6E605

6E6051

B.Tech. VI-Sem. (Main & Back) Examination, April-May 2018
Electronics & Communication Engg.
6EC1A Micriowave Engineering-II

Time : 3 Hours] **[Maximum Marks : 80**
[Min. Passing Marks : 26

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.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. Smith chart 2. NIL

UNIT - I

1 (a) What does impedance matching imply ? Mention a few techniques used for realizing impedance matching at microwave frequencies.

(b) Match a load impdance of $Z_L = 100 \div j80$ to a 50 Ω line using a single series open-circuited stub. Assuming that the load is matched at 24 Hz and that the load consists of a resistor and inductor in series, plot the reflection coefficient magnitude from 1 to 3 GHz.

8+8 = 16

OR

1 (a) Describe the procedure of load matching with quarter wave transformer for different types of loads. What are the advantages and shortcomings involved in this method ?

(b) A lossless line of characteristics impedance $R_0 = 50\ \Omega$ is to be matched to a load $Z_l = 50 / |2+j(2+\sqrt{3})\ \Omega$ by means of a lossless short-circuited stub. The characteritic impedance of the stub is 100 Ω. Find the stub position (closest to the load) and length so that a match is obtained.

8

UNIT - II

(a) What is varactor diode ? Discuss how the voltage variable capacitance of a varactor can be used for harmonic generation. What is a snap-off varactor ?

8

(b) Describe the different modes of operation realizable with a Gunn diode.

8

OR

2 (a) Discuss the principle of operation of an IMPATT diode and explain the origin of negative resistance in the operation of such a device.

8

(b) Explain the function of the PIN diodes. Describe its application as a single-pole PIN diode switches and single bit phase shifters.

8

UNIT - III

3 (a) What are the salient features of Si microwave bipolar transistors ? What are the three physical structures used for microwave transistors ? Explain it.

8

(b) A GaAs has a thickness of 0.40 μm and a doping concentration Na of 5×10^{17} em^{-3}. The relative dielectric constant Er of GaAs is 13.10. Calculate the pinch-off voltage in volts.

8

OR

3 (a) Discuss the structure and principle of operation of a MESFET device. 8

(b) Derive the expression for transducer gain with unilateral transistor. Explain design criteria for maximum gain. 8

UNIT - IV

4 (a) Explain the construction, principle of working, and operation of a reflex Klystron. 8

(b) A reflex Klystron operates at the peak of the n = 2 mode. The dc power input is 40 mW and $V_1/V_0 = 0.278$. If 20% of the power delivered by the beam is dissipated in the cavity walls, find the power delivered to the load. 8

OR

4 (a) Explain the construction and working of a cylindrical magnetron. Derive the equation for cut-off magnetic field for a cylindrical magnetron. 8

b) An X-band pulsed cylindrical magnetron has the following parameters :

Anode Voltage V_o = 26 KV, beam current I_o = 27A, Magnetic flux density B_o = 0.336 Wb/m^2, Radius of cathode cylinder a = 5cm, Radius of vane edge to centre b = 10 cm.

Compute :

(i) The cyclotron angular frequency

(ii) The cutoff voltage for a fixed B_o

(iii) The cutoff magnetic flux density for a fixed V_o.

UNIT - V

5 (a) Explainthe velocity modulation and bunching process in two-cavity Klystron. Drive the expression for bunching parameters.

8

(b) A two-cavity amplifier Klystron has the following parameters : Beam voltage V_0 = 900 V, Beam current I_0 = 30 mA, frequency f = 8GHz, Gap spacing in either cavity d = 1 mm, spacing between centers of cavities l = 4 cm. Effective shunt impedance Rsh = 40 $K\Omega$.

Determine :

(i) The electron velocity

(ii) The dc electron transit time

(iii) The input voltage for maximum output voltage

(iv) The voltage gain in decibels.

2×4=8

OR

5 (a) Explain in detail the operation of a helix-type TWT amplifier. Derive the electronic and circuit equations for TWT.

8

(b) An O-type helix TWT operates at 8 GHz. The slow-wave structure has a pitch angle of 4.4 and an attenuation constant of 2 Np/m. Determine the propagation constant γ of the travelling wave in the tube.

8