[179] SEAT No._____ No. of Pages To Be Printed: 02

SARDAR PATEL UNIVERSITY

M.Sc. (Applied Statistics),Semester III

PS03EAST21: (Planning and Analysis of Industrial Experiments)

22nd October 2018, Monday

Time: 02:00 PM to 05:00 PM **Total Marks: 70**

Q.1) Multiple Choice Questions. [38]

1) For which values of N (No. of experimental runs) Placket-Burman Designs are NOT of interest?

a. 12 b. 18 c. 20 d. 28

2) The most efficient way to model a quadratic relationship is through .....

a. Response Surface Design
b. 3^k Factorial Design
c. Plackett-Burman Design
d. Fractional Factorial Design

3) Which of these is NOT true for higher level "L" designs?

a. They retain plenty of information about main effects in less no. of runs
b. They provide plenty of information about interaction effects
c. They are orthogonal arrays
d. They require more runs than a 2^{k-p} Design

4) A 2^{3-1} fractional factorial design is most commonly, of .....

a. Resolution III
b. Resolution IV
c. Resolution V
d. None of the above

5) How many latin square designs formed with the letters A, B, C, D?

a. 144 b. 254 c. 121 d. None of the above

6) Consider 2^3 experiment with r = 2. If SSE = 18020.50 then SE(Effect) is;

a. 21.73
b. 22.73
c. 23.73
d. None of above

7) If TSS=800 and RSS=690 with corresponding degrees of freedoms 11 and 5 respectively, then the adj. R^2 is .....

a. 0.7056 b. 0.6979 c. 0.7256 d. 0.7479

8) If total of responses for treatments in a 2^2 - factorial experiment with factor A and B from three replications are, $[a_0b_0] = 18$, $[a_1b_0] = 17$, $[a_0b_1] = 25$ and $[a_1b_1] = 30$ then sum of square due to interaction AB equal to;

a. 4 b. 6 c. 3 d. None of above

Q.2) Answer any seven. [14]

i) Give the geometrical representation of first order interaction effects in 2^3 factorial experiments.

ii) List the rule to construct sign table in three level factorial experiments.

iii) List reasons to construct confounded factorial experiments.

iv) Discuss method to obtain single missing value in randomized block design.

v) What do you mean by design resolution?

vi) Discuss the key principles of the use of fractional factorial designs.

vii) Discuss advantages and disadvantages of three-level and mixed-level "L" Designs.

viii) Briefly discuss about the location of a stationary point.

ix) What is Rotatability?

Q.3)a) Estimate the model parameters of ANCOVA for one way classification with single concomitant variable under unrestricted and restricted treatment effects. [06]

b) Discuss Taguchi loss function and give orthogonal array of L4 and L8 designs. [06]

=OR=

b) A chemical engineer is investigating the yield of process. The process variable are of interest; temperature, pressure, concentration. The engineer decides to run a 2^3-design with the four center points. The all treatment combination and corresponding yield is given as follow: [06]

$$X=\begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ -1 & 1 & -1 & 1 & -1 & 1 & -1 & 1 & 0 & 0 & 0 & 0 \\ -1 & -1 & 1 & 1 & -1 & -1 & 1 & 1 & 0 & 0 & 0 & 0 \\ -1 & -1 & -1 & -1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Y	=	32	46	57	65	36	48	57	68	50	44	53	56

Fit the regression model for the given data.

Q.4)a) Give geometrical view of 3^3 factorial experiments. Discuss Yates method to compute factorial total of effects for two factors each at three levels. [06]

b) What is confounding? List advantages and disadvantages of confounding. Construct $(2^5, 2^3)$ signally replicated factorial experiment by confounding ABC and BDE interactions. [06]

=OR=

b) Construct $(2^5, 2^3)$ balanced factorial arrangement in five replications so that main effects and first order interactions remains unconfounded while $(1/5)^{th}$ of information on each of the 2^{nd} and 3^{rd} order interaction is lost. [06]

Q.5)a) Discuss canonical analysis. [06]

b) Briefly discuss the analysis of the second order response surface model. [06]

=OR=

b) What do you mean by the Box-Behnken Design? How is it different from the Central Composite Design? [06]

Q.6)a) Discuss the Alias Structures in Fractional Factorial of complex designs. [06]

b) Write a short note on Plackett-Burman Designs. [06]

=OR=

b) Discuss the 3^{4-2} Design in detail. [06]

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