Con. 5484-09. T. E. (EXTC) Sem V (R) SP-8615

(REVISED COURSE)

16/12/09

(3 Hours) [Total Marks : 100

Z16

R.F. Circuit Design

2.30 to 5.30

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

1. (a) Draw the electric equivalent circuit for the high frequency capacitor. Compute the high frequency impedance of a 20 PF capacitor in terms of F(frequency). Whose dielectric medium consists of aluminium oxide ($Al_2O_3$) processing a series loss tangent of $10^{-4}$ and whose leads are 1·25 cm with $\sigma_{cu} = 64{\cdot}51 \times 10^6$ ohm$^{-1}$ m$^{-1}$. 6

(b) Compute the transmission line parameters for a parallel plate transmission line. 6
Given— $\sigma_{diet} = 0{\cdot}125$ m s/m
$\sigma_{cond} = 64{\cdot}516 \times 10^6$ ohm$^{-1}$ m$^{-1}$
$w = 6$ mm ; $\varepsilon_r = 2{\cdot}25$ ; $\mu_r = 1$
$d = 1$ mm ; $f = 1$ GHz

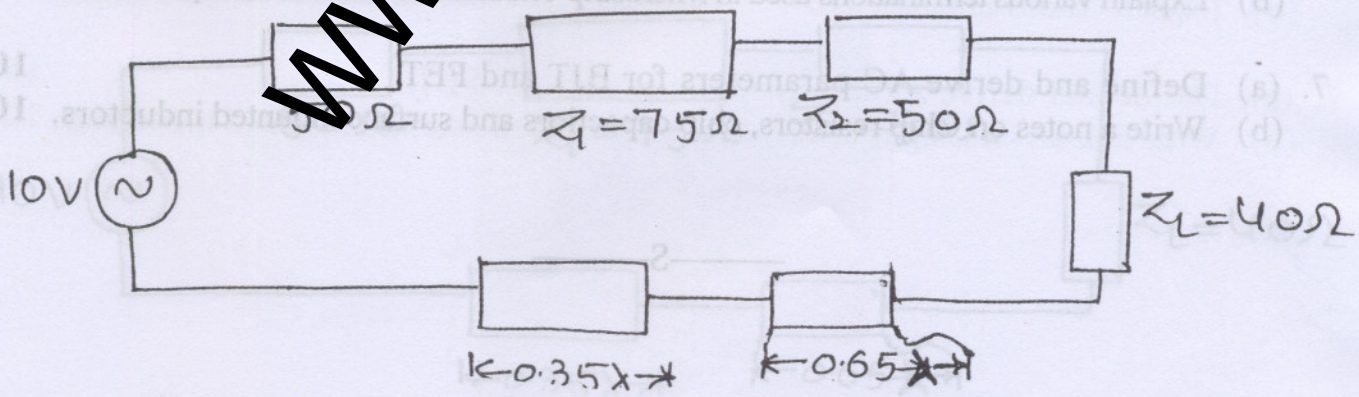
(c) Explain the current flow in pn junction and give the expression for Idiff in terms of diffusion constand and V diff in terms of doping concentration. 4

(d) Consider a load $Z_L = 60 + j\,20$ ohms connected to a lossy transmission line— 4

$$Z_0 = \sqrt{\frac{0{\cdot}1 + j\,20}{0{\cdot}05 + j\,0{\cdot}003}}$$

Determine the reflection coefficent and SWR at load.

2. (a) For the following transmission line system compute input power and power delivered to the load— 10




(b) Show the RF small signal circuit model and equivalent model using Miller Effect. Find the values of $CM_1$ and $CM_2$ in terms of $C_{be}$, $V_{ce}$ and $V_{be}$. 10

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3. (a) Identify the following normalized impedances and convert into admittances. Using Smith Chart. Also find corresponding reflection coefficients and SWR— 10
   (i) $Z = 0{\cdot}1 + j\ 0{\cdot}7$
   (ii) $Z = 0{\cdot}2 - j\ 0{\cdot}7$
   (iii) $Z = 0{\cdot}5$.

   (b) For a RLC parallel resonant circuit. Derive the expression for Q. If $R_S = 150$ ohms, $R_L = 1$ kilo ohm and $Q = 20$ at 50 MHz. Find the R, L, C values. 10

4. (a) Explain the following parameters— 10
   (i) Insertion loss
   (ii) Ripple
   (iii) Bandwidth
   (iv) Shield factor and
   (v) Rejection.

   (b) Draw the small signal h-parameter representation of BJT and find the values of $r_\pi$, $C_\pi$, $r_o$ and $g_m$. 10

   Given : $I_c^Q = 6$ mA, $I_B^Q = 40$ µA
   $V_{AN} = 30$ V, $f_T = 37$ GHz
   $V_T = 0{\cdot}026$ V.

5. (a) A coaxial cable of characteristic impedance $Z_0 = 75$ ohms is terminated with a load impedance of $Z_L = 60 + j\ 30$ ohms. Find input impedance of line at $f = 1$ GHz and $d = 50$ cm. 10

   (b) Explain Schottky contact with the help of Energy Band diagram for metal and semiconductor do not interact and metal semiconductor contact. 10

6. (a) Compare large signal FET models with samll signal FET models. 10
   (b) Explain various terminations used in Microstrip Transmission line and compare them. 10

7. (a) Define and derive AC parameters for BJT and FET. 10
   (b) Write a notes on Chip resistors, chip capactiors and surface mounted inductors. 10