

### Problems related to half-wave and full-wave rectifier

1. A half-wave rectifier uses a diode with a forward resistance of  $100\ \Omega$ . If the input ac voltage is  $220\text{ V rms}$  and local resistance is  $2\text{ k}\Omega$ . Determine:  
(i)  $I_{\text{max}}$ ,  $I_{\text{dc}}$ , and  $I_{\text{rms}}$  (ii) PIV (iii) load output voltage (iv) d.c. output power and a.c. input power (v) ripple factor (vi) TUF (vii) rectification efficiency.  
*Ans: (i) 148 mA, 47 mA, and 74 (ii) 311 V (iii) 94.32 V (iv) 4.45 W, 11.5 W (v) 1.21 (vi) 0.27 (vii) 38.6%*
2. The load resistance of a centre tap full-wave rectifier is  $500\ \Omega$  and secondary voltage is  $60\sin(100\pi t)$ . Calculate (i) peak, average and rms value of current (ii) ripple factor (iii) efficiency. Each diode has an idealized I-V characteristics having slope corresponding to a resistance of  $50\ \Omega$ .  
*Ans: (i) 0.109 A, 0.069 A and 0.077 A (ii) 0.482 (iii) 73.82%*
3. A half-wave rectifier has a load resistance of  $3.5\text{ k}\Omega$ . If the diode and secondary of the transformer have a total resistance of  $800\ \Omega$  and the input voltage has an a.c. signal of  $240\text{ V}$  (peak value). Determine:  
(i) peak, average and rms value of current (ii) d.c. output power (iii) a.c. input power (iv) efficiency (iii) ripple factor.  
*Ans: (i) 55.81 mA, 17.76 mA and 27.91 mA (ii) 1.1 W (iii) 3.35 W (iv) 32.85% (v) 1.21*
4. A half-wave rectifier, having a diode of resistance  $1000\ \Omega$  and load resistance of  $1000\ \Omega$  rectifies an a.c. voltage of  $310\text{ V}$  peak value. Calculate:  
(i) peak, average and rms value of current (ii) d.c. output power (iii) a.c. input power (iv) efficiency  
*Ans: (i) 0.219 A, 0.07 A and 0.1096 A (ii) 4.868 W (iii) 24.02 W (iv) 20.26%*
5. A full-wave rectifier uses a double diode with each element having a constant forward resistance of  $500\ \Omega$ . The transformer rms secondary voltage from the centre tap to each plate is  $300\text{ V}$ , the load resistance of  $2.5\text{ k}\Omega$ . Determine:  
(i) dc out power and ac input power (ii) efficiency.  
*Ans: (i) 20.3 W and 30 W (ii) 67.67 %*
6. A single wave full-wave rectifier uses two diodes the internal resistance of each being  $20\ \Omega$ . The transformer rms secondary voltage for centre tap to each of the secondary is  $50\text{ V}$  and load resistance is  $980\ \Omega$ . Determine:  
(i) mean load current (ii) rms load current (iii) efficiency  
*Ans: (i) 45 mA (ii) 50 mA (iii) 79.58%*
7. The turn ratio of a transformer used in a half-wave rectifier is 10:1. The primary is connected to the power mains  $220\text{ V}$ . The diode resistance in forward bias is  $5\ \Omega$ . The load resistance is  $10\text{ k}\Omega$ . Determine:  
(i) dc output voltage, (ii) rms output voltage, (iii) TUF (iv) Rectification efficiency.
8. An a.c. supply of  $230\text{ V}$  is applied to a half wave rectifier circuit through a transformer of turn ratio 10:1. Find (i) the output d.c. voltage and (ii) the peak inverse voltage. Assume the diode to be ideal.  
*Ans: (i) 10.36 V (ii) 32.35*
9. A crystal diode having internal resistance  $r_f = 20\ \Omega$  is used for half wave rectification. If applied voltage  $v = 50\sin \omega t$  and load resistance  $R_L = 800\ \Omega$ , find:  
(i)  $I_m$ ,  $I_{\text{dc}}$ ,  $I_{\text{rms}}$  (ii) a.c. power input and d.c. power output (iii) d.c. output voltage (iv) efficiency  
*Ans: (i) 61 mA, 19.4 mA, 30.5 mA (ii) 0.763 W, 0.301 W (iii) 15.52 V (iv) 39.5%*
10. A half wave rectifier is used to supply  $50\text{ V d.c.}$  to a resistance load of  $800\ \Omega$ . The diode has a resistance of  $25\ \Omega$ . Calculate a.c. voltage required.  
*Ans: maximum voltage required  $V_m = 162\text{ V}$*
11. A full wave rectifier uses two diodes, the internal resistance of each diode may be assumed constant at  $20\ \Omega$ . The transformer rms secondary voltage from center tap to each end of secondary is  $50\text{ V}$  and load resistance of  $980\ \Omega$ . Find:  
(i) the mean load current (ii) the rms value of load current  
*Ans: (i) 45 mA (ii) 50 mA*

12. A full wave rectifier uses two ideal diodes. The turn ratio of a transformer used is 5:1. The primary is connected to the power mains 230V and load resistance of  $100\Omega$ . Find:  
(i) d.c. output voltage (ii) PIV (iii) rectification efficiency  
*Ans: (i) 20.7V (ii) 65 V (iii) 81.2%*
13. A half wave bridge rectifier uses four ideal diodes. The turn ratio of a transformer used is 4:1. The primary is connected to the power mains 230V, 50Hz and load resistance of  $200\Omega$ . Find:  
(i) d.c. output voltage (ii) PIV (iii) output frequency  
*Ans: (i) 52V (ii) 81.3V (iii) 100Hz*
14. The four diode used in a bridge rectifier circuit have forward resistance which may be considered constant at  $1\Omega$  and infinite reverse resistance. The alternating supply voltage is 240 V r.m.s. and load resistance is  $480\Omega$ . Calculate (i) mean load current (ii) power dissipated in each load.  
*Ans: (i) 0.45 A (ii) 0.123 W*