Dernière mise à jour : 21.3.2017

Exercices chapitre 3: diodes et diodes Zener

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| [Circuits à diode(s)](#_Circuit_avec_diode(s)) | [Circuits à diode(s) Zener](#_Circuit_avec_diode(s)_Zener_1) | [Puissance dissipée par une diode ou diode Zener](#_Puissance_dissipée_dans_une diode o) | [Circuits à diodes](#_Circuits_à_diodes_1) |
| [Circuits](#_Circuits_redresseur)  [redresseurs](#_Circuits_redresseur) |  |  |  |

## Circuit à diode(s)

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|  | Calculer la tension aux bornes de la résistance R pour R = 10 Ω ; puis pour R = 5 Ω.  Spécifications de la diode : Udiode = 0,7 V ; Rdyn.= 500 mΩ  D1  U=20 V  R  + |  |  |
| ***Réponse(s):*** *Pour R= 10 Ω : UR=18,4 V ; pour R= 5 Ω : UR=17,5 V* | | *SP* | |
|  | Calculer la tension aux bornes de la résistance R1. Toutes les diodes ont une tension de seuil de 0,7 V. R=50 Ω  U=20 V  D3  D2  D1  R1  R2=20 Ω  + |  |  |
| ***Réponse(s):*** *IR1=256 mA ; UR=12,8 V* | | *SP* | |
|  | Calculer les courants dans R1 et R2. D1=D2 avec une tension de seuil de 0,7 V  U=5 V  R1=5 Ω  R2=100 Ω  +  D2  D1 |  |  |
| ***Réponse(s):*** *IR1=0A ; IR2=43 mA* | | *SP* | |

[Retour au haut de la page](#_top)

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|  | Tension de seuil de la diode = 0,7 V  Calculer I source |  |  |
| ***Réponse(s):*** *Is= 2,62A; I1=1,95 A; I23=0,66 A* | | *SP* | |
|  | Vcc = 30 V  Udiode = 0,7 V  Calculer I source. |  |  |
| ***Réponse(s):*** *I23=2,44A ; I1=2,93A ; Is=5,37A* | | *SP* | |
|  | Vcc = 24 V  ULED = 2V et ILED= 20 mA  Quelle doit être la valeur de R1 pour que la LED travaille correctement ? |  |  |
| ***Réponse(s):*** *R1=1,1kΩ* | | *SP* | |
|  | Calculer la résistance dynamique de la diode à partir de la caractéristique suivante :  [V]  0,2 V / division  [A]  2 A / division |  |  |
| ***Réponse(s):*** *Rdyn.=33 mΩ* | | *SP* | |

[Retour au haut de la page](#_top)

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|  |  | | Calculer le courant de source, avec  R1 = 50 Ω  R2 = 150 Ω  R3 = 270 Ω  UD = 0,7V  U = 35 V | |  |  |
| ***Réponse(s):*** *Is=766 mA; IR1=686mA; IR2= IR3=80mA* | | | | | *SP* | |
|  | Dessiner le schéma équivalant d’une diode idéale **et** d’une diode réelle.  diode réelle | | | |  |  |
| ***Réponse(s):*** | |  | |  | *SP* | |
|  | La caractéristique d'une diode à 20 °C est la suivante. Redessiner cette caractéristique pour 120 °C si K= -2mV/°C  0,2 0,4 0,6 0,8 1,0 1,2 1,4  U [V]  I [A] | | | |  |  |
| ***Réponse(s):*** *idem mais translatée vers la gauche de 0,2 V* | | | | | *SP* | |
|  | Dessiner i = f (u) d’une diode idéale et d’une diode réelle  **diode idéale diode réelle**  i  i  u  u | | | |  |  |
| ***Réponse(s): N/A*** | | | | | *SP* | |

[Retour au haut de la page](#_top)

