Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013

Subject code: 1710411 Date: 10-01-2014

Subject Name: RF and Microwave Engineering

Time: 10.30 am – 01.00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Starting from Maxwell's equations derive the wave equations. Show that these represent wave propagating in free space with velocity of light.	**07**
	(b)	Explain in detail types of Velocities related to the propagation of electromagnetic waves.	**07**
Q.2	**(a)**	Briefly explain Energy and Power in detail	**07**
	(b)	Explain the principle, working and application of microwave active device such as Mixers.	**07**
		OR	
	(b)	A $\lambda/2$ resonator is made from a piece of copper coaxial line, with an inner conductor radius of 1 mm. and an outer Conductor radius of 4 mm. If the resonant frequency is 5 GHz, compare the Q of an air-filled coaxial line resonator to that of a Teflon-filled coaxial line resonator. conductivity of copper is $\sigma = 5.813 \times 10^7$ S/m.	**07**
Q.3	**(a)**	Write short notes on Microwave Integrated Circuits.	**07**
	(b)	"Smith Chart is a graphical aid that is very useful when solving transmission line problems", Justify this statement with suitable example.	**07**
		OR	
Q.3	**(a)**	What is signal flow graph? Explain in detail basic rules used for decomposition of signal flow graph to obtain any desired wave amplitude ratio.	**07**
	(b)	A lossless T-junction power divider has a source impedance of 50 Ω. Find the output characteristic impedances so that the input power is divided in a 2:1 ratio. Compute the reflection coefficients seen looking into the Output ports.	**07**
Q.4	**(a)**	Explain in detail the impedance and admittance matrices	**07**
	(b)	Explain in detail operation of rectangular waveguide in TE modes by deriving different equations.	**07**
		OR	
Q.4	**(a)**	Discuss how loss affects the permeability tensor, and the demagnetization field inside a finite-sized piece of ferrite.	**07**
Q.4	**(b)**	Explain circuits that are useful for microwave frequency oscillators primarily in terms of negative resistance devices	**07**
Q.5	**(a)**	Write short notes on Short-circuited $\lambda/4$ transmission line resonator.	**07**
	(b)	Explain in detail with analysis rat-race type directional coupler.	**07**
		OR	

Q.5 **(a)** Explain in detail Plane Waves in a Lossless Medium and Determine the wavelength, phase velocity of the current on a transmission line is given as, **07**

$i(t) = 1.2\cos(1.51 \times 10^{10} t - 80.3 z)$.

(b) Explain in detail with analysis Binomial multi section matching transformer. **07**

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