ROLL NO. _____

Code: AE72 **Subject: MICROWAVE THEORY AND TECHNIQUES**

AMIETE – ET

Time: 3 Hours **DECEMBER 2014** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: **(2×10)**

a. A low-loss transmission line filled only with dielectric medium has a velocity factor on the order of

(A) 1.02 **(B)** 1.65
(C) 0.56 **(D)** 0.65

b. The standing wave ratio of a pure travelling wave is

(A) Unity **(B)** Infinite
(C) $\lambda/2$ **(D)** λ

c. Whenever two or more modes have the same cut-off frequency, they are said to be

(A) TE_{11} mode **(B)** TM_{01} mode
(C) Degenerative mode **(D)** Dominant mode

d. List two microwave devices using faraday rotation principles

(A) Modulator & Isolator **(B)** Modulator & Power Limitter
(C) Circulator & Modulator **(D)** Circulator & Isolator

e. Coupling parameters of directional coupler are

(A) Insertion loss & Isolation **(B)** Coupling coefficient & Directivity
(C) Both **(A)** & **(B)** **(D)** None of these

f. The parameters on which bunching depend on

(A) Drift space should be properly adjusted
(B) DC anode voltage
(C) Signal amplitude should be such that proper bunching takes place
(D) All of these

g. The factors reducing efficiency of IMPATT diode are

(A) Space charge effect & Reverse saturation current effect
(B) High frequency skin effect & Ionization saturation effect
(C) Both **(A)** & **(B)**
(D) None of these

h. Some materials like GaAs exhibit negative differential mobility, when biased above a threshold value of the electric field. This behaviour is called

(A) Field Effect **(B)** Magnetron Effect
(C) Transferred Electron Effect **(D)** Both **(A)** and **(B)**

i. The main purpose of slotted section with line carriage is

(A) Measure the VSWR and standing wave pattern
(B) Reflection coefficient
(C) Return loss measurement
(D) All of these

j. The ratio of total power radiated to total power accepted at its input is

(A) Phase Velocity Factor **(B)** Radiation Efficiency
(C) Standing Wave Ratio **(D)** Both **(A)** & **(C)**

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. A transmission line has the following parameters: **(6)**
R= 2 ohm/m G=0.5 mmho/m f=1 GHz
L=8 nH/m C=0.23 pF
Calculate: (i) the characteristics impedance (ii) the propagation constant.

b. Derive the equation for determining the reflection coefficient at any point along the line. **(10)**

Q.3 a. An air-filled waveguide with cross section 2 x 1 cm transport energy in the TE_{10} mode at the rate of 0.5 hp. The impressed frequency is 30 GHz. What is the peak value of the electric field occurring? **(6)**

b. Show that the power transmission derived from the Poynting's theory is same as from the circuit theory for an ordinary transmission line. **(10)**

Q.4 a. Explain the Waveguide Corners, Bends and Twists in waveguide components. **(8)**

b. Derive the expression for the resonant frequency and the unloaded Q_0 of cavity resonator. **(8)**

Q.5 a. Draw the equivalent circuits of Tunnel Diodes and Calculate gain equations of a tunnel diode amplifier. **(10)**

b. Draw equivalent circuit for a parametric amplifier and explain the working operation of it. **(6)**

Q.6 a. Show that the gain bandwidth product is independent of frequency. **(8)**

b. Explain the working operation of Reflex Klystron with neat Schematic. **(8)**

Q.7 a. Draw the equivalent circuit for resonator of a magnetron and derive the expressions for Power output and efficiency. **(10)**

b. A CFA operates under the following parameters: **(6)**

Anode dc voltage : V_{ao} = 2 kV

Anode dc current : I_{ao} = 1.5 A

Electron Efficiency: η_e = 20%

RF input power: P_{in} = 80 W

Calculate: The induced RF power, Total RF output power,
Power gain in decibels.

Q.8 a. Derive expression for Quality Factor 'Q' of Micro-Strip Lines and show that it is approximately the reciprocal of the dielectric loss tangent θ. **(10)**

b. Describe about Coplanar Strip Losses. **(6)**

Q.9 Write a detail note on the following:- **(2×8)**
(a) MMIC Fabrication Techniques
(b) Hybrid Integrated – Circuit Fabrication