Python classes guide

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classes in python all concept

Here is **the complete, beginner-to-advanced, interview-level guide to Python Classes and OOP concepts** — explained clearly with examples.

✅ PYTHON CLASSES — COMPLETE GUIDE (Beginner → Advanced)

🔵 1. What is a Class?

A **class** is a blueprint/template for creating objects (instances).

python

```
class Student:
    pass
```

🔵 2. What is an Object?

An **object** is an instance of a class.

python

```
s1 = Student()
s2 = Student()
```

🔵 3. The `__init__` Constructor

Runs automatically when an object is created.

```python
class Student:
    def __init__(self, name, age):
        self.name = name
        self.age = age

s = Student("Aamir", 21)
```

✔ `self` → refers to the current object
✔ attributes stored as `self.name`, `self.age`

🔵 4. Class Attributes vs Instance Attributes

✔ Instance Attribute

Different for each object.

```python
class Car:
    def __init__(self, color):
        self.color = color
```

✔ Class Attribute

Shared by ALL objects.

```
python
```

```
class Car:
    wheels = 4   # class attribute
```

🔵 5. Methods in Classes

✔ Instance Method

Works on object data.

```
python
```

```
class Car:
    def start(self):
        print("Car started")
```

✔ Class Method (uses `@classmethod`)

Works on class data.

```python
class Car:
    wheels = 4

    @classmethod
    def change_wheels(cls, w):
        cls.wheels = w
```

✔ Static Method (uses `@staticmethod`)

Independent function inside class.

```python
class Math:
    @staticmethod
    def add(a, b):
        return a + b
```

🔵 6. Encapsulation (Hiding Data)

✔ Public

```python
self.name
```

✔ Protected (`_variable`)

```python
self._age = 20
```

✔ Private (`__variable`)

```python
self.__salary = 50000
```

Private variables can be accessed using:

python

```
object._ClassName__variable
```

🔵 7. Getters and Setters

python

```
class Emp:
    def __init__(self, salary):
        self.__salary = salary

    def get_salary(self):
        return self.__salary

    def set_salary(self, salary):
        if salary > 0:
            self.__salary = salary
```

🔵 8. Inheritance (Extending Classes)

✔ Single Inheritance

```
python
```

```
class A:
    pass

class B(A):
    pass
```

✔ Multilevel Inheritance

```
python
```

```
class A: pass
class B(A): pass
class C(B): pass
```

✔ Multiple Inheritance

```python
class A: pass
class B: pass
class C(A, B): pass
```

🔵 9. `super()` Keyword

Used to call parent class constructor or methods.

```python
class A:
    def __init__(self):
        print("A constructor")

class B(A):
    def __init__(self):
        super().__init__()
        print("B constructor")
```

🔵 10. Method Overriding

Child class replaces parent method.

python

```
class A:
    def show(self):
        print("A show")

class B(A):
    def show(self):
        print("B show")
```

🔵 11. Polymorphism

Same method, different behavior.

python

```
for obj in [A(), B()]:
    obj.show()
```

🔵 12. Abstract Classes — `abc` Module

```
python



from abc import ABC, abstractmethod

class Animal(ABC):

    @abstractmethod
    def sound(self):
        pass
```

Cannot create object of abstract class.

🔵 13. Dataclasses (Python 3.7+)

Auto-creates init, repr, eq, etc.

```
python



from dataclasses import dataclass

@dataclass
class Student:
    name: str
    age: int
```

🔵 14. Magic/Dunder Methods

Special methods starting with `__`.

Method	Purpose
`__init__`	constructor

Method	Purpose
`__str__`	string representation
`__len__`	length
`__add__`	+ operator
`__getitem__`	indexing
`__call__`	make object callable

Example:

```
python

class Box:
    def __init__(self, volume):
        self.volume = volume

    def __add__(self, other):
        return self.volume + other.volume
```

🔵 15. Composition (HAS-A Relationship)

```
python

class Engine:
    pass

class Car:
    def __init__(self):
        self.engine = Engine()  # Car HAS a Engine
```

🔵 16. Class Documentation (`__doc__`)

python

```
class A:
    """This is class A"""
```

🔵 17. Nested Classes

python

```
class A:
    class B:
        pass
```

🔵 18. Private Methods

python

```
class A:
    def __secret(self):
        print("secret")
```

🔵 19. Property Decorator (Modern Getter/Setter)

```python
class Student:
    @property
    def name(self):
        return self._name

    @name.setter
    def name(self, value):
        self._name = value
```

🔵 20. Singleton Class (Only 1 object allowed)

```python
class Single:
    _instance = None
    def __new__(cls):
        if cls._instance is None:
            cls._instance = super().__new__(cls)
        return cls._instance
```

🎉 Done! This is the complete Python classes & OOP guide.

