01 EXTC/TE/Sem-V OLD ~~CBSGS~~ /RFCD 23/5/16

Q.P. Code : **29249**

(3 Hours) [Total Marks :100

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.

1. (a) Assuming the dielectric and conductor losses in transmission line are small (i.e. $G << \omega C$ and $R << \omega L$), show that propagation constant k can be written as $k = \alpha + j\beta = \frac{1}{2}\left(\frac{R}{Z_0} + GZ_0\right) + j\omega\sqrt{LC}$ 5

Where $Z_0 = \sqrt{L/C}$ fs the characteristic impedance of the line in the absence of loss.

(b) Show that the maximum value of normalized resistance is numerically equal to the voltage standing wave ratio i.e.$r_{max} = \rho$ 5

(c) You are required to build a low pass butterwort filter that provides an attenuation value of atleast 50 dB at $f = 1.5\ f_{3dB}$. What is filter order? How many components (inductors and capacitors) are required to realize this filter? 5

(d) Explain the current flow in pn junction and give the expression for I diff in terms of diffusion constant and Vdiff in terms of doping concentration. 5

2. (a) Starting from definition of time - averaged power, obtain expression for the power absorbed by the load for lossless and lossy transmission line. 10

(b) The electric wave field of a positive z-travelling wave in a medium with relative dielectric constant of $\varepsilon_r = 4$ and with frequency of 5 GHz is given by Ex =Eox cos (wt - kz) V/m 10

(i) Find he magnetic field it Eox = 10^6 v/m
(ii) Determine phase velocity and wavelength.
(iii) Compute the spatial advance of the travelling wave between time intervals $t_1 = 3\mu s$ and $t_2 = 7\mu s$

3. (a) An N =3 chebyshev bandpass filter is be designed with a 3dB passband ripple for a communication link. The center frequency is at 2.4 GHz and filter has to meet a bandwidth requirement of 20%. The filter has to be inserted into a 50 Ω characteristic line impedance. Find the inductive elements and plot the attenuation response in the frequency range of 1 to 4 GHz. 10

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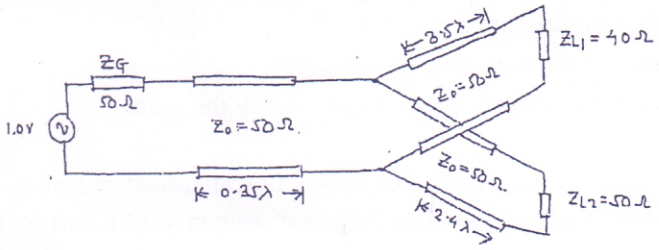
(b) For the following system, find the both the power produced by the source and the power delivered to each load. 10



4. (a) A short circuiled 50 W transmission line section is operated at 1 GHz and possesses a phase velocity of 75% of the speed of light. Use both the analyical and the smith chart approach to determine the shortest light required to obtain an 4.7 nH inductor 10

(b) Explain different filter parameters with generic attenuation profile diagram. 10

5. (a) Explain high frequency resistors, capacitors and inductors by giving related equations and wave forms. 10

(b) Explain stocky contact with the help of energy bond diagram for 10

(i) metal and semiconductor do not interact

(ii) metal semiconductor contact.

6. (a) Explain the design procedure of small signal BJT amplifier. (DC circuit design and RF circuit design) 10

(b) For two pn-diodes with abrupt function, one of which is made of Si and another is made of GaAs, with $N_A = 10^{17}$ cm^{-3} and $N_D = 2 \times 10^{14}$ cm^{-3} in both cases : 10

(a) Find the barrier voltage.

(b) Find the maximum electric field and the space charge region width.

(c) Plot the space charge, potential, and electric field distribution along the diode axis.

7. Write short note on following : 20

(a) One to one mapping between the normalized impedance plane and the reflection coefficient plane.

(b) Chip components.

(c) Parallel and series connections.

(d) Microstrip transmission lines.
