

SEVENTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION NOV 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. Starting from the input impedance Z_{s} , construct Smith chart and explain the salient features of Smith chart.
- 1B. Obtain the expression for voltage and current distribution in a dissipation less line when $Z_R=0$, $Z_R=R_O$ and $Z_R=3R_O$ and sketch the same for $s=2\lambda$.
- 1C. What are the applications of quarter wave line? Explain. It is required to match a 200Ω load to a 300Ω source using quarter wave transformer. What must be the characteristic impedance of the quarter wave transformer used for this purpose.

(5+3+2)

- 2A. Starting from the velocity modulation equation, derive an expression for round trip transit time in repeller region. Also derive and prove that the maximum efficiency of reflex klystron is 22.7%.
- 2B. Construct circulator using two hybrid Tees and phase shifter. Also explain its applications.
- 2C. A parallel plane waveguide of plate separation of 0.2m is excited with TE_{10} mode. Find phase constant, cut off frequency, guide wavelength, and phase velocity. Assume operating frequency=3GHz.

(5+3+2)

- 3A. Explain the working of magnetron oscillator with neat diagram. What are its merits? Derive the Hull cut off voltage equation for a magnetron.
- 3B. Draw the diagram of a TWT amplifier and explain its working.
- 3C. With neat sketch explain the working of an isolator based on the principle of Faraday rotation.

(5+3+2)

- 4A. A rectangular wave guide has cross section of 7 cm x 4 cm. Determine all the possible modes which will propagate at a frequency of 3 GHz. Also determine f_c , λ_c , λ , α , β , γ & v_{ph} for the fundamental mode.
- 4B. A lossless line with a characteristic impedance of 50 ohms is terminated by an impedance Z_L. The voltage maximum and minimum are found to be 2.5V and 1V respectively. Distance between successive minima is 5 cm. The line is first terminated by a short and then the unknown load, so that a shift in the voltage minimum of 1.25cm is observed towards the generator. Determine load impedance using smith chart.

4C. Prove the impossibility of TEM wave in a rectangular waveguide.

(5+3+2)

- 5A. Explain the working of a typical directional coupler. Define its coupling coefficient, insertion loss and directivity. Also derive its S matrix.
- 5B. Discuss any two limitations of vacuum tube triode at high frequency with proper justification.
- 5C. Show that for a rectangular waveguide $\frac{1}{\lambda^2} = \frac{1}{\overline{\lambda}^2} + \frac{1}{\lambda_c^2}$ with usual notations.

(5+3+2)