(1) Define each of them of the following terms, Confounding ,Nested design and Split- plot design

(2) Write a linear model representing split- plot design and explain each component of the model

(3) Write R program to carry out the analysis of two factor- factorial design assuming the factors under consideration are A and B with both factor having 5 levels of treatremant

(4) A company that produces seasoning oils from ginger roots at three production plants uses four different grades of the roots. The management suspects that the yields from the four grades of roots are different. Since the skills at the plants vary, a study was carried out with each production plant processing the four grades of roots in unequal replicates. Three different batches of the four grades of root were used at the three plants. The data show percentage yield: Analyze the data. Based on incomplete unbalanced Two-Stage Nested Design

Production plants	**I**				**II**				**III**			
Root grades	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
	20	20	33	22	22	40	21	41	28	19	30	29
	21	27	41	24	23	38	36	43	26	32	35	38
	30	32	36	31	28	33	34	44	24	25	37	40
	47			28	24			41	21			27

(5) For 2^4 factorial experiments describes a study on the yield of maize production based on four factors. The factors studied and their levels are as follows:

Factors	**Low level (-)**	**High level (+)**
A: amount of rainfall (mm)	87	93
B: amount of fertilizer (min)	15	30
C: soil Ph value	35	45
D: temperature (^{o}C)	60	70

(i) Write the treatment combinations

(ii) Set up the 2^4 experiment in this problem in two blocks with ABCD confounded.

(iii) Analyze the data from this design and Is comment on the largeness block effect

(6) A 2^3 factorial experiment was carried out on methods of cultivating sunflower. The factors were

(i) Fertilizers applied in spring or summer

(ii) Spraying or nonspraying

(iii) Irrigation or lack of irrigation

The experiment was performed twice, and the percentage of poor quality sunflower was observed in each case. Analyze the data fully, stating your conclusions clearly. Suggest the treatment combinations that are significant. [10 marks]

		Spring		Summer	
	Replicate	Spray	Nonspray	Spray	Nonspray
Irrigated	1	20.5	28.7	26.2	37.5
	2	19.7	31.3	29.9	35
Nonirrigated	1	24.8	21.8	19.7	29.4
	2	26.5	26	27.0	26.6