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RN-7381

B. E. IV (Sem. VII) (Electronics & Communication) Examination

May / June – 2010

Microwave Techniques

Time : 3 Hours] [Total Marks : 100

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ B. E. 4 (Sem. 7) (Electronics & Communication)

Name of the Subject :

☛ Microwave Techniques

☛ Subject Code No. : 7 3 8 1 ☛ Section No. (1, 2,.....) : 1&2

Seat No. :

Student's Signature

(2) Attempt all questions.
(3) Assume suitable data whenever necessary.
(4) Figures to the right indicate full marks.
(5) Use of scientific calculator (CASIO FX 82/83 or equivalent) is allowed.

SECTION - I

Q.1 Attempt the followings.

(A) Answer the following questions in brief with proper justification. **10**

(1) Define Line parameters of transmission line.
(2) What is infinite line in context with transmission line?
(3) What are Tee-junctions? Give some examples.
(4) Briefly explain the operation of a microwave device which provides unidirectional flow of signal.
(5) What are the different types of Directional Couplers?

(B) Derive the relationship between the transmission co-efficient and the reflection co-efficient. **5**

(C) Write short note on a microwave component which produces output signal on $n+1^{th}$ port if input is provided on n^{th} port. Assume that this component contains more than two ports. **5**

Q.2 Attempt the following questions.

(A) What do you mean by cavity resonator? Derive the expression of resonant frequency for circular cavity resonator. **6**

(B) For a transmission line Ro=50 Ω and SWR=2 when the line is loaded. When the load is shorted then minima shift 0.15λ towards the load. With the use of Smith Chart determine the load impedance. **9**

OR

Q.2 Attempt the following questions.

(A) With the use of transmission line equation, derive the formulas of the following terms: i) Propagation constant ii) Attenuation and Phase constant iii) Characteristic Impedance iv) Phase velocity. **8**

(B) A lossless line has a characteristic impedance of 50 Ω and is terminated in a load resistance of 75 Ω. The line is energized by a generator which has an output impedance of 50 Ω and an open circuit output voltage of 30 V (rms). The line is assumed to be 2.25 λ long. Determine (1) Input impedance (2) Magnitude of the instantaneous load voltage (3) instantaneous power delivered to load. **7**

Q.3 Attempt the following. (Any three) **15**

1) Draw the structure of Hybrid Tee and derive its scattering matrix. Prove that it satisfies all its properties.
2) Why do we require microwave Attenuator? List out the types, applications and working of Attenuators.
3) Discuss the comparison between waveguides and two wire transmission line.
4) Discuss the construction of Micro strip lines. Also list out the benefits and limitations of it.
5) Explain operation of TM modes in rectangular waveguides.

SECTION - II

Q.4 Attempt the followings.

(A) Answer the following questions in brief with proper justification. **10**

(1) Give classification of solid state microwave devices.
(2) Explain phase focusing effect.
(3) Explain plasma formation in TRAPATT diode.
(4) How the klystron amplifier can act as klystron oscillator? What are the applications of klystron amplifier?
(5) Define Doppler Effect in connection with RADAR.

(B) What is Cavity Magnetron? Explain its construction and write applications of it. **5**

(C) Explain principle and applications of Parametric Amplifier. **5**

Q.5

(A) What is RADAR? Draw and explain block diagram of MTI RADAR. **7**

(B) Explain working of two cavity Klystron amplifier with necessary diagram and waveforms. **8**

OR

Q.5

(A) Draw and explain block diagram of FMCW RADAR with necessary derivations. **8**

(B) Calculate the maximum range of RADAR system which operates at 3cm with peak pulse power of 600 kW, antenna aperture is 5 m^2, minimum detectable signal is 10^{-13} W and RADAR cross section area of target is 20 m^2. **4**

(C)A civilian RADAR has max. range of 30 km. Determine the max. range with an equivalent echoing area of 50 times and effect of doubling the transmitter power on the range. **3**

Q.6 Attempt the following. (Any three) **15**

1) Limitations of conventional devices at microwave frequencies
2) Principle and application of TWT
3) Working and applications of PIN diode
4) Derivation of RADAR range equation
5) Scanning and tracking with RADAR