If you want, I can next provide:

✅ **Python Classes — 100 Interview Questions**
✅ **Python OOP Practice Problems**
✅ **PDF version**
✅ **Explain with real-world examples (Bank, Library, ATM, etc.)**

Just tell me!

regarding interview questions and ans with proper explanation

Great! Here are **TOP Python OOP/Class interview questions with answers + proper explanations** (Beginner → Advanced).
These are the most asked questions in **FAANG, product-based, and service-based** interviews.

✅ PYTHON OOP & CLASSES — INTERVIEW Q&A (With Explanation)

🔵 1. What is a Class in Python?

✅ Answer:

A class is a **blueprint** for creating objects. It defines the properties (variables) and behaviors (methods).

🧠 Explanation:

Just like a blueprint defines how a house looks, a class defines how objects behave.

```python
class Student:
    pass
```

🔵 2. What is an Object?

✅ Answer:

An object is an **instance** of a class.

```
python
```

```
s = Student()
```

🧠 Explanation:

Object = real entity created from class.
Class = design, Object = actual product.

🔵 3. What is the `__init__` method?

✅ Answer:

`__init__` is a constructor that initializes object attributes.

```
python
```

```
class Student:
    def __init__(self, name):
        self.name = name
```

🧠 Explanation:

Runs automatically when object is created.

🔵 4. What is the difference between a Class Variable and Instance Variable?

✅ Answer:

Type	Stored where?	Shared?
Instance Variable	inside object	❌ No
Class Variable	inside class	✔ Yes (shared)

Example:

```
python




class Car:
    wheels = 4  # class variable
    def __init__(self, color):
        self.color = color  # instance var
```

🔵 5. What is `self` in Python?

✅ Answer:

`self` refers to the **current object**.

🧠 Explanation:

Every object keeps its own data: `self.name`, `self.age`.

🔵 6. What is Inheritance?

✅ Answer:

Inheritance allows a class (child) to get features of another class (parent).

```
python
```

```
class A:
    pass

class B(A):
    pass
```

🧠 Explanation:

Used for code reuse & building hierarchies.

🔵 7. Types of Inheritance in Python

✔ Single

✔ Multiple

✔ Multilevel

✔ Hierarchical

✔ Hybrid

Python supports **all types**.

🔵 8. What is Method Overriding?

✅ Answer:

When a child class redefines a method from parent.

python

```
class A:
    def show(self):
        print("A")

class B(A):
    def show(self):
        print("B")
```

🧠 Explanation:

Used in polymorphism — different behavior for same method.

🔵 9. What is Polymorphism?

✅ Answer:

Same function name but different behavior.

Example:

python

```
for obj in [A(), B()]:
    obj.show()
```

🔵 10. What is `super()` used for?

✅ Answer:

`super()` is used to call parent class methods/constructor.

```
python
```

```
class B(A):
    def __init__(self):
        super().__init__()
```

🧠 Explanation:

Used in inheritance to avoid duplicating code.

🔵 11. What is Encapsulation?

✅ Answer:

Encapsulation means **hiding internal data** using:

- Public
- Protected: `_var`
- Private: `__var`

```
python
```

```
self.__salary = 50000
```

🔵 12. What are Getters and Setters?

Example:

```
python



class Emp:
    def get_salary(self):
        return self.__salary

    def set_salary(self, value):
        self.__salary = value
```

🧠 Explanation:

Used to **control access** to private variables.

🔵 13. What is an Abstract Class?

Uses `ABC` module.

