Printed Pages : 2 **Roll No.** | | | | | | | | | | | **NEC601**

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 $k_c^2=\omega^2 \mu \varepsilon$ 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.

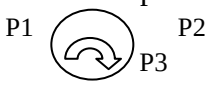

Fig .1

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 εr 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 Z0 of the microstrip line

(ii) Surface resistivity Rs of copper conductor

(iii) Conductor attenuation constant αC

(iv) Dielectric attenuation constant αd

(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=7.5cm,b=4cm and c=16 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.

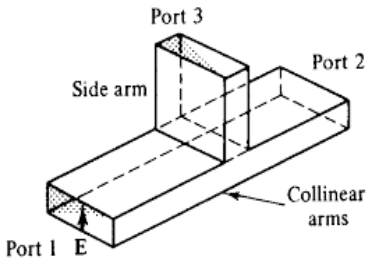

Fig .2

(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.