Ref No. Ex/ ET/T/414/2018(S)

B. ETCE 4TH YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION, 2018

MICROWAVE ENGINEERING

Time: 3 Hours **Full Marks: 100**

Use separate Answer - Script for each Part

50 marks for each part

All questions carry the equal marks

PART-I

Answer any **Five (5)** Questions from the followings: 5×10

1. A) Why scattering matrix is used in microwave frequencies. Define the scattering matrix of a two port network.

   B) The S-parameters for certain two port network is

   $$S_{11} = 0.23\text{-}j0.16,\ S_{12} = S_{21} = 0.44 \text{ and } S_{22} = 0.38 - j\ 0.59$$

   i) Determine the input refection coefficient and transducer loss when $Z_G = Z_L = Z_O$

   ii) Repeat for $Z_G = Z_O$ and $Z_L = 3Z_O$

2. A) Distinguish between *E*-plane and *H*-plane tees and hence discuss the construction and working of an *H*- plane tee.
3. Define the directivity, coupling factor and isolation of a two port directional coupler. Obtain scattering matrix of a two port directional coupler.
4. Explain the use of magic–tee for a four port circulator. Write down the scattering matrix of a four port circulator.
5. Write down the working principle of a cavity resonator? What are their most desirable properties? A resonant cavity with dimensions a = 6 cm, b = 5 cm, and d = 9 cm is made of copper σ_c = 5.8×10^7 mhos/m. It is filled with a lossless material μ_r =1 and ε_r =3. Find the resonant frequency f_r for TE_{101} mode.
6. Give the comparative study of series and parallel resonant RLC circuit. How the impedance of a parallel resonant RLC circuit is determined?
7. What are Ferrites? What properties do they have? Explain the operation of reciprocal phase shifter and give its application.
8. What do you meant by waveguide discontinuity? How this discontinuity related with the change of height and width of waveguide? How the resonant frequency is determined?

[Turn over

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B.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING
FOURTH YEAR FIRST SEMESTER
SUPPLEMENTARY EXAM 2018

Microwave Engineering

Time: Three hours Full Marks: 50

Use separate answer scripts for each half.

PART II

Answer **Q.1** and ***any two*** questions from the rest.

1. a) What is TDR? How position of discontinuity can be measured using TDR? [1+5]
   b) How will you find the impedance of an unknown load using a slotted line? [5]
   c) "Characteristic impedance can be measured using open and short transmission line section." - explain. [3]

2. a) What is "Reentrant Cavity"? Draw a neat diagram of a coaxial cavity and find its resonant frequency. [2+6]

   b) Explain velocity modulation in two cavity klystron amplifier using mathematical derivations and drawings. [10]

3. a) Explain the bunching process and calculate minimum and maximum electron velocities and bunching distance? [9]

   b) A two-cavity amplifier klystron has the following parameters:
   Beam Voltage: $V_o = 1100$ V
   Beam Current: $I_o = 26$ mA
   Frequency: $f = 8$ GHz
   Gap spacing in either cavity: $d = 1$ mm
   Spacing between centers of cavities: $L = 4$ cm
   Effective shunt impedance: $R_{sh} = 40$ k Ohm (excluding beam loading)

   Find:
   i) the input voltage for maximum output voltage
   ii) the voltage gain neglecting the beam loading in the output cavity.
   iii) efficiency of the amplifier [9]

4. a) Write the differences between power gain, available gain, the transducer power gain of an amplifier. [3]

   b) Explain conditional and unconditional stability for a high frequency amplifier? Derive the equations for stability circles. Draw and explain stability circles for conditionally stable devices. [2+10+3]

5. Write short notes on: [3x6 = 18]
   a) VSWR measurement techniques
   b) Network Analyzer
   d) Reflex klystron