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|  | Quel est la tension aux bornes de R2 lorsque S1 est ouvert, puis fermé ?  Quel est la puissance dissipée par R1 lorsque S1 est ouvert, puis fermé ?  Avec : U = 10 V  Udiode = 0,7 V  R1 = 40 Ω  R2 = 60 Ω | | |  |  |  |
| ***Réponse(s):***  *S1 ouvert :**U2 = 6 V ; U1= 4 V ; P1 = 400 mW*  *S1 fermé :**U2 = 3,5 V ; U1= 6,5 V ; P1 = 1,06 W* | | | | | *SP* | |
|  | Quel est la tension aux bornes de R2 lorsque S1 est ouvert ? puis fermé ?  Avec : U = 10 V  Udiode = 0,7 V  R1 = 70 Ω  R2 = 30 Ω | |  | |  |  |
| ***Réponse(s):*** *U2 = 3,0 V que S1 soit ouvert ou fermé* | | | | | *SP* | |
|  |  | Calculer le courant de source, avec:  R1 = 50 Ω  R2 = 150 Ω  R3 = 250 Ω  UD = 0,7V  U = 12 V | | |  |  |
| ***Réponse(s):*** *IR1=0 mA; Is= IR2= IR3=26,5 mA* | | | | | *SP* | |

## Circuit à diode(s) Zener

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|  | Calculer le courant dans la diode Zener.  Calculer la puissance dissipée par la Zener  U=24 V  Dz =6,2 V  R2=5 Ω  R1=10 Ω  + |  |  | |
| ***Réponse(s):*** *Zener conduit ; IZ=0,54A ; PZ=3,35 W* | | *SP* | | |
|  | U = 15 V  Pour quelle(s) valeur(s) de R la diode Zener conduit-elle ? |  |  | |
| ***Réponse(s):*** *0 Ω ≤ R ≤ 15 Ω* | | *SP* | | |
|  | Calculer IZener lorsque U = 24 V |  |  | |
| ***Réponse(s):*** *U23=9 V, donc la Zener ne conduit pas;  IZ = 0 A* | | *SP* | | |
|  | Calculer IZener lorsque U = 50 V |  |  | |
| ***Réponse(s):*** *Zener conduit ;  IZ= 0,9A* | | *SP* | | |
|  | Calculer IR1 ; IZener et IR2  Re-calculer IR1 ; IZener et IR2 si la tension de la source est ajustée à U = 13 V |  |  |
| ***Réponse(s):***  *Avec U = 15 V : Zener conduit ; IR1=1,14 A ; IR2=775mA ; IZener=365 mA*  *Avec U = 13 V : Zener ne conduit pas; IR1=765 mA ; IR2=765 mA  ; IZener=0 A* | | *SP* | |

[Retour au haut de la page](#_top)

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|  | Placer une diode Zener dans le circuit suivant  afin de protéger R2 contre des tensions dépassant 6V.  +  R2  R1 |  |  |
| ***Réponse(s):*** *N/A* | | *SP* | |
|  | Dessiner la caractéristique i = f(u) d’une diode Zener et son symbole.  i  u |  |  |
| ***Réponse(s):*** *N/A* | | *SP* | |
|  | A partir de quelle tension U, la diode Zener conduit-elle ?  Que vaut le courant de Zener si U = 15 V ? |  |  |
| ***Réponse(s):*** *A partir de U ≥ 9,45V ; IR1=174 mA ; IR2=63 mA ; Iz = 111 mA;* | | *SP* | |
|  | Calculer le courant dans la diode Zener  U=24 V  Dz =9,2 V  R2=5 Ω  R1=10 Ω  + |  |  |
| ***Réponse(s):*** *Zener ne conduit pas ! ; IZ=0 A* | | *SP* | |
|  | Pour quelle tension de la source, la Zener conduit-elle ? |  |  |
| ***Réponse(s):*** *A partir de U = 32V* | | *SP* | |

[Retour au haut de la page](#_top)

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|  | Tracer le graphe UR2 = f (U) pour le circuit suivant : calculer quelques points clés.  U  UR2 |  |  |
| ***Réponse(s):***  U [V]  UR2 [V]  5V  7,5V | | *SP* | |

[Retour au haut de la page](#_top)

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|  |  | E = 0...15 V  R1=12 Ω  R2=68 Ω  Dz=6,8 V |  |  |
| Compléter le tableau:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | E [V] | 5 | 8 | 10 | 14 | 15 | | IR1 [mA] |  |  |  |  |  | | IR2 [mA] |  |  |  |  |  | | Iz [mA] |  |  |  |  |  | | Pz [W] |  |  |  |  |  | | |
| ***Réponse(s):***   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *E [V]* | *5* | *8* | *10* | *14* | *15* | | *IR1 [mA]* | *62,5* | *100* | *267* | *600* | *683* | | *IR2 [mA]* | *62,5* | *100* | *100* | *100* | *100* | | *Iz [mA]* | *0* | *0* | *167* | *500* | *583* | | *Pz [W]* | *0* | *0* | *1,14* | *3,4* | *3,96* | | | | *SP* | |
|  |  | E = 40 V  UD= 0,7 V  UDz = 10 V  R1 = 10 Ω  R2 = 20 Ω  R3 = 30 Ω  R4 = 40 Ω  Calculer le courant dans la résistance R2 |  |  |
| ***Réponse(s):****UTH = 15 V; RTH =18,75 Ω; IR2 =369 mA; diode Zener ne conduit pas !* | | | *SP* | |

