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B. TECH.
(SEM VII) THEORY EXAMINATION 2021-22
MICROWAVE & RADAR ENGINEERING

Time: 3 Hours

Total Marks: 100

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

2 x 10 = 20

- (a) Differentiate dominant and degenerative mode in waveguide.
- (b) Define cut-off wave number (k_c). Show that $k_c^2 = \omega^2 \mu \epsilon$ for lossless dielectric.
- (c) Give the difference between Isolator and Circulator.
- (d) What is Hybrid ring in microwave?
- (e) In a helical slow wave structure if pitch is 5 cm and diameter is 10 cm, calculate the axial velocity with which wave will propagate.
- (f) What is the condition for sustained oscillation in Reflex Klystron?
- (g) Explain Mode jumping in Magnetron?
- (h) What do you mean by slotted line?
- (i) What is radar clutter?
- (j) Define maximum unambiguous range of radar.

SECTION B

2. Attempt any three of the following:

10 x 3 = 30

- (a) Explain the limitations of conventional active devices at microwave frequency?
- (b) What is directional coupler? Explain the working principle of 2-hole directional coupler and determine its S-matrix.
- (c) What is a Microstrip line? How does its characteristic impedance change with change in width to height ratio? Give a reason for using lower dielectric constant substrate in place of alumina at higher microwave frequencies.
- (d) What is meant by insertion loss and attenuation? Discuss any one method for measurement of attenuation using microwave test bench.
- (e) Derive the radar range equation.

SECTION C

3. Attempt any one part of the following:

10 x 1 = 10

- (a) Derive the field distribution of TE_{10} mode in rectangular waveguide. Show that TE_{01} and TM_{10} modes do not exist in rectangular waveguide
- (b) What is a microwave cavity resonator? Explain it with suitable diagram and equivalent circuit. Where does it find applications?

4. Attempt any one part of the following:

10 x 1 = 10

- (a) Why S parameters are used at microwave frequencies to describe multiport network? Draw the schematic diagram of four port microwave circulator and derive its S matrix.
- (b) Explain the operation of a Faraday rotation isolator with the help of neat sketch. List the applications of ferrite isolator.



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5. Attempt any *one* part of the following: 10 x 1 = 10
- (a) With support of figures, explain the working of TWT. Also write its limitations.
- (b) Explain the working principle of two cavity Klystron amplifier. Calculate optimum length of drift space.
6. Attempt any *one* part of the following: 10 x 1 = 10
- (a) Discuss the salient features of microwave measurements. Describe a voltage standing wave ratio (VSWR) meter.
- (b) What are various methods for measuring frequency? Discuss in detail.
7. Attempt any *one* part of the following: 10 x 1 = 10
- (a) Derive expression for probability of false alarm in radar.
- (b) Draw Block diagram and explain the operation of MTI radar.

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