Example:

```
python



from abc import ABC, abstractmethod

class Animal(ABC):
    @abstractmethod
    def sound(self):
        pass
```

Explanation:

Cannot create object of abstract class.
Used for defining structure.

🔵 14. What is a Static Method?

```
python




class A:
    @staticmethod
    def add(a, b):
        return a + b
```

✔ No `self`
✔ Works like normal function inside class

🔵 15. What is a Class Method?

```
python




class A:
    count = 0

    @classmethod
    def increment(cls):
        cls.count += 1
```

✔ uses `cls`
✔ works on class variables

🔵 16. What is Multiple Inheritance?

Example:

python

```
class A: pass
class B: pass
class C(A, B): pass
```

Python supports it using **MRO** (Method Resolution Order).

🔵 17. What is MRO in Python?

✅ Answer:

MRO = Order in which Python searches for methods in multiple inheritance.

Check using:

python

```
print(C.mro())
```

Python uses **C3 Linearization**.

🔵 18. What is Operator Overloading?

Example:

```
python

class Box:
    def __init__(self, v):
        self.v = v

    def __add__(self, other):
        return self.v + other.v
```

✔ Allows +, -, *, == to work for objects.

🔵 19. What are Magic/Dunder Methods?

Examples:

- `__init__`
- `__str__`
- `__len__`
- `__add__`
- `__getitem__`
- `__call__`

Explanation:

These allow objects to behave like built-in types.

🔵 20. What is a Dataclass?

Example:

```
python
```

```
from dataclasses import dataclass
@dataclass
class Student:
    name: str
    age: int
```

Provides:

- auto `__init__`
- auto `__repr__`
- auto `__eq__`

🔵 21. Difference between Composition & Inheritance?

✔ Inheritance (IS-A relationship)

Car **is a** Vehicle.

✔ Composition (HAS-A relationship)

Car **has an** Engine.

Example:

python

```
class Engine: pass
class Car:
    def __init__(self):
        self.engine = Engine()
```

🔵 22. What is a Singleton Class?

Allows only **one object**.

python

```
class Single:
    _inst = None
    def __new__(cls):
        if cls._inst is None:
            cls._inst = super().__new__(cls)
        return cls._inst
```

🔵 23. What is Duck Typing?

"If it walks like a duck and quacks like a duck, it is a duck."

python

```
class Bird:
    def fly(self):
        print("Flying")

class Airplane:
    def fly(self):
        print("Airplane flying")
```

Both can be passed to a function expecting `.fly()`.

🔵 24. What is difference between `__str__` and `__repr__`?

python

```
__str__  → human readable
__repr__ → developer/debug readable
```

🔵 25. Can Python have private constructors?

Yes using:

python

```
def __init__(self):
    raise Exception("Cannot create object")
```

or
Singleton pattern.

🎉 Done!

These were the **top 25 OOP/Class interview questions** with clear explanations.

Want more?

I can generate:

✅ **50 questions**
✅ **100 questions**
✅ **PDF version**
✅ **Coding problems on OOP**

Just tell me what you want!

exception handling all concept explain

Here is the **complete, beginner → advanced guide to Python Exception Handling**, explained in a clear, interview-friendly way with examples.
This covers **ALL concepts** you may need for interviews, coding rounds, and real-world development.

✅ PYTHON EXCEPTION HANDLING — FULL GUIDE (All Concepts)

🔵 1. What is an Exception?

An **exception** is an error that occurs at runtime and stops program execution.

Examples:

- ZeroDivisionError
- TypeError
- IndexError
- KeyError
- FileNotFoundError

```python
a = 10 / 0   # ZeroDivisionError
```

🔵 2. Why Use Exception Handling?

✔ Prevent program crash
✔ Show proper error messages
✔ Continue program execution
✔ Handle unexpected situations gracefully

🔵 3. `try` and `except` — Basic Structure

```python
try:
    x = 10 / 0
except ZeroDivisionError:
    print("Cannot divide by zero")
```

🔵 4. Catching Multiple Exceptions

Method 1 — Separate blocks

python

```
try:
    x = int("A")
except ValueError:
    print("Value error")
except TypeError:
    print("Type error")
```

Method 2 — Using a tuple

python

```
try:
    x = 10 / 0
except (ZeroDivisionError, ValueError):
    print("Error occurred")
```

🔵 5. Generic Exception Handling

```
python
```

```
try:
    x = 10 / 0
except Exception as e:
    print("Error:", e)
```

✔ `Exception` catches all errors
✔ Good for logging, debugging

🔵 6. `else` Block in Exceptions

Runs **only if no exception occurs**.

```
python
```

```
try:
    print("No error")
except:
    print("Error")
else:
    print("Else block executed")
```

🔵 7. `finally` Block

Runs **always**, whether exception occurs or not.

