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.				ving questions nd carry equa		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 - 000		Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q	O Korol		
	1	143	141	150	146	STED.		
	2	152	149	137	143	5		
	3	134	136	132	127			
	4	129	127	132	129			
1.	The mean square of the model is							
Option A:	281.56	\$ 2 0 p		8 9 8 9 8 W	S S S S			
Option B:	844.69	The King So	34000	12 C C C C C C C C C C C C C C C C C C C	1 2 5°			
Option C:	19.69	E B B B		E STANDER	\$3.45°			
Option D:	236.25	N. 43. 44			OKO,			
	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	3770	SA PRINCE		No.			
2.	Degree of freedom of the model is							
Option A:								
Option B:								
Option C:	13 × × × × × × × × × × × × × × × × × × ×							
Option D:								
W. K. D.	3 4 6 6 6 C	300 K 300	V. S.	T. A.				
£ 3.5° 6	Degree of freedom of the error is							
Option A:								
Option B:	3 8 8 8 8 8 8 8 8 8 8 8 8							
Option C:	437777777							
Option D:	4							
2 4.4 0	The basic principles of experimental design are							
Option A:	randomization, repetition, blocking							
Option B:	repetition, randomization, factorization							
Option C:	replication, blocking, randomization							
Option D:	Optimization, blocking, factorization							
	K B B S S S S S S S S S S S S S S S S S							
5.5.5	The analysis pand measurabl			rimental data w	ith uncontrollable			
Ontion		e <u>nuisance</u>	ractor 18					
Option A:	blocking							
Option B:	analysis of covariance analysis of variance							
Option C:	analysis of var	iance						

6. An independent repeat run of each factor combinations is called Option A: Replication Option B: Randomization Option C: Blocking Option D: Repeated measurement 7. ANOVA stands for Option A: Analysis of Variance Option B: Analysis of Variue Option C: Analysis of Variety 8. A technique of statistical interference used to assist the experimenter in compering two formulations is known as Option A: Hypothesis testing Option B: Factor testing Option D: Level testing Option D: Level testing Option D: Level testing Option D: Level testing Option D: Level testing Coption D: Level testing Option A: A Lechnique of the following case: A chemist wishes to test the effect of four chemical agents on the strength of a particular type of cloth. Because there might be variability from one bolt to another, the chemist decides to use a randomized block design, with the bolts of cloth considered as blocks. She selects five bolts and applies all four chemicals in random order to each bolt. The resulting tensile strengths as follows (use α=0.05) Chemical bolt	
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Option B: Randomization Option C: Blocking Repeated measurement 7. ANOVA stands for Option A: Analysis of Variance Option B: Analysis of Variety Option C: Analysis of Variety 8. A technique of statistical interference used to assist the experimenter in compering two formulations is known as Option A: Hypothesis testing Option B: Factor testing Option D: Level testing Option C: Variable testing Option D: Level testing Option D: Level testing Questions 9&10 are based on the following case: A chemist wishes to test the effect of four chemical agents on the strength of a particular type of cloth. Because there might be variability from one bolt to another, the chemist decides to use a randomized block design, with the bolts of cloth considered as blocks. She selects five bolts and applies all four chemicals in random order to each bolt. The resulting tensile strengths as follows (use α=0.05) chemical bolt 1 2 3 4 5 1 73 68 74 71 67 2 73 67 75 72 70 3 75 68 78 73 68 4 73 71 75 75 69	
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Option D: Repeated measurement	
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Option D: Level testing Questions 9&10 are based on the following case: A chemist wishes to test the effect of four chemical agents on the strength of a particular type of cloth. Because there might be variability from one bolt to another, the chemist decides to use a randomized block design, with the bolts of cloth considered as blocks. She selects five bolts and applies all four chemicals in random order to each bolt. The resulting tensile strengths as follows (use α=0.05) Chemical bolt 1 2 3 4 5 1 73 68 74 71 67 2 73 67 75 72 70 3 75 68 78 73 68 4 73 71 75 75 69 9 Mean square value of block in this experiment is	
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1 2 3 4 5 1 73 68 74 71 67 2 73 67 75 72 70 3 75 68 78 73 68 4 73 71 75 75 69 9. Mean square value of block in this experiment is	
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3 75 68 78 73 68 4 73 71 75 75 69 9. Mean square value of block in this experiment is	
9. Mean square value of block in this experiment is	
9. Mean square value of block in this experiment is	
Option A: 4.32	
MY 7 T T T T T T T T T T T T T T T T T T	
Option B: 1.82	
Option C: 39.25	
Option D: 12.95	
10. Mean square value of treatment in this experiment is	
Option A: 4.32	
Option B: 1.82	
Option C: 39.25	
Option D: 12.95	
Q.2 Solve any Four out of Five (5 marks each)	
A Write a note on Latin Square Design with example.	20 marks
B Define the Hypothesis in DOE.	20 marks

D) - m 1 - / 1	un in DO				1200 CV	3,00,00,00	
	Define the Population in DOE.								
E	Define the Sample in DOE Why is randomization important in an experiment?								
