TE/ ExTc/ sem v/ RW
R.F. Circuit Design.

190 : 2ndhf10Cmk

Con. 6032-10. **(REVISED COURSE)** **GT-6756**

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assume any **suitable** data wherever **required** and **justify**.
(4) **Figures** to the **right** indicate **marks**.

1. (a) Compute the skin depths for copper, aluminium at 1 GHz and 10 GHz and find the resistance of a 10 cm wire with diameter of 1 mm : — **6**
$\sigma_{cu} = 64{\cdot}516 \times 10^6$ s/m
$\sigma_{Al} = 40 \times 10^6$ s/m.

(b) A transmission line of characteristic impedance $Z_o = 50\ \Omega$ and length $d = 0{\cdot}15\ \lambda$ is terminated into a load impedance of $Z_L = (25 - j30)\ \Omega$. **6**
Find Γ_o, $Z_{in}(d)$ and SWR by using Z-Smith chart.

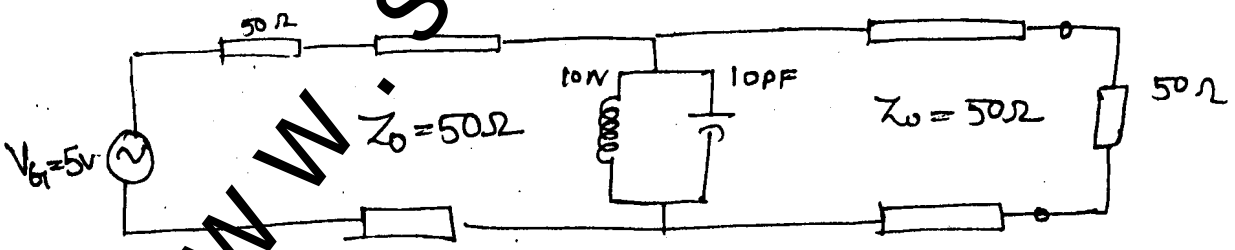
(c) Draw the lumped element circuit model for a transmission line. Derive the expression for voltage and current travelling waves. **4**

(d) Draw the equivalent circuit and find the odd and even mode parameters for coupled transmission line. **4**

2. (a) Design a low-pass filter whose input and output are matched to a 50 Ω impedance with cut-off frequency of 3 GHz, equi ripple of 0·5 dB and rejection of atleast 40 dB at approximately twice the cut-off frequency. Assume a dielectric material that results in a phase velocity of 60% of the speed of light. **12**

(b) With the help of suitable derivation, explain power considerations for a transmission line. **8**

3. (a) For a filter circuit shown : — **10**



Find the loaded, unloaded and external quality factors.

(b) For a transmission line circuit involving source and load terminations of $Z_G = 60\ \Omega$ and $Z_L = 50\ \Omega$ respectively and $Z_O = 75\ \Omega$, compute the input power and power delivered to the load. Assume length of line to be $\lambda/4$ with source of $V_G = 8$ V. **10**

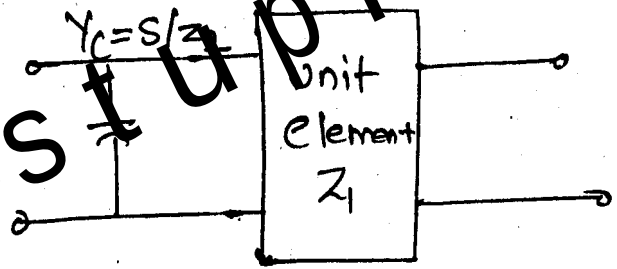
4. (a) Explain different types of diode models (RF) and differentiate them with respect to junction capacitance, band gap energy and conductance. **10**

(b) Draw the Ebers-Moll model of large signal BJT and explain in detail the transport representation and injection form. **10**

4. (a) Explain different types of diode models (RF) and differentiate them with respect to junction capacitance, band gap energy and conductance. 10

   (b) Draw the Ebers-Moll model of large signal BJT and explain in detail the transport representation and injection form. 10

5. (a) Define unit element and find the ABCD parameters for the following circuit using Kuroda's identity. 10



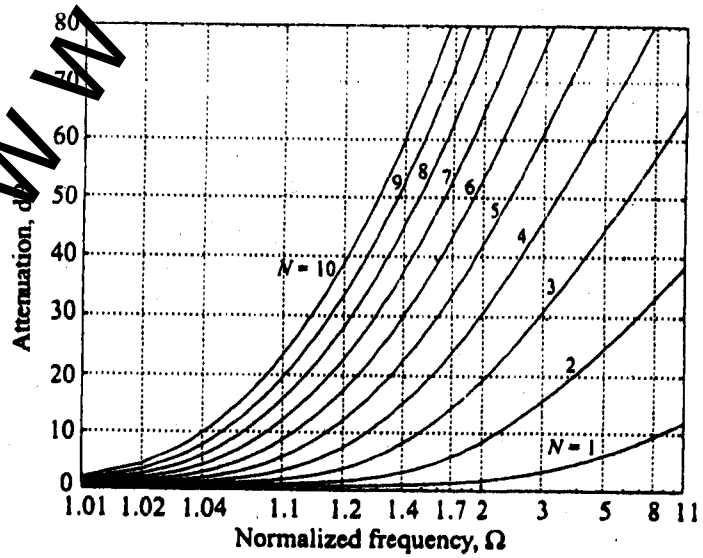
(b) Explain the construction and operation of HEMT and RF field effect transistor. **10**

6. (a) Explain the role of scattering parameters and its properties at RF and microwaves. **10**
   (b) Explain RF behaviour of high frequency resistor, capacitor and inductors. **10**

7. Write short notes on the following :— **20**
   (a) Microstrip transmission lines
   (b) Parallel and series connections and its importance in RF design
   (c) DC characterization of Bipolar junction transistor
   (d) Physical properties of semiconductor.

Chebyshev filter coefficients; 0.5 dB filter design (N = 1 to 10)

N	g_1	g_2	g_3	g_4	g_5	g_6	g_7	g_8	g_9	g_{10}	g_{11}
1	0.6986	1.0000									
2	1.4029	0.7071	1.9841								
3	1.5963	1.0967	1.5963	1.0000							
4	1.6703	1.1926	2.3661	0.8419	1.9841						
5	1.7058	1.2296	2.5408	1.2296	1.7058	1.0000					
6	1.7254	1.2479	2.6064	1.3137	2.4758	0.8696	1.9841				
7	1.7372	1.2583	2.6381	1.3444	2.6381	1.2583	1.7372	1.0000			
8	1.7451	1.2647	2.6564	1.3590	2.6964	1.3389	2.5093	0.8796	1.9841		
9	1.7504	1.2690	2.6678	1.3673	2.7239	1.3673	2.6678	1.2690	1.7504	1.0000	
10	1.7543	1.2721	2.6754	1.3725	2.7392	1.3806	2.7231	1.3485	2.5239	0.8842	1.9841



Attenuation response for 0.5 dB Chebyshev design.

NAME	TITLE	DWG. NO. A
SMITH CHART FORM 82-8SPR(9-66)		DATE

IMPEDANCE OR ADMITTANCE COORDINATES