

Answer any **FIVE** Questions

All Questions carry **equal** marks

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1. Derive the expressions for the field components due to TM waves in rectangular waveguide.

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2. (a) Discuss the conductor losses in a micro strip line.  
(b) What is the importance of Bessel functions in computing the solutions for fields in circular waveguides?

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3. What are the different methods of power coupling to or from a waveguide? Explain probe and loop coupling methods.

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4. Explain the importance of S-parameters. Show that the scattering matrix for a section of uniform lossless guide of electrical length  $\theta = 2\pi \frac{L}{\lambda_g}$  is  $[s] = \exp(-j\theta) \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ .

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5. (a) List two discriminations between conventional tube and microwave tube. What can be the possible solutions to the limitations of conventional tubes at high frequencies? Which one is the best?  
(b) Write short notes on bunching process in a two-cavity Klystron amplifier.

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6. (a) Write short notes on wave modes.  
(b) Mention how a TWT can be converted to an oscillator. Explain the operation of such a device. Why large tuning range, are possible with such a device?

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7. (a) Explain the V-I characteristics of a Gunn diode.  
(b) List the differences between microwave transistor and TED devices.

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8. (a) Describe how an ordinary voltmeter can be calibrated to VSWR directly. What are the drawbacks of such a VSWR meter?  
(b) Determine S-parameters of a 10 dB directional coupler of directivity 30 dB. Assuming directivity of coupler loss-less VSWR at each port under matched condition is unity.