**[Que-50.10] - Explain the concept of ensemble learning.**

Ensemble learning is a machine learning paradigm where multiple models, often referred to as "weak learners," are trained and combined to solve a particular problem. The primary goal is to improve the overall performance, robustness, and generalizability of the model compared to individual models. The combination of predictions from multiple models usually leads to better accuracy and reliability.

### **Key Concepts in Ensemble Learning**

1. **Weak Learner**:
   * A model that performs slightly better than random guessing.
   * Examples: Shallow decision trees, simple linear models.
2. **Strong Learner**:
   * A model that is a combination of weak learners and performs better than any individual weak learner.

### **Types of Ensemble Learning Techniques**

1. **Bagging (Bootstrap Aggregating)**:
   * A technique where multiple models are trained independently using different subsets of the training data obtained through bootstrapping (random sampling with replacement).
   * The final prediction is made by averaging the predictions (regression) or majority voting (classification) from all models.
2. **Boosting**:
   * A technique where models are trained sequentially, each new model focusing on correcting the errors made by the previous ones.
   * The final prediction is a weighted sum of the predictions from all models.
   * Examples: AdaBoost, Gradient Boosting, XGBoost.
3. **Stacking (Stacked Generalization)**:
   * A technique where multiple models (base learners) are trained, and a meta-model (stacker) is trained on their outputs to make the final prediction.
   * Base learners are trained in parallel, and their predictions are combined as input features for the meta-model.