E	why is rand	iomizan	on impor	tant in an	experime.	nt:		7	
Q.3	Solve any Two Questions out of Three (10 marks each)								
A	List Guidelines for Designing Experiments and explain any one							20 marks	
	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)								
	type	1	5	7		0 0 0 1	25	7. 4. 6. 0. V.	
	type	130	155	34	40	20	70	2000 4 4 6 6	
	1	74	180	80	75	82	58		
		150	188	136	122	25	70		
	2	159	126	106	115	58	45	OK POST	
		138	110	174	120	96	104	13 S	
	3	168	160	150	139	82	60	S. S	
			9 8 5 S	7 7 P 2 3	2 T 36 6	C 25 4 5	S NO CO		
В		28°	2 Kg 20 2 Kg	9974	500 P. L. F.	20014	A LA LA CO		
	The Analy	sis of V	ariance	Table fo	r the Ty	wo-Facto	r Factorial,		
	Fixed Effec	ets Mode		B S S L		3000	BO CE		
		1 DO	\$ 100 m	Sex Book	12 20 0 V	S. 5 8 2			
	Source of	0-1 V. V. V. V.	A CAN	Degrees o		Mean	F0		
	Variation	Squa	ares	Freedom	8, 45 ° 0	Square	<u> </u>		
	treatments	0000	3446			St. O. O. O. E.			
	B	17 20 C			50 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				
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A	0 0 0 0	D. O.	2 20 0 V	2 4 4 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6		7			
257	Interaction	D. O.							
\$ C. C.	Interaction Error	D. O.				-			
800	Interaction	D. O.							
	Interaction Error	D. O.							
	Interaction Error		sic Princi	ples of Ra	andomiza	tion			
\$\frac{1}{2}\frac{1}{2	Interaction Error Total Explain in o	letail Ba	Se Bas			tion			
Q.4	Interaction Error Total Explain in C	letail Ba	of Three	(10 mar	ks each)			20 marks	
4260 KE	Interaction Error Total Explain in o	letail Ba Fwo out bottler	of Three	(10 mar	ks each)	re unifor	n fill heights	20 marks	
4260 KE	Interaction Error Total Explain in of the soft drink in the bott	les prod	of Three is interest uced by	(10 mar) ed in obta his man	ks each) nining mo	re unifor	The filling	20 marks	
4260 KE	Interaction Error Total Explain in of the soft drink in the bott machine the	letail Ba Fwo out bottler les prodeoretical	of Three is interest uced by ly fills ea	e (10 mar ed in obta his manu ch bottle	ks each) hining mo hifacturing to the cor	re unifori process	The filling et height, but	20 marks	
4260 KE	Explain in a Solve any Taxon A soft drink in the bott machine the in practice,	Ivo out bottler les prodeoreticall there is	of Three is interest uced by ly fills eavariation	e (10 mar ed in obta his manu ch bottle around th	ks each) hining monifacturing to the cornistarget,	re uniform process rect targe and the b	The filling et height, but bottler would	20 marks	
4260 KE	Explain in a Solve any The A soft drink in the bott machine the in practice, like to under the solve and the solve	letail Ba Fwo out bottler les prodeoretical there is	of Three is interest uced by ly fills ea variation ne source	e (10 mar ted in obta his manu ch bottle around the	ks each) hining monage if acturing to the cornistarget, variability	re uniform process rect targe and the land	The filling et height, but bottler would ad eventually	20 marks	
Q.4	Explain in a Solve any Taxon A soft drink in the bott machine the in practice, like to undereduce it. T	letail Ba Fwo out bottler les prodeoretical there is erstand the	of Three is interest uced by ly fills ea variation ne source ss engine	e (10 mar) ed in obta his manu ch bottle around th s of this veer can co	ks each) hining mo hifacturing to the cornis target, variability htrol thre	re uniform process rect targe and the better ar e variable	The filling of height, but bottler would deventually es during the	20 marks	
4260 KE	Explain in a Solve any TA soft drink in the bott machine the in practice, like to under reduce it. T filling process.	letail Ba Two out bottler les prod coretical there is erstand the proce	of Three is interest uced by ly fills ea variation ne source ess engine percent c	ted in obtation in the distribution in the din	ks each) nining monafacturing to the cornis target, variability ntrol three in (A), the	re uniform process rect targe and the to better are e variable operatin	The filling of height, but bottler would ad eventually es during the g pressure in	20 marks	
Q.4	Explain in a Solve any The Solve any The Solve and The Sol	letail Ba Two out bottler becoretically there is erstand the proceess: the poly, and the	of Three is interest uced by ly fills ea variation ne source ss engine percent co bottles p	e (10 mar) ted in obta his manu the bottle around the s of this veer can co arbonation produced p	ks each) ining monafacturing to the cornistarget, variability ntrol thre or (A), the per minute	re uniform process rect targe and the better are e variable operating	The filling of height, but bottler would ad eventually es during the g pressure in the speed (<i>C</i>).	20 marks	
Q.4	Explain in a Solve any The Solve and