[Retour au haut de la page](#_top)

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|  | Calculer la constante de temps τ et le courant dans la diode Zener lorsque le condensateur est chargé.  Ensuite, esquisser (sur un même graphique) les caractéristiques de uc = f (t) et de iZener= f(t) | Avec:  U = 20 V  UZENER= 15,5 V  R1= 250 Ω  C= 40 μF |  |  |
| ***Réponse(s) :*** *τ = 10 ms; iZener=5 mA (lorsque le condensateur est chargé)*  *Caractéristiques uc=f(t) et iZener=f(t):*  t [ms]  uc [V]  iZ [mA]    t [ms] | | | *SP* | |

## Puissance dissipée par une diode ou diode Zener

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|  | Déterminer la puissance dissipée par la diode D2 | | | | |  |  |
| ***Réponse(s):*** *ID2=80 mA; PD2=56 mW* | | | | | | *SP* | |
|  | Déterminer la puissance dissipée par la diode Zener lorsque U = 50 V | | | | |  |  |
| ***Réponse(s):*** *Zener conduit ;**IR1=874 mA; IR2=63 mA; IZ=811 mA; PZ=5,11 W* | | | | | | *SP* | |
|  |  | | Déterminer la puissance dissipée par la diode et par la diode Zener, avec:  U = 15 V  UD = 0,7 V  UDz = 6,3 V  R1 = 9 Ω  R2 = 14 Ω | | |  |  |
| ***Réponse(s):*** | | *Zener conduit ;**IR1=889 mA; PD =622mW; IR2=450 mA;*  *IZ=439 mA;PDz=2,765 W* | | | | *SP* | |
|  | On souhaite indiquer l’état de charge d’une batterie de 12 VDC à l’aide du  VU mètre ci-contre.  L’aiguille doit être :   * à « 12h00 » lorsque Ubatt. = 12 V * à « 14h00\* » lorsque Ubatt. = 14 V   \* aiguille au maximum du cadran  Réaliser le circuit qui permet de répondre à ces critères à l’aide d’une diode Zener et d’une résistance de la série E12 | | | Imax. = 688 µA (aiguille au maximum du cadran)  Rinst. = 650 Ω | |  |  |
| ***Réponse(s):*** | | *Umin.(instr.) = 10 V*  *Umax.(instr.) = 14 V*  *UZener = 10 V*  *Radd = 5,2 KΩ => E12 : 5,6 KΩ* | | |  | *SP* | |

[Retour au haut de la page](#_top)

## Circuits à diodes

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|  | Dessiner l’allure de la tension aux bornes de Rch pour U = 24 V.  U = 24 VAC ; R = 14 Ω ; Uz = 15 V; Rch = 20 Ω     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | |  |  |
| ***Réponse(s) :*** | |  | *SP* | |
|  | Que se passe-t-il lorsque S1 seul est actionné ?  Que se passe-t-il lorsque S2 seul est actionné ?  Que se passe-t-il lorsque S1 et S2 sont actionnés ?    Remarque : VG2 est une source de tension alternative ! | |  |  |
| ***Réponse(s) :*** *S1 seul : P1 est activée ; S2 seul : P2 est activée ;*  *S1 et S2 sont activés :P1 et P2 sont activée* | | | *SP* | |

[Retour au haut de la page](#_top)

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|  | Dessiner l’allure de la tension aux bornes de Rch si Uz = 3 V.  Identifier l’axe avec une ou des valeurs.  Avec : R = 10 Ω et Rch = 100 Ω  U [V]  4,5  3,5    Uch [V]  t   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   t | |  |  |
| ***Réponse(s) :*** | | *Usource minimum pour que la Zener conduise = 3,3 V* | *SP* | |

