2 marks:

1. Define ANOVA.

* Analysis of variance (ANOVA) is the separation of variance ascribable to one group of causes from the variance ascribable to other groups

* It is nothing but an arithmetical procedure, used to express the total variation of data, as the sum of its non-negative components.

2. Uses of ANOVA.

* Analysis of Variance (ANOVA) is a statistical formula used to compare variances across the means of different groups.

* It helps to find out the F-test.

* To test the homogeneity of several means.

3. Assumptions involved in ANOVA.

* The observations are independent.

* Parent population from which observations are taken is normal.

* Various treatment and environmental effects are additive, in nature.

4. ANOVA table for One Way Classification.

| Source of Variation | Sum of squares | Degrees of freedom | Mean sum of squares | Variance ratio | Table value |
|---|---|---|---|---|---|
| Between columns | SSC | C-1 | $MSC = \frac{SSC}{C-1}$ | $F = \frac{MSC}{MSE}$ or $F = \frac{MSE}{MSC}$ | |
| ~~Between~~ Errors. | SSE | N-C | $MSE = \frac{SSE}{N-C}$ | | |

5. ANOVA table for Two Way Classification.

| Source of variation | Sum of Squares | Degrees of freedom | Mean Square | Variance ratio | Table value |
|---|---|---|---|---|---|
| Between Columns | SSC | $C-1$ | $MSC = \frac{SSC}{C-1}$ | $F_C = \frac{MSC}{MSE}$ or $F_C = \frac{MSE}{MSC}$ | |
| Between Rows | SSR | $r-1$ | $MSR = \frac{SSR}{r-1}$ | $F_R = \frac{MSR}{MSE}$ or $F_R = \frac{MSE}{MSR}$ | |
| Error | SSE | $(C-1)(r-1)$ | $MSE = \frac{SSE}{(C-1)(r-1)}$ | | |

6. ANOVA table for Latin Square.

| Source of variation | Sum of Squares | Degrees of freedom | Mean Square | Variance ratio | Table value |
|---|---|---|---|---|---|
| Between Columns | SSC | $k-1$ | $MSC = \frac{SSC}{k-1}$ | $F_C = \frac{MSC}{MSE}$ or $\frac{MSE}{MSC}$ | |
| Between Rows | SSR | $k-1$ | $MSR = \frac{SSR}{k-1}$ | $F_R = \frac{MSR}{MSE}$ or $\frac{MSE}{MSR}$ | |
| Between Treatments | SSK | $k-1$ | $MSK = \frac{SSK}{k-1}$ | $F_T = \frac{MSK}{MSE}$ or $\frac{MSE}{MSK}$ | |
| Errors | SSE | $(k-1)(k-2)$ | $MSE = \frac{SSE}{(k-1)(k-2)}$ | | |

7. Basic Principles in the design of experiments.

There are 3 basic principles of experimental design, they are

* Randomization
* Replication
* Local control

1. Randomization:

* A set of objects is said to be randomized, when they are arranged in random order.
* The most frequently used assumption is the one which relates the observations (units) are independent.

2. Replication

* The independent execution of an experiment more than once is called replication.

* It is necessary to increase the accuracy of estimates of the treatment effects.

This includes techniques such as grouping, blocking and balancing of experimental units used in the experimental design.

3. Local control

This includes techniques such as grouping, blocking and balancing of experimental units used in the experimental design.

8. Advantages of CRD.

* It is easy to layout the design.

* It allows for complete flexibility. Any number of factor classes and replications may be used.

* The statistical analysis is relatively simple, even if we do not have the same number of replicates for each factor class or if the experimental errors are not the same from class to class of this factor.

* The method of analysis remains simple, when data are missing or rejected and the loss of information due to missing data is smaller than any other design.

9. Applications of CRD.

* Completely randomised design is more useful in laboratory technique and methodological studies.

* CRD is also recommended in situations where an appreciable fraction of units is likely to be destroyed or fail to respond.

10. Define Latin Square.

Latin squares are very extensively used in agricultural trials in order to eliminate fertility trends in two directions, simultaneously. The data are classified according to the different criteria, (i.e) according to columns, rows and varieties and are arranged in a square known as Latin square.

11. Advantages of Latin Square.

* Latin square design controls variation in two directions of the experimental material as rows and columns resulting in the reduction of experimental error.
* The analysis of remains relatively simple even with missing data.
* The analysis of the design results in a three-way classification of analysis of variance.

12. Assumptions of Latin Square.

The Latin Square model assumes that interactions between treatments and row and column grouping are non-existent. Since, each treatment occurs only once in each row or column, if interactions are present, it is possible for them to cause an apparently significant difference between treatments.

13. Compare LSD and RBD.

| LSD | RBD |
|---|---|
| * It is suitable for small number of treatments, between 5 and 12. | * No such restrictions suitable for upto 24 treatments. |
| * The number of rows and columns are equal and hence, the number of replication is equal to the number of treatments. | * There is no such restrictions. It can have any number replications and treatments. |
| * Variation is controlled in two directions. | * Variation is controlled in one direction only. |
| * Experimental area must be a square. | * Suitable, if it is a rectangle or square. |