 0.03 \angle 20^\circ$$

$$S_{21} = 2.56 \angle 17^\circ, S_{22} = 0.48 \angle -20^\circ$$

$$\Gamma_{S_{in}} = 0.75 \angle 170^\circ, \Gamma_{L_{out}} = 0.72 \angle 105^\circ$$

Determine  $G_{A_{max}}$ .

Unit - IV

4. a) What is velocity and current modulation in reflex Klystron? Describe the reflex Klystron with aid of schematic diagram. (10)
- b) A reflex Klystron is to be operated at frequency of 10GHz with dc beam voltage 300V, repeller space 0.1 cm for  $1\frac{3}{4}$  mode. Calculate  $P_{RF_{max}}$  and corresponding repeller voltage for a beam current of 20 mA. (06)

(OR)

4. a) Describe the construction of a multicavity magnetron and obtain an expression for full cut off voltage for  $\pi$ -mode of operation. Explain how mode Jumping can be avoided. (12)

b) A frequency agile magnetron has duty cycle of 1 ms and pulse duration of 0.20, 0.40 and 0.80  $\mu$ s. If the pulse rate on the target be  $N = 20$  per scan determine : (04)

- i) The agile excursion
- ii) The signal frequency
- iii) The agile rate.

**Unit - V**

5. Write short notes on (any two)

(2×8=16)

- i) Slow wave structures used in TWT.
- ii) Two cavity Klystron amplifier.
- iii) Backward wave oscillator.
- iv) Coupled cavity TWT.

**(OR)**

5. A multicavity TWT is operating at cathode voltage 30kV and cathode current 7.5A. The output power is 60 kW and the collector voltage is -12kV. What is electronic and overall efficiency? (16)