## **University of Mumbai Examinations Summer 2022**

1T01435 / / T.E.(Mechanical) Engineering)(SEM-V)(CBCGS) ((R-19) (C Scheme)

## 32626 / / Design of Exaperiments

## SET-1

Time: 2 hour 30 minutes

Max. Marks: 80

Q1.	Choose the co	_				20 marks
	All the Questions are compulsory and carry equal marks  Questions 1,2&3 are based on the following case  A manufacturer of television sets is interested in the effect of tube conductivity of four different types of coating for color picture tubes. The following conductivity data are obtained (Use α=0.05)					
	Coting type	conduct	ivity			
	1	143	141	150	146	
	2	152	149	137	143	
	3	134	136	132	127	
	4	129	127	132	129	
1.	The mean squa	re of the r	nodel is			
Option A:	281.56					
Option B:	844.69					
Option C:	19.69					
Option D:	236.25					
2.	Degree of free	dom of the	model is			
Option A:	12					
Option B:	3					
Option C:	13					
Option D:	4					
3	Degree of free	dom of the	error is			
Option A:	12					
Option B:	3	The second secon				-
Option C:	13					<del></del>
Option D:	4		· ·			
						<del></del>
4.	The basic princ	ciples of ex	xperimental o	design are		
Option A:	randomization.			<del>-</del>		
Option B:	repetition, rand			on		
Option C:	replication, blo	cking, ran	domization	** ***	-	
Option D:	Optimization,					
5.	and measurable			imental data w	itii uncontrollable	
Option A.	blocking					
Option B:	analysis of cov					
Option C:	analysis of var	iance				

