

# 國立中央大學九十一學年度碩士班研究生入學試題卷

所別：網路學習科技研究所 甲組 科目：普通物理 共 / 頁 第 / 頁

1. A hybrid transmitting (Tx) and receiving (Rx) device is shown in Fig. 1. Its simplified circuit is depicted in Fig. 2. What is the condition for resistors  $R_1$ ,  $R_2$ ,  $R_3$ , and  $R_{load}$  such that the receiving signal (echo)  $V_R$  is minimum when this device is transmitting signal ( $V_T \neq 0$ )? (20%)

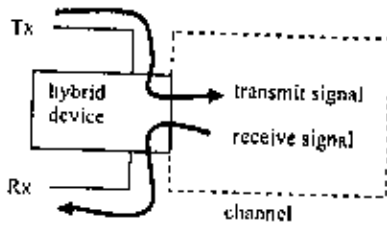


Fig. 1

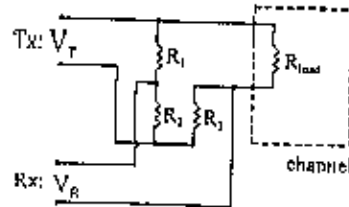


Fig. 2

2. Fig. 3 is an RLC circuit with an input signal  $v_s = v_0 \sin \omega t$ . (a) Derive its current equation by voltage loop rule. (10%) (b) A particular solution of differential equation  $y''(t) + ay'(t) + by(t) = f \cos \omega t$  is

$$y(t) = \frac{f \cos(\omega t - \phi)}{\sqrt{(b - \omega^2)^2 + (a\omega)^2}}, \quad \text{where } \phi = \tan^{-1} \frac{a\omega}{b - \omega^2}.$$

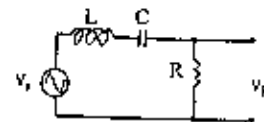


Fig. 3

- Find the input frequency  $\omega_s$  when the output signal  $v_R$  has a maximal value. (10%) (c). Find the output half-power bandwidth (i.e., the frequency region that the output signal decreases from  $v_{R,max}$  to  $v_{R,max} / \sqrt{2}$  when the input frequency is varied.) (10%)

3. An incident laser beam enters one end of an optical fiber with incident angle  $\theta_1$  as shown in Fig. 4. The refraction indexes of the core, cladding and air are  $n_1$ ,  $n_2$ , and  $n_0$  respectively ( $n_1 > n_2 > n_0 = 1$ .) Find the largest incident angle  $\theta_1$  (in terms of  $n_1$ ,  $n_2$ ) such that the total energy propagates in the core of the fiber (neglect the reflection on the end.) (20%)

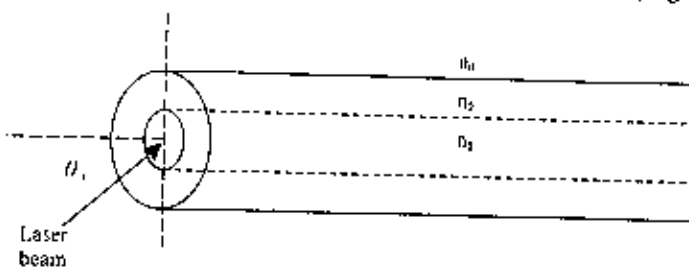


Fig. 4

參考用

4. Please describe briefly the physical principle of following peripheral or device of computer & communication system: monitor, disk drive, printer, scanner, mouse, CD-ROM, CCD, speaker, coaxial cable, and antenna. (30%)