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M.Tech (ME) (2020 Onwards) (Sem.–2)

RESEARCH METHODOLOGY

Subject Code : MTME-201

M.Code : 74977

Time : 3 Hrs. Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

1. **Attempt any FIVE questions out of EIGHT questions.**
2. **Each question carries TWENTY marks.**

1. a. Define and explain the term "Research".

   b. Explain the importance of research in engineering. Briefly explain the objective of research.

2. a. How will you design and do analysis of multi-factor experiment? Give suitable examples.

   b. What are blocking and confounding in DOE? Explain the steps in partial confounding.

3. a. What is hypothesis? Explain its importance and type of hypothesis

   b. What do you mean by research report? What is the importance of research report? Explain the characteristics of the research report

4. The yield of a chemical process is being studied. The most important variable are thought to be the pressure and the temperature. Three level of each factor are selected, and a factorial experiment with two replicate is performed. The yield data follows :

Temperature (°C)	Pressure (Psig)		
	200	215	230
150	90.4	90.7	90.2
	90.2	90.6	90.4
160	90.1	90.5	89.9
	90.3	90.6	90.1
170	90.5	90.8	90.4
	90.7	90.9	90.1

   a) Analyse the data and draw conclusions. Use ✔ = 0.05

   b) Prepare approximate residual plot and comment on the model adequacy

   c) Under what conditions would you operate this process?

5. a) What are the three main disadvantages of the conventional design of experiments approach as compared with Taguchi's method?

   b) Explain the various stages in the process of achieving desirable quality of a product using Taguchi's methodology.

6. A researcher conducts experiments to explore the machining behavior of composites materials using Taguchi's L_9 OA. The various parameters under considerations were cutting speed in RPM, Feed in mm/rev, Step diameter in mm and drill point angle and their coded values at different level is represented as A,B,C and D respectively and shown in Table below. The output quality characteristics under consideration is Thrust force which is repeated thrice to minimize the error. Plot the behavior of the process with respect to raw data and S/N ratio and find out the percentage contribution of each input process parameters on thrust force.

Exp. No.	A	B	C	D	Rep 1	Rep 2	Rep 3
1	1	1	1	1	113	117	123
2	1	2	2	2	113	100	120
3	1	3	3	3	113	110	107
4	2	1	2	3	123	117	120
5	2	2	3	1	117	133	140
6	2	3	1	2	133	147	137
7	3	1	3	2	163	163	160
8	3	2	1	3	143	147	153
9	3	3	2	1	163	160	160

7. An industrial engineer has developed a computer simulation model of two-item inventory system. The decision variables are the order quantity and the recorder point for each item. The response to be minimized is total inventory cost. The simulation model is used to produce the data shown in the following table. Identify the experimental design. Find the path of steepest descent.

Item 1		Item 2		Total Cost
Order Quantity (a_1)	Reorder Point (a_2)	Order Quantity (a_3)	Reorder Point (a_4)	
100	25	250	40	625
140	45	250	40	670
140	25	300	40	663
140	25	250	80	654
100	45	300	40	648
100	45	250	80	634
100	25	300	80	692
140	45	300	80	686
120	35	275	60	680
120	35	275	60	674
120	35	275	60	681

8. Write short note on the following :

a) Signal to noise ratio

b) SPSS

NOTE : Disclosure of identity by writing mobile number or making passing request on any page of Answer sheet will lead to UMC case against the Student.