Option D:	none of th	ese				7,7				
<u> </u>	A . 1									
6.	An indepe	ndent rep	eat run of	each factor	combination	ns is called				
Option A:		Replication Randomization								
Option B:	Randomization									
Option C:	Blocking									
Option D:	Repeated measurement									
7.	ANOVA s									
Option A:		Analysis of Variance								
Option B:		Analysis of Value								
Option C:	Analysis o				4 26 6 3					
Option D:	Analysis o	f Variety								
8.	A techniqu	ie of stati	istical inter	ference use	d to assist t	he experimente	r			
	in comperi	ng two fo	ormulations	is known a	ıs					
Option A:	Hypothesis									
Option B:	Factor test				7 <u>888</u> 8					
Option C:	Variable te									
Option D.	Level testin	ng								
		33		the follow						
	from one block design	a particul polt to ar gn, with the	lar type of c nother, the he bolts of	chemist de cloth consid	cides to use dered as blo	tht be variability e a randomized cks. She selects				
	strength of from one t block desig five bolts a	a particul oolt to ar gn, with the nd applie	lar type of conther, the he bolts of all four c	chemist de cloth consid hemicals in	cides to use dered as blo	tht be variability e a randomized cks. She selects der to each bolt				
	strength of from one t block desig five bolts a	a particul oolt to ar gn, with the nd applie	lar type of conther, the he bolts of all four c	chemist de cloth consid hemicals in	cides to use dered as blo random ore	tht be variability e a randomized cks. She selects der to each bolt				
	strength of from one t block desig five bolts a The resultin	a particul	lar type of conther, the he bolts of all four c	chemist de cloth consid hemicals in	cides to use dered as blo random ore	th the variability e a randomized cks. She selects der to each bolt.				
	strength of from one t block desig five bolts a The resultin	a particul colt to an gn, with the nd applie ng tensile	lar type of conother, the he bolts of es all four constructions are strengths a	chemist de cloth consid hemicals in as follows (1	cides to use dered as blo random orcuse α=0.05)	th the variability e a randomized cks. She selects der to each bolt.				
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	strength of from one to block design five bolts a The resulting chemical	a particul colt to an gn, with the nd applie ng tensile bolt 1 73	lar type of conother, the he bolts of es all four constraints at the strengths at the strengths at the strengths at the strength at the streng	chemist de cloth considhemicals in as follows (1	cides to use dered as blo random orcuse α=0.05)	th be variability e a randomized cks. She selects der to each bolt.  5 67 70				
	strength of from one to block design five bolts a The resulting chemical	a particuloolt to an gn, with the gn, with the gn applies a gn applies	lar type of conother, the he bolts of es all four constrengths are strengths are 68	chemist de cloth conside hemicals in as follows (1)	cides to use dered as blo random or use α=0.05)  4 71 72 73	th be variability e a randomized cks. She selects der to each bolt.  5 67 70 68				
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	strength of from one to block design five bolts a The resulting chemical 1 2 3 4	a particuloolt to an en, with the engine tensile bolt 1 73 73 75 73	lar type of conother, the he bolts of es all four constructions are strengths at the strengths at the strengths at the strength at the strengt	chemist de cloth considere cloth considere cloth considere cloth considere cloth considere cloth considere cloth cloth considere cloth clo	cides to use dered as blo random or use α=0.05)  4 71 72 73 75	th be variability e a randomized cks. She selects der to each bolt.  5 67 70 68				
9.	strength of from one to block design five bolts a The resulting chemical 1 2 3 4	a particuloolt to an en, with the engine tensile bolt 1 73 73 75 73	lar type of conother, the he bolts of es all four constructions are strengths at the strengths at the strengths at the strength at the strengt	chemist de cloth considere cloth considere cloth considere cloth considere cloth considere cloth considere cloth cloth considere cloth clo	cides to use dered as blo random or use α=0.05)  4 71 72 73 75	th be variability e a randomized cks. She selects der to each bolt.  5 67 70 68				
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Option A: Option B: Option C:	strength of from one to block design five bolts a The resulting chemical 1 2 3 4 4 Mean square 4.32 1.82 39.25	a particuloolt to an en, with the engine tensile bolt 1 73 73 75 73	lar type of conother, the he bolts of es all four constructions are strengths at the strengths at the strengths at the strength at the strengt	chemist de cloth considere cloth considere cloth considere cloth considere cloth considere cloth considere cloth cloth considere cloth clo	cides to use dered as blo random or use α=0.05)  4 71 72 73 75	th be variability e a randomized cks. She selects der to each bolt.  5 67 70 68				
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Define the	Population	on in D	OE.				
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Why is rane	domizati	on impo	ortant in an	experin	nent?	7.8 (7.8 (8)).	
	-						
Solve any	Two Que	estions	out of Thr	ee (10 n	narks eacl	) & / S &	20 marks
List Guidel	ines for l	Designi	ng Experin	ents an	d explain a	ny one	
design exar and find Su	nple. Do m of Squ	the An	alysis of Va	ariance	for Battery	Life Data	
Material			Tampara	turo (0E			
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3				<del></del>			
	168	160	150	139	82	60	
Variation A treatments B treatments	Squa		Degrees of Freedom		Mean Square	FO	
Explain in a	letail Bas	sic Princ	ciples of Ra	ndomiz	ration		
							<del>                                     </del>
Solve any	Two out	of Thre	e (10 marl	(s each)			20 marks
A soft drink in the bottl machine the in practice, like to undo reduce it. T filling proce the filler (B) The pressur is more diff varies with experiment,	bottler i les producereticall there is verstand the he processes: the poly, and the e and spee ficult to produce the engine	s intereduced by y fills evariation in sources engine bottles ed are excentral tempineer ca	sted in obta  his manusach bottle to around the es of this value carbonation produced produced produced during acceptance. Hen control	ining manager facturing of the color through the	ore uniform g process. prect targe t, and the b y better an ee variable e operating te or the lir the percent nufacturing for purp ion at three	The filling theight, but ottler would deventually as during the gressure in the speed (C). carbonation groups because it oses of an are levels: 10,	
	Solve any List Guidel Table presedesign exarand find Suformat give  Material type  1  2  3  The Analy Fixed Effect  Source of Variation A treatments Interaction Error Total  Explain in of the bott machine the in practice, like to undereduce it. The filling proceeding the filler (B) The pressur is more different with experiment, and the solution of the filler (B) The pressur is more different with experiment, and the solution of the filler (B) The pressur is more different with experiment, and the solution of the filler (B) The pressur is more different with experiment, and the solution of the filler (B) The pressur is more different with experiment, and the solution of the filler (B) The pressur is more different with experiment, and the solution of the so	Solve any Two Questions for Table presents the edesign example. Do and find Sum of Square format given.    Material   type	Solve any Two Questions List Guidelines for Designi Table presents the effective design example. Do the An and find Sum of Square, Deformat given.    Material   type	Solve any Two Questions out of Thre List Guidelines for Designing Experim Table presents the effective life (in hot design example. Do the Analysis of Va and find Sum of Square, Degrees of Fr format given.    Material   Temperative   Temper	Solve any Two Questions out of Three (10 in List Guidelines for Designing Experiments and Table presents the effective life (in hours) obsidesign example. Do the Analysis of Variance and find Sum of Square, Degrees of Freedom, format given.    Material   Temperature (°F)	Define the Sample in DOE  Why is randomization important in an experiment?  Solve any Two Questions out of Three (10 marks each List Guidelines for Designing Experiments and explain a Table presents the effective life (in hours) observed in the design example. Do the Analysis of Variance for Battery and find Sum of Square, Degrees of Freedom, and fill it is format given.    Material   Temperature (°F)	Define the Sample in DOE Why is randomization important in an experiment?  Solve any Two Questions out of Three (10 marks each) List Guidelines for Designing Experiments and explain any one Table presents the effective life (in hours) observed in the battery design example. Do the Analysis of Variance for Battery Life Data and find Sum of Square, Degrees of Freedom, and fill it in tabular format given.    Material   Temperature (°F)   125   130   155   34   40   20   70   125   140

	two replicates of	a factoria	l design	in these t	hree facto	ors, with all 24	FSV.			
	runs taken in ran									
	average deviation	from the	target fil	l height c	bserved i	n a production				
	run of bottles at ea	ch set of	condition	s. The da	ta that res	ulted from this				
		experiment are shown in Table Positive deviations are fill heights above the target, whereas negative deviations are fill heights below the								
	target.		-8			Sue colo ii inc				
	Percent	0	perating	pressure(1	B)					
	Carbonation(A)		psi psi		psi					
			eed(c)							
		200	250	Line sp	250					
		-3	-1	-1	1					
	10	-1	0	0	1 1					
			2		1					
	12	0		2	6					
		1	1	3	5					
	14	5	I	780	10					
		4	6	9	11					
	Do the Analysis of			ttery Life	e Data and	d find Sum of				
	Square, Degrees o									
В	Write and explain the stapes to be consider while Using Statistical Techniques in Experimentation.									
C	What are the potential risks of a single large, comprehensive									
	experiment in contrast to a sequential approach?									