Reg. No. :

Question Paper Code: 49214

M.E. DEGREE EXAMINATION, DECEMBER 2014.

First Semester

CAD / CAM

14PCD522 – DESIGN AND ANALYSIS OF EXPERIMENTS

(Regulation 2014)

(Use of F table for α = 0.10, 0.05 and 0.01 is permitted)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions.

PART A - (5 x 1 = 5 Marks)

1. Which of the following is not a terminology of DOE

    (a) Replication   (b) Interaction   (c) Levels   (d) Range

2. Find the odd one from quantitative factors

    (a) Weight   (b) Pressure   (c) Temperature   (d) Accuracy

3. The diagram used to quickly find out central tendency of any observations is

    (a) Histogram   (b) Normal plot   (c) Dot diagram   (d) Response surface

4. What does PRESS stand for

    (a) Predicted end surface stress

    (b) Present error sum of squares

    (c) Predicted error sum of squares

    (d) Preset error sum of squares

5. In a complete factorial design if number of factors 4 with 3 levels has 162 total numbers of runs then the number of replications will be

    (a) 1   (b) 2   (c) 3   (d) 4

6. List and contrast the characteristics of population parameters and sample statistics.

7. Obtain relative efficiency of RBD in comparison to CRD.

8. Describe the concept of confounding in factorial experiments?

9. Give details on the use of response surface designs.

10. Write about three basic principles of statistical DOE.

PART - C (5 x 16 = 80 Marks)

11. (a) Express the importance of statistics in experimentation; also explain three basic steps in the statistical design and analysis of experiment. (16)

Or

(b) The population mean and standard deviation of typical cetane numbers measured on fuels used in compression–ignition engines is known to be $\mu = 30$ and $\sigma = 5$. Fifteen random samples of these fuels were taken from the relevant fuel population, and the sample means and standard deviations were calculated. This random sampling procedure was repeated (replicated) nine times.

Replicate No.	n	Sample mean	Sample Standard Deviation
1	15	32.61	4.64
2	15	28.57	6.49
3	15	29.66	4.68
4	15	30.09	5.35
5	15	30.11	6.39
6	15	28.02	4.05
7	15	30.09	5.35
8	15	29.08	3.56
9	15	28.91	4.88

Consider the population of all sample means of size $n = 15$. What proportion of means from this population should be expected to be between the 30 ± 5 limits? How does this sample of nine averages compare with what should be expected? (16)

12. (a) An experiment was conducted to determine if either firing temperature or furnace position affects baked density of carbon anode. The data are shown below:

Position	Temperature (°C)		
	800	825	850
1	570	1063	565
	565	1080	510
	583	1043	590
2	528	988	526
	547	1026	538
	521	1004	532

Suppose we assume that no interaction exists. Write down statistical model. Conduct the analysis of variance and test hypotheses on the main effects. What conclusions can be drawn? Comment on the model's adequacy. (16)

Or

(b) (i) Describe the analysis of a completely Randomized Design with k observations percell. (8)

(ii) Develop the analysis of covariance for randomized block design with one concomitant variable, stating clearly the assumptions. (8)

13. (a) Construct a 2^3 design with *ABC* confounded in the first two replicates and *BC* confounded in the third. Outline the analysis of variance and comment on the information obtained. (16)

Or

(b) Generate 2^k complete factorial design for confounded design with four blocks. Each factor has 2 treatments. (16)

14. (a) Enlighten first order model of response surface method. Discuss in detail on any two types of RSM design. (16)

Or

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(b) List and explain the following models of mixture experiment:

(i) Linear model

(ii) Quadratic polynomial model

(iii) Full cubic model

(iv) Special cubic model

(16)

15. (a) Construct a case study for the three types of signal-to- noise ratio (S/N Ratio) used in taguchi's robust design. (16)

Or

(b) An experiment has five factors, viz. A,B,C,D and E. Factor A is with four levels and the remaining factors with two levels. The investigator has decided to use L8 orthogonal array with three replications for each trial. The assignment of factors and data are shown below. Analyze the data and draw conclusion at a significance level of 0.05 using ANOVA for un-pooled as well as pooled variances.

Orthogonal array with data

Trail No.	Factors and Interactions					Replications		
	A	B	C	D	S			
	Column No.							
	1	4	5	6	7	1	2	3
1	1	1	1	1	1	7	6	4
2	2	2	2	2	2	2	2	4
3	1	2	2	2	2	4	7	1
4	2	1	1	2	2	5	6	5
5	3	1	2	1	2	2	2	6
6	3	2	1	2	1	8	6	4
7	4	1	2	2	1	5	4	6
8	4	2	1	1	2	6	7	5

(16)

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