ME (ETC) 2nd Semester Final Examination 2012
Microwave Devices and Circuits
ET 933

Group A

Answer any three questions from this group

1. With a neat schematic explain the operation of reflex Klystron. Find out an expression for efficiency and calculate the maximum theoretical efficiency of a reflex klystron.

   Explain the operation of a multi-cavity Klystron amplifier?

   [4+5+2]

2. Draw different structures of magnetron and make a comparison between them. Why magnetic field requires for the operation of a magnetron is called 'critical' and find out an expression for critical magnetic field required for the operation of magnetron.

   What do you mean by 'mode jumping' in magnetron and how it can be avoided by the method of strapping?

   [2+1+5+3]

3. Draw different types of slow wave structures and mention their role in a traveling wave tube. How an O-type traveling wave tube differs from an M-type? Explain the bunching phenomena that took place in a traveling wave tube. On what parameter the gain of the traveling wave tube amplifier depends?

   [4+2+4+1]

4. Using small signal analysis to find out an expression for the impedance of an IMPATT diode. Draw the equivalent circuit of an IMPATT diode. With a neat circuit explain the operation of reflection type IMPATT amplifier.

   [7+1+ 3]

5. (a) Draw the structure and equivalent circuit of a Gunn diode. Also explain the different modes of operation of a Gunn diode.
   (b). Draw the equivalent circuit of a tunnel diode and find out expressions for two of its cut-off frequencies. Find out an expression for gain of a tunnel diode amplifier where the load is connected in series.

   [(2+4)+(3+2)]

Group-B

Answer any three questions from this group.

Two marks of each group are reserved for neat and to the point answer

1. (a) Draw the electrical field distribution of microstrip lines and describe their parallel plate and fringing capacitances. Define different type of microstrip losses. Why do microstrip lines not support a pure TEM wave?-explain

(b) Write the expression for characteristic impedance and effective dielectric constant of a microstrip line. How do you find guided wavelength, propagation constant, phase velocity, and electrical length for such lines? What are surface waves?

[5+6]

2. (a) Define the transfer function of a two-port filter network. How is it defined for linear, time-invariant networks? What are insertion loss, and group delay.

(b) Write down the n^{th} order Chebyshev function in term of normalized frequency. Hence drive the Chebyshev lowpass approximate filter function. Draw and explain the lowpass prototype ladder network and its dual for all-pole filters.

[4+7]

3. (a) How frequency and impedance are transformed from a lowpass prototype to a practical lowpass filter? How do basic elements transformed from a lowpass prototype to a practical bandpass filter?

(b) Describe the design steps of microstrip lowpass filter realized by open stub.

[7+4]

4. (a) Define impedance, and idmittance Inverter network. An immittance inverter is used to convert a shunt capacitance into an equivalent circuit with series inductance-give explanation. Write down the lowpass prototype filters modified to include immittance inverters.

(b) How do you realize the immittance inverters practically? Why filters designed with immittance inverters are narrow-band.

[7+4]

5. (a) What do you understand by Even- and Odd-mode propagation for couple microstrip lines. Derive the expressions of the characteristic impedances and effective dielectric constants for such modes. How a microstrip gap is modeled by equivalent shunt and series capacitances? What type of filter is designed with this principle?

(b) What do you understand by microstrip resonator? Give few example of popular by microstrip resonators. Define loaded and unloaded quality factor for such resonator.

[7+4]