Used for resource cleanup:

- closing file
- closing DB connection

python

```
try:
    f = open("test.txt")
except:
    print("Error opening file")
finally:
    print("File handling complete")
```

🔵 8. Raising Exceptions Manually (`raise`)

python

```
def check_age(age):
    if age < 18:
        raise ValueError("Age must be 18+")
    return "Valid age"
```

🔵 9. Custom User-Defined Exceptions

Step 1: Create class

python

```
class NegativeValueError(Exception):
    pass
```

Step 2: Use it

python

```python
def set_price(p):
    if p < 0:
        raise NegativeValueError("Price cannot be negative")
```

🔵 10. Nested `try-except`

python

```python
try:
    try:
        x = 10 / 0
    except ZeroDivisionError:
        print("Inner exception")
except Exception:
    print("Outer exception")
```

🔵 11. Exception Chaining (`raise ... from`)

python

```
try:
    int("abc")
except ValueError as e:
    raise RuntimeError("Failed to convert") from e
```

Useful for debugging, shows parent-child exception.

🔵 12. `assert` — Debugging Tool

python

```
x = -1
assert x >= 0, "Number must be positive"
```

If condition fails → AssertionError.

🔵 13. Logging Exceptions (Best Practice)

```
python




import logging

try:
    x = 10 / 0
except Exception as e:
    logging.error("Error occurred: %s", e)
```

Used in production applications.

🔵 14. Handling File Exceptions

```
python




try:
    f = open("abc.txt")
    data = f.read()
except FileNotFoundError:
    print("File not found")
finally:
    f.close()
```

🔵 15. Exception Handling with Loops

```
python




for i in range(5):
    try:
        print(10 / i)
    except ZeroDivisionError:
        print("Cannot divide by zero")
```

🔵 16. Multiple Except + One Finally

```
python




try:
    x = int(input("Enter number: "))
except ValueError:
    print("Enter valid integer")
except Exception:
    print("Some other error")
finally:
    print("Always executed")
```

🔵 17. Avoiding Empty Exception Blocks (Bad Practice)

❌ Wrong:

python

```
try:
    x = 10 / 0
except:
    pass
```

✔ Hides bugs
✔ Hard to debug

🔵 18. Exception vs Error (Difference)

Exception	Error
Recoverable	Non-Recoverable
Can catch using try	Cannot be caught
Example: ValueError	Example: MemoryError

🔵 19. Built-in Exception Hierarchy (Important for Interviews)

```php
php




BaseException
 ├── SystemExit
 ├── KeyboardInterrupt
 ├── Exception
      ├── ArithmeticError
      │      └── ZeroDivisionError
      ├── LookupError
      │      ├── IndexError
      │      └── KeyError
      ├── ValueError
      ├── TypeError
      ├── FileNotFoundError
      └── ...
```

🔵 20. Best Practices in Exception Handling

✔ Catch specific exceptions
✔ Use finally to close resources
✔ Never use empty except
✔ Raise exceptions when input invalid
✔ Log errors for debugging
✔ Keep exception messages clear

🎉 Done! All Python Exception Handling concepts covered successfully.

Want more?

I can provide:

✅ 50+ Exception Handling Interview Questions
✅ Practice Questions & Coding Problems
✅ Real-world example scenarios (Bank, File System, ATM, API)
✅ PDF notes

Just tell me!

read write all file handling

Here is the **complete, beginner → advanced explanation of Python File Handling**, including **read/write modes, all functions, examples, best practices, and interview-level concepts**.

✅ PYTHON FILE HANDLING — COMPLETE GUIDE

Python uses the built-in `open()` function to work with files.