[Retour au haut de la page](#_top)

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|  | Dessiner l’allure de la tension aux bornes de Rch si Uz = 4 V.  Identifier l’axe avec une ou des valeurs.  Avec : R = 10 Ω et Rch = 5 Ω  U [V]  15  9    Uch [V]  t   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   t | |  |  |
| ***Réponse(s) :*** | | *La diode Zener conduit dès que Uch > 4 V* | *SP* | |

[Retour au haut de la page](#_top)

## Circuits redresseurs

|  |  |  |  |
| --- | --- | --- | --- |
|  | Pour le montage suivant : quelle réponse correspond à l’allure de la tension u(t) connaissant la tension v (t)    Entourer la bonne réponse : |  |  |
| ***Réponse(s) :*** *B* | | *SP* | |
|  | Pour le montage suivant : quelle réponse correspond à l’allure de la tension u(t) connaissant la tension v (t)    Entourer la bonne réponse : |  |  |
| ***Réponse(s) :*** *D* | | *SP* | |
|  | Pour le montage suivant : quelle réponse correspond à l’allure de la tension u(t) connaissant la tension v (t)    Entourer la bonne réponse : |  |  |
| ***Réponse(s) :*** *A* | | *SP* | |

[Retour au haut de la page](#_top)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Pour le montage suivant : quelle réponse correspond à l’allure de la tension u(t) connaissant la tension v (t)    Entourer la bonne réponse : |  |  |
| ***Réponse(s) :*** *D* | | *SP* | |
|  | Dans ce type de montage, quelles sont les diodes qui conduisent en même temps ? Cocher les bonnes réponses : |  |  |
| ***Réponse(s) :*** *D1-D3 et D2-D4* | | *SP* | |
|  | Dans ce type de montage, quelles sont les diodes qui conduisent lors de l’alternance positive ? |  |  |
| ***Réponse(s) :*** *D1-D3* | | *SP* | |

[Retour au haut de la page](#_top)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Dans ce type de montage, quelles sont les diodes qui conduisent lors de l’alternance négative ? |  |  |
| ***Réponse(s) :*** *D2-D4* | | *SP* | |
|  | Si la fréquence du signal v(t) est f = 60 Hz, quelle est la fréquence de la tension u(t) ? |  |  |
| ***Réponse(s) :*** *120 Hz* | | *SP* | |
|  | Si la fréquence du signal u(t) est f = 100 Hz, quelle est la fréquence de la tension v(t) ? |  |  |
| ***Réponse(s) :*** *50 Hz* | | *SP* | |

[Retour au haut de la page](#_top)

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| --- | --- | --- | --- |
|  | Si la période du signal v(t) est T=20 ms, quelle est la période de la tension u(t) ? |  |  |
| ***Réponse(s) :*** *10 ms* | | *SP* | |
|  | Si la période du signal u(t) est T=20 ms, quelle est la période de la tension v(t) ? |  |  |
| ***Réponse(s) :*** *40 ms* | | *SP* | |
|  | Quel est le terme le plus exact pour qualifier le type de courant obtenu grâce à ce type de montage redresseur |  |  |
| ***Réponse(s) :*** *courant continu pulsé* | | *SP* | |

[Retour au haut de la page](#_top)

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| --- | --- | --- | --- |
|  | Ce type de montage redresseur permet d’obtenir un redressement ?    ⁭ mono alternance  ⁭ double alternance |  |  |
| ***Réponse(s) :*** *mono alternance* | | *SP* | |
|  | Ce type de montage redresseur permet d’obtenir un redressement ?    ⁭ mono alternance  ⁭ double alternance |  |  |
| ***Réponse(s) :*** *double alternance* | | *SP* | |

[Retour au haut de la page](#_top)

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| --- | --- | --- | --- | --- |
|  | Réaliser le schéma d’un circuit redresseur pont de Graëtz.  Représenter la source, les diodes et la charge.  Quel sera la fréquence de la tension redressée ?  Quelle modification apporteriez-vous à votre circuit pour améliorer la forme du signal redressé ? | |  |  |
| ***Réponse(s) :*** | | *f = 100 Hz ; ajouter un condensateur en // de la charge* | *SP* | |
|  | Quelle est l’allure de la tension vue par le voltmètre ? | |  |  |
| ***Réponse(s) :*** *Tension continue de 40 V* | | | *SP* | |