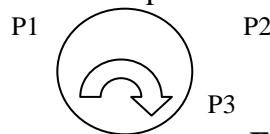


B.TECH.**THEORY EXAMINATION (SEM–VI) 2016-17****MICROWAVE ENGINEERING****Time : 3 Hours****Max. Marks : 100****Note : Be precise in your answer. In case of numerical problem assume data wherever not provided.****SECTION – A****1. Explain the following:****10 x 2 = 20**

- (a) What is evanescence mode in waveguides?
- (b) Write any two properties of E-plane tee microwave device.
- (c) Define cut-off wave number (k_c). show that $k_c^2 = \omega^2 \mu \epsilon$ for loss less dielectric.
- (d) Explain threshold field for Gunn diode.
- (e) Draw and explain the trajectory of electron moving from cathode to anode if Hull magnetic field is applied in magnetron
- (f) In a helical slow wave structure if pitch is 5 cm and diameter is 10 cm, calculate the axial velocity with which wave will propagate.
- (g) Explain V-I characteristics of tunnel diode.
- (h) How microwave solid state device is different from low frequency devices.
- (i) What is the condition for sustained oscillation in Reflex Klystron?
- (j) Write the S-parameter matrix of a 3 port circulator shown in Fig.1.

**Fig .1****SECTION – B****2. Attempt any five of the following questions:****5 x 10 = 50**

- (a) A microstrip line is made of a copper conductor 0.0254 mm wide on a G-10 fiberglass-epoxy board 0.20mm in height. The relative dielectric constant ϵ_r of the board material is 4.8, measured at 25 GHz. The microstrip line 0.035 mm thick is to be used for 10 GHz. Determine the:
 - (i) Characteristic impedance Z_0 of the microstrip line
 - (ii) Surface resistivity R_s of copper conductor
 - (iii) Conductor attenuation constant α_C
 - (iv) Dielectric attenuation constant α_d
 - (v) Quality factor
- (b) With the help of functional diagram, explain the working principle of two cavity Klystron amplifier. Calculate optimum length of drift space, maximum efficiency, and voltage gain.
- (c) What is directional coupler? What are the different types of directional coupler? Explain the working principle of 2-hole directional coupler. Also determine its S-matrix
- (d)
 - (i) Discuss the salient features of microwave measurements. Describe a voltage standing wave ratio (VSWR) meter.
 - (ii) What is meant by insertion loss and attenuation? Discuss any one method for measurement of attenuation using microwave test bench.
- (e)
 - (i) Classify different types of microwave amplifiers and oscillators. Discuss working principle of avalanche transit time devices.
 - (ii) Explain Gunn Effect with respect to two valley model. Draw the graph between

- applied electric field and current density across Gunn diode.
- (f) (i) Explain the construction, working and application of microwave isolators.
 - (ii) A rectangular cavity resonator has dimension $a=7.5\text{cm}$, $b=4\text{cm}$ and $c=16\text{ cm}$. calculate cut- off wave number and phase constant.
 - (g) Draw the schematic diagram of IMPATT diode. Explain its principle of operation. Derive an expression for operating frequency and efficiency of IMPATT diode.
 - (h) (i) Explain the experimental setup measurement set up of radiation pattern and beam width.
 - (ii) Explain the method of measuring VSWR < 10

SECTION – C

Attempt any two of the following questions:

2 x 15 = 30

3. (a) Design the S-parameter matrix of a microwave device given in Fig2. If a signal of power 20 mW is fed into port 1, determine the power in remaining port when other ports are perfectly matched.

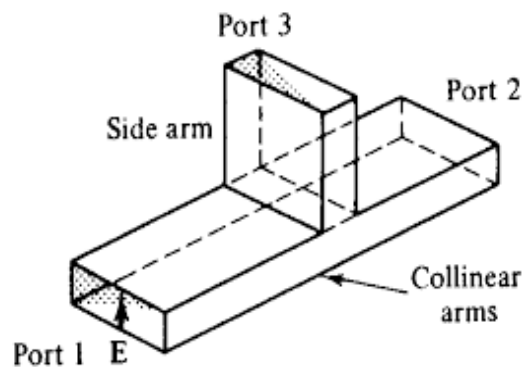


Fig .2

- (b) A TE_{11} mode is propagating through a circular waveguide. The guide is air filled and has a diameter of 12 cm. Calculate: (Given $X'_{11}=1.841$)
 - (i) Cut off frequency
 - (ii) Guide wavelength for the frequency of 2.5GHz
 - (iii) Wave impedance at 2.5 GHz frequency.
- 4. (a) By means of applegate diagram explain the working of reflex klystron.
- (b) Why is Magnetron called cross field device? What is meant by π mode operation in Magnetron containing eight cavity resonators? Describe how strapping separates the π mode from other possible modes.
- 5. (a) Derive all Electric and Magnetic field components in Transverse magnetic mode of rectangular waveguides.
- (b) Show that the TM_{01} and TM_{10} modes in rectangular waveguide do not exist.