Registration No: | | | | | | | | | | |

Total Number of Pages: 02 **Course: B.Tech**
Sub Code: REC6C001

6th Semester Regular / Back Examination: 2022-23
SUBJECT: Microwave Engineering
BRANCH(S): ECE, ETC
Time: 3 Hour
Max Marks: 100
Q. Code: M499

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Define characteristic impedance in a rectangular waveguide.
b) Define the mode of a coaxial cable transmission line.
c) Draw the field lines of dominant mode in a rectangular waveguide.
d) Define the critical coupling used in microwave resonators.
e) Write the scattering matrix of Wilkinson power divider.
f) Why parabolic reflector antenna is popularly used in long distance communication?
g) Define the conditions for oscillations.
h) Write the application of circulator.
i) Define antenna efficiency of an antenna.
j) How to find impedance bandwidth of an antenna from a graph S11 vs frequency?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

a) Derive the Telegrapher equations for a transmission line.
b) Describe the characteristics of a cylindrical waveguide.
c) The short circuit and open circuit impedances measured at the input terminals of a lossless transmission line of length 20 cm are + j154 Ω and -j16.3 Ω respectively. Find (i) characteristic impedance and β of the line (ii) Determine the input impedance of a short-circuited line that is twice the given length at the same operating frequency.
d) Describe the features of series resonator.
e) Write the S-matrix of directional coupler. A 20 dBm power source is connected to the input of a directional coupler having a coupling factor of 20 dB, a directivity of 35 dB, and an insertion loss of 0.5 dB. If all ports are matched, find the output powers (in dBm) at the through, coupled, and isolated ports.

f) Discuss the limitation of single stub matching and how they are taken care? Explain the concept of double stub matching.

g) An RF input signal at 1800 MHz is down-converted in a mixer to an IF frequency of 100 MHz, Calculate corresponding image frequencies.

h) Define different types of power gains in a two-port network.

i) Show how you can convert the circulator to act as an amplifier.

j) Describe the working principle of Mixer.

k) Why Cassegrain type of reflector antenna is popularly used for long distance wireless communication?

l) Write short note on "Impedance measurement of pyramidal horn antenna".

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** A 50 coaxial line has a current i (t, z) = 2 cos (3×10^9 t − 18z) mA. Determine (a) the frequency, (b) the phase velocity, (c) the wavelength, (d) the relative permittivity of the line, (e) the phasor form of the current, and (f) the time domain voltage on the line. **(8x2)**

b) Provide brief a comparison between different type attenuators.

Q4 **a)** Derive an expression for the unloaded Q of a transmission line resonator consisting of an open-circuited transmission line 1λ long. **(8x2)**

b) Design a lossless T-junction divider with a 50-source impedance to give a 3:1 power split. Design quarter-wave matching transformers to convert the impedances of the output lines to 50Ω. Determine the magnitude of the scattering parameters for this circuit, using 50-characteristic impedance.

Q5 **a)** Describe the working principle of Doherty amplifier. **(8x2)**

b) Describe the working principle of Gunn Oscillator.

Q6 **a)** Write a short note on "Radiation Pattern of any antenna and its measurement". **(8x2)**

b) Describe and explain different types of attenuation of microwaves in Ionosphere.