

B.E. (ETC) Part-III 6th Semester Examination, 2010
Microwave and Radar Engineering
(ET-601)

Time : 3 hours

Full Marks : 70

Use separate answerscript for each group.
Answer SIX questions, taking THREE from each group.
Two marks are reserved for neatness in each group.

GROUP-A

1. Describe how velocity modulation of a beam is obtained in Klystron amplified. With a neat schematic explain the operation of reflex Klystron as a microwave oscillator. How does a reflex Klystron differ from an amplifier Klystron. 13+6+2]
2. What is the significance of the term "critical magnetic field" as it is used in connection with magnetron? With suitable diagram explain how oscillations are sustained in the cavity magnetron. What is the purpose of strapping in a magnetron? [3+5+3]
3. Draw the structure and equivalent circuit of an H-plane Tee. Using the property of S-parameter prove that an H-plane can be used as power divider. Why hybrid E-H plane Tee is referred to as 'Magic Tee*'? I(1+1+7)+2)
4. a) With a neat schematic explain the operation of a multihole directional coupler. Also write down some uses of a directional coupler.
b) A directional coupler of 10dB coupling and 40 dB directivity produces a transmission loss of 1 dB. For an input power of 10mW at the input port of the main arm, determine the power at the other ports. 1(6+1)+4]
5. Why ferrite devices are called non-reciprocal devices? With a neat schematic explain the operation of a 3-port circulator. Write down its S-matrix. [2+7+2]

GROUP-B

6. a) Describe various techniques of measuring unknown frequency of a microwave signal.
b) Compare the power ratio and substitution methods of measuring attenuation provided by an attenuator. [7+4]

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7. With a neat experimental arrangement explain how high microwave power can be measured by 'Calorimeter-Wattmeter*' method.
Also explain why the above mentioned method is not suitable for low power measurement.
Suggest one method for measurement of low microwave power. [6+2+3]
8. a) Find out an expression for maximum detectable range of a target by radar.
b) Calculate the maximum range of a radar, which operates at a frequency of 10 GHz, peak power is 600 kW, if the antenna cross-section is 5 m^2 and the area of the target is 20 m^2 . Minimum detectable power for the radar is 10^{-3} watts. [7+4]
9. With the help of a block diagram explain the operation of a MTI radar.
Write down the differences between a search radar and a tracking radar.
What is blind speed of a radar system. [7+2+2]
10. What is clutter? What do you mean by the terms 'missed detection' and 'false alarm'?
What is radome? How it differs from a rotadome?
Mention different methods of tracking of a radar system. [1+2+1+2+5]