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Total No. of Questions : 08

M.Tech (ME) (2019 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) What is research methodology ? Explain steps in scientific research processes.

   b) Briefly explain about review of literature.

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

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

3. An engineer suspects that the surface finish of a metal part is influenced by the feed rate and the depth of cut. He selects three feed rates and four depths of cut. He then conducts a factorial experiments and obtain the following date :

Feed rate (in/min)	Depth of cut (in)			
	0.15	0.18	0.20	0.25
0.20	74	79	82	99
	64	68	88	104
	60	73	92	96
0.25	92	98	99	104
	86	104	108	110
	88	88	95	99
0.30	99	104	108	114
	98	99	110	111
	102	95	99	107

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

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

   c) Obtain estimates of the mean surface finish at each feed rate

   d) Find the P-value of the test.

4. An experiments was run to determine whether four specific intervals of patrolling (in minutes) by a quality inspector affects the number of acceptable parts produced per hour in a machine. The corresponding data for four different periods with four replications are shown as :

Replication	Period of inspection			
	30 min	**45 min**	**60 min**	**75 min**
	50	30	40	35
	25	60	12	10
	40	20	30	48
	23	38	39	25

Perform ANOVA as per completely randomized design and state the inference at a significance level of 5%.

5. a) There are two types of losses that society incur because of poor quality of a product. What are those losses ?

   b) Discuss the three stages in the process of achieving desirable quality by design.

6. a) The Taguchi's method is considered a technique that helps build quality into a product or process. Explain what aspect of quality it influences and how.

   b) Discuss and explain the term signal to noise ratio.

7. A chemical plant produces oxygen by liquefying air and separating it into its component gases by fractional distillation. The purity of the oxygen is a function of the main condenser temperature and the pressure ratio between the upper and lower columns. Current operating conditions are temperature (a_1) = – 220ºC and pressure ratio (a_2) = 1.2. Using the following data, find the path of steepest ascent :

Temperature (a_1)	Pressure ratio (a_2)	Purity
–225	1.1	82.8
–225	1.3	83.5
–215	1.1	84.7
–215	1.3	85.0
–220	1.2	84.1
–220	1.2	84.5
–220	1.2	83.9
–220	1.2	84.3

8. Write short note on the following :

   a) Analysis of variance

   b) Response surface methodology.

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.