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BIEL-016

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

June, 2016

00336

BIEL-016 : MICROWAVE AND RADAR ENGINEERING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***seven*** *questions. Assume suitable missing data, if any. Question no.* ***1*** *is* ***compulsory****. Use of scientific calculator is allowed.*

1. (a) What is degenerate mode of operation in a waveguide ?

(b) Find out the Q-factor of a cavity resonator.

(c) Show how power can be measured by directional couplers, using a diagram.

(d) Write down the assumptions taken while analysing 2-cavity klystron.

(e) Write the expression of radar range equation and define all the parameters. *5×2=10*

2. Solve the Helmholtz equation for a rectangular co-ordinate system considering different cases. Find the solution when the waveguide operates in TE_{mn} mode. *5+5*

3. (a) Write the theorems of Tee-junction and explain E-plane and H-plane Tee with corresponding S-matrix under matching conditions. *6*

(b) A transmission line has a characteristic impedance of $50 + j\ 0{\cdot}01\ \Omega$ and is terminated in a load impedance of $73 - j\ 42{\cdot}5\ \Omega$. Calculate

(i) the reflection coefficient,

(ii) the standing-wave ratio. *4*

4. (a) Explain the frequency limitations on different parameters of a microwave transistor. *6*

(b) Calculate the maximum allowable power for a transistor having the following parameters : *4*

Reactance = 1 Ω, Transit time cut-off frequency = 4 GHz, Maximum electric field = $1{\cdot}6 \times 10^5$ V/cm, Saturation drift velocity = 4×10^5 cm/sec.

5. (a) Explain the working of a Tunnel diode with its V – I characteristics. 5

(b) Explain the limitations of conventional active devices at microwave frequency. 5

6. (a) Explain the operation of an IMPATT diode by drawing its structure. 6

(b) Compute the maximum CW output power and resonant frequency of an IMPATT diode having the following parameters : 4

Carrier drift velocity = 2×10^7 cm/sec, Drift region length = 6 μm, Maximum operating voltage = 100 V, Maximum operating current = 200 mA, Efficiency = 15% and Breakdown voltage = 90 V.

7. (a) Explain the operation of CW Radar with a necessary block diagram. How is isolation between a transmitter and a receiver done ? Give an example. 6

(b) Differentiate between Pulse and CW Radar. 4

8. (a) Derive the noise figure dependent Radar range equation. 5

(b) What do you mean by Radar Clutter ? 5

9. Write short notes on any ***two*** of the following : *2×5=10*

(a) Microwave Circulator

(b) Gunn Diode

(c) TWT

(d) Radar Duplexer