🔵 1. Opening a File

```
python
```

```
file = open("data.txt", "r")
```

Syntax:

```
python
```

```
open(filename, mode)
```

🔵 2. File Modes (VERY IMPORTANT)

Mode	Meaning	use-case
`r`	read (file must exist)	reading
`w`	write (overwrites)	create new / replace
`a`	append	add data at end
`x`	create file (error if exists)	safe creation

Mode	Meaning	use-case
`r+`	read + write (no overwrite)	update file
`w+`	write + read (overwrite)	recreate + read
`a+`	append + read	add & read

🔵 3. Reading a File

✔ `read()` — Read entire file

```
python
```

```
f = open("data.txt","r")
data = f.read()
print(data)
f.close()
```

✔ `read(n)` — Read n characters

```
python
```

```
f.read(5)
```

✔ `readline()` — Read one line

python

```
line = f.readline()
```

✔ `readlines()` — Read all lines into a list

python

```
lines = f.readlines()
```

🔵 4. Writing to File

✔ `write()`

python

```
f = open("data.txt","w")
f.write("Hello World")
f.close()
```

`w` overwrites file.

✔ `writelines()` — write list of lines

```python
f.writelines(["Aamir\n", "Hussain\n", "Azad\n"])
```

🔵 5. Append to a File

```python
f = open("data.txt","a")
f.write("New Line Added\n")
f.close()
```

✔ Does NOT overwrite
✔ Always adds at bottom

🔵 6. BEST PRACTICE — using `with open()`

No need to close file manually.

```python
with open("data.txt", "r") as f:
    content = f.read()
```

Python automatically closes the file.

🔵 7. Reading File Line by Line (Efficient)

Method 1

python

```
with open("data.txt") as f:
    for line in f:
        print(line)
```

Method 2

python

```
while True:
    line = f.readline()
    if not line:
        break
```

🔵 8. File Pointer / `tell()` and `seek()`

✔ `tell()` — current position

```python
pos = f.tell()
```

✔ `seek()` — move pointer

```python
f.seek(0)  # move to beginning
```

Useful in large files and logs.

🔵 9. Working With Binary Files

Read binary

```python
with open("image.jpg","rb") as f:
    data = f.read()
```

Write binary

python

```
with open("copy.jpg","wb") as f:
    f.write(data)
```

Binary = images, videos, PDF, MP3

🔵 10. Check If File Exists

Using `os.path`:

python

```
import os

if os.path.exists("data.txt"):
    print("File exists")
```

🔵 11. Delete a File

python

```
os.remove("data.txt")
```

🔵 12. Rename a File

python

```
os.rename("old.txt", "new.txt")
```

🔵 13. Exceptions in File Handling

python

```
try:
    f = open("abc.txt")
except FileNotFoundError:
    print("File does not exist")
```

Very important for interviews.

🔵 14. JSON File Read/Write

---

python

```
import json

data = {"name":"Aamir","age":21}

# Write JSON
with open("data.json","w") as f:
    json.dump(data,f)

# Read JSON
with open("data.json","r") as f:
    result = json.load(f)
```

🔵 15. CSV File Read/Write

---

python

```
import csv

# Write CSV
with open("emp.csv","w",newline="") as f:
    wr = csv.writer(f)
    wr.writerow(["Name","Age"])
    wr.writerow(["Aamir",21])

# Read CSV
with open("emp.csv") as f:
    rd = csv.reader(f)
    for row in rd:
        print(row)
```

🔵 16. File Handling Interview Questions (Quick List)

---

1. Difference between `read`, `readline`, `readlines`
2. What is the use of `seek()`?
3. What happens if file opened in `w` mode?
4. Difference between `w` and `a` mode
5. How to safely open file? (using `with`)
6. What is binary mode?
7. What is `tell()` used for?
8. What is file pointer?
9. How to handle file not found?
10. Read large files efficiently?

I can provide **answers to all these** if you want.

🎉 You now know ALL File Handling concepts in Python — beginner to advanced.

Want next?

✅ File Handling Interview Questions + Answers
✅ File Handling Practice Problems
✅ Real-world tasks (log reader, CSV analyzer, save user data, etc.)
Just tell me!