B-Tech Examination

Microwave and Radar Engineering (ECE-312)

Time: 3hrs

M. Marks: 60

Note: Attempt all the questions in Part -I. Attempt any four questions from Part –II.

PART-I

Q.1 (i) An isolator has an insertion loss of 0.5 dB and an isolation of 30 dB. Determine the scattering matrix of the isolator if the isolated ports are perfectly matched to the junction. (2)

(ii) Double minima method is used to determine the VSWR value on waveguide. If the separation between two nulls is 3.5 cm and that between twice power points is 2.5mm. Determine the value of VSWR. (2)

(iii) Why is the S matrix used in microwave analysis? (2)

(iv) What is the principle of microwave phase shifter? (2)

(v) What is the condition for oscillation in reflex klystron? (2)

(vi) What do you mean by O-type tubes? Name some O- type tubes? (2)

(vii) What is full form of TRAPATT? What is the main advantage of TRAPATT over IMPATT? (2)

(viii) What is a wavemeter? (2)

(ix) Define insertion loss? (2)

(x) Define the unambiguous range of radar system. (2)

PART-II

Q. 2 A rectangular air filled waveguide of inside dimensions 7×3.5cm operates in dominant mode at 3.5 GHz frequency. Find: (10)
- (1) Cut-off frequency
- (2) Phase constant
- (3) Phase velocity
- (4) Guide wavelength
- (5) Characteristic impedance
- (6) Attenuation constant

Q. 3(a) Determine the scattering parameters of a 20 dB directional coupler. The directivity D= 50dB. Assume that it is lossless and VSWR at each port is one under matched conditions. (5)

(b) Explain how the magic Tee can be used as mixer. (5)

Q. 4(a) How is bunching achieved in cavity magnetron? Explain the phase focusing (5) effect.

(b) What is TWT? Explain the construction and amplification process. (5)

Q. 5(a) Explain how the bolometer is used for power measurement. (5)

(b) Explain the Gunn effect using two valley theory. (5)

Q. 6(a) What is PIN diode? Describe the construction of PIN diode and also its (5) characteristics.

(b) A guided missile tracking Radar has the following specification: (5)
Transmitted power =400 KW, pulse repetition frequency = 1500 pps, pulse width =0.8 µsec.
Determine (a) unambiguous range (b) duty cycle (c) average power (d) suitable bandwidth of the radar

Q. 7(a) What is radar range equation? Explain the factors that affect the maximum (5) range of radar.

(b) Explain the tunnel diode characteristics with the aid of energy band diagram. (5)