2002 SCHEME

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EC62

Sixth Semester B.E. Degree Examination, December 2010
Microwave Communications

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer any FIVE full questions.*
2. *Missing data may suitably be assumed.*
3. *Use of Smith chart is permitted.*

1 a. Explain with structures and expressions for the characteristic impedance of i) Strip lines ii) Microstrip lines. **(08 Marks)**

b. What are the advantages and disadvantages of planar transmission lines over coaxial lines? **(06 Marks)**

c. The total inductance of an air filled 50 m long coaxial cable was measured to be 8 μH. If the radius of the inner conductor is 1.5 cm, determine:
i) The radius of the outer conductor,
ii) Capacitance per unit length of the cable,
iii) The characteristic impedance of the cable. **(06 Marks)**

2 a. Obtain the general condition for impedance matching between circuits. **(06 Marks)**

b. Show that a quarter wave impedance matching transformer has impedance equal to the geometric mean of the source and load impedances. **(06 Marks)**

c. A line of R_o = 300 ohm is connected to a load of 70 ohm resistance operated at a frequency of 45 MHz. Using Smith chart, design a single stub to produce an impedance match. **(08 Marks)**

3 a. Explain the working of "Magic-Tee", with the help of a neat diagram. Derive its S-matrix and magic property. **(10 Marks)**

b. What is an isolator? With the help of a neat diagram, describe the working of Faraday notation isolator. **(06 Marks)**

c. A three port Y-circulator provides an isolation of 25 dB in the anticlockwise direction and an insertion loss of 0.5 dB in the clockwise direction. If the VSWR is 1.2, find all the scattering coefficients of the circulator. **(04 Marks)**

4 a. With the help of neat diagrams, explain the working of "Reflex Klystron" oscillator. **(08 Marks)**

b. What are the differences between a reflex klystron and a TWT amplifier? **(06 Marks)**

c. A dc beam voltage of 280 volts is applied to the anode of a reflex klystron whose cavity is tuned to a frequency of 9.75 GHz. The length of the repeller space is 1.2×10^{-3} m and is operated under $2\frac{3}{4}$ mode of operation. If the resulting beam current is 1.5 mA, determine the optimum value of RF power and the corresponding repeller voltage to be applied. **(06 Marks)**

5 a. What is a PIN diode? Explain how it can act as "ON-OFF" switch in circuits. **(06 Marks)**

b. What is "transferred electron effect" in semi conductors? Explain how this is used in a solid state device in generating microwave oscillations. **(07 Marks)**

c. What is an IMPATT – diode? Explain its working in the generation of microwave. **(07 Marks)**

6 a. Explain briefly the following antenna parameters: **(06 Marks)**
i) Directivity ii) Efficiency iii) Beam width

b. Derive radar range equation. Explain the effect of each parameter on the maximum range. **(08 Marks)**

c. An antenna having a gain of 15 dB transmits 10 kW power at a frequency of 300 MHz. Using Frii power transmission equation, calculate the power received by another antenna having the same gain as the transmitting antenna, situated at a distance of 10 km from the transmitting antenna. **(06 Marks)**

7 a. What is Doppler effect? How it is used to locate and track moving targets? **(08 Marks)**

b. Explain the working of Dicke Radiometer, with a neat block diagram. **(08 Marks)**

c. Calculate the maximum range of a radar system which operates at 3 cm wavelength with a peak pulse power of 600 watts.
Given : The minimum receivable power is 10^{-13} watts; the capture area of the antenna is 5 m^2, radar cross section area of the target is 20 m^2. **(04 Marks)**

8 a. With neat diagrams, explain the working of magnetron oscillator. **(10 Marks)**

b. Explain the method of measurement of insertion loss and attenuation with relevant block diagram and equations. **(10 Marks)**

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