Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL A Constituent Institution of Manipal University

SEVENTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION NOV/DEC 2017

SUBJECT: RF & MICROWAVE ENGINEERING (ECE -4102)

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.
- Smith charts will be provided
- 1A. A two cavity klystron amplifier has the following parameters:

 $V_o=1000V, \ R_o=40 \ \text{K}\Omega \ \text{, } I_o=25 \text{mA}, \ f=3GHz$

Gap spacing in either cavity: d = 1mm

Spacing between two cavities L = 4cm

Effective shunt impedance, excluding beam loading R_{sh} = 30 K Ω

- (a) Find the input gap voltage to give maximum voltage V_2
- (b) Find the voltage gain, neglecting the beam loading in the output cavity.
- (c) Find the efficiency of the amplifier, neglecting beam loading
- 1B. Explain the construction and working of a Directional Coupler.
- 1C. What is impedance matching? Explain the various methods of impedance matching.

(5+3+2)

- 2A. From the fundamentals, derive the expressions for field components when TM waves are propagated between two parallel perfectly conducting planes.
- 2B. Using Smith chart find the input impedance, reflection coefficient and VSWR of a transmission line of 4.3 λ length, when Z₀=100 Ω and Z_L=(200-j150) Ω .
- 2C. Explain the working of cylindrical magnetron.

(5+3+2)

- 3A. Explain the construction and working of a Magic Tee. Derive its S matrix. Mention its applications.
- 3B. A rectangular waveguide has dimensions 2.3cm x 1.1 cm. Determine all the possible TE and TM modes which will propagate at a frequency of 20 GHz.
- 3C. With neat sketches explain wave impedance in guided waves.

(5+3+2)

- 4A. From the fundamentals derive an expression for the voltage and current at any point on the transmission line in trigonometric form.
- 4B. Obtain the expression for voltage and current distribution in a dissipation less line when $Z_R=\infty$, $Z_R=R_O$ and $Z_R=R_O/3$ and sketch the same for $s=3\lambda/2$.

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4C. A three port circulator has an insertion loss of 1dB, isolation of 30dB and VSWR of 1.5. Find its S- matrix..

(5+3+2)

- 5A. With a neat diagram, explain the construction and amplification process of a helical TWT.
- 5B. With the help of two valley band theory, explain how n –type GaAs Gunn diode exhibits negative differential resistance.
- 5C. Write S matrix for a 2 port microwave device and define its elements. Explain its properties with examples.

(5+3+2)