

21.2 Rectification and smoothing

Name: _____ Class: _____ Date: _____

Total: 27 marks

KEY WORDS rectification 整流 • bridge rectifier 桥式整流器 • diode 二极管 • smoothing 平滑
• half-wave rectification 半波整流

Objective

Build the skills to answer exam questions on **rectification** and **smoothing**.

You must be able to:

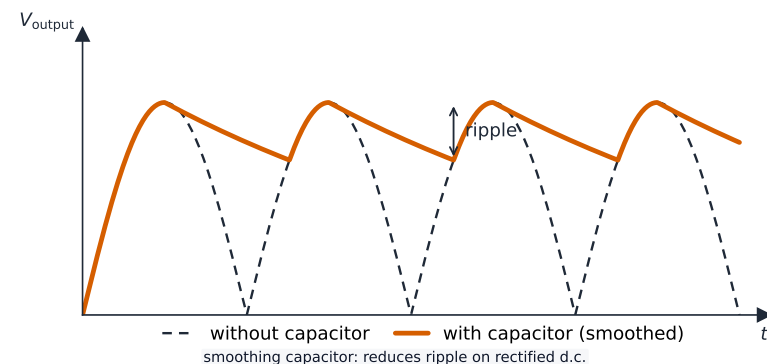
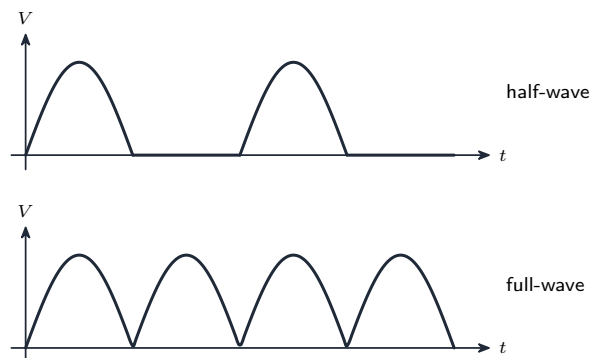
- distinguish **half-wave** and **full-wave** rectification
- explain the **single diode** and the **bridge rectifier**
- explain capacitor **smoothing**

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ Rectification

Rectification turns a.c. into one-direction (d.c.-like) voltage using **diodes**:



A smoothing capacitor after rectification

- **half-wave** (single diode): passes only positive half-cycles — half the input wasted;
- **full-wave** (4-diode **bridge rectifier**): uses every half-cycle, giving continuous humps at **twice** the frequency.

■ Smoothing

A **capacitor** across the load charges on each peak and discharges through the load in the gaps, reducing the **ripple**. A **larger** capacitance (or larger load resistance) gives **smoother** output (larger time constant RC).

2 Practice

Now apply the methods above.

2.1 State what **rectification** does. [1]

2.2 State how many **diodes** a bridge rectifier uses. [1]

2.3 State the difference between **half-wave** and **full-wave** output. [2]

2.4 State the purpose of a **smoothing capacitor**. [1]

3 Exam-style questions

3.1 A **single diode** in series with a load produces: [1]

- | | |
|---|---|
| A | B |
| C | D |
- A full-wave rectification
B half-wave rectification
C smoothed d.c.
D alternating current

3.2 Explain how a single diode produces **half-wave** rectification. [2]

3.3 Describe how a **bridge rectifier** (four diodes) achieves **full-wave** rectification. [3]

3.4 Explain how a **capacitor** smooths the output, and what happens to the smoothing if the **capacitance is increased**. [3]

3.5 A bridge rectifier is built from four diodes and supplied with a sinusoidal input of peak voltage 12 V. The input completes 8 cycles in 2.8 s.

(a) **State** what is meant by **rectification**, and name the type produced by a bridge rectifier. [2]

(b) **Show that** the period of the input is 0.35 s. [1]

(c) **Calculate** the root-mean-square input voltage. [2]

(d) In the space below, **sketch** the output voltage V_{OUT} across the load against time, from $t = 0$ to $t = 0.35$ s. **Label** both axes with values. [3]

(e) A large capacitor is now connected **across the load**. On the same sketch, **draw** the new output and **explain** its shape. [3]

(f) **State and explain** the effect on the smoothed output of (i) using a larger capacitance, and (ii) connecting a smaller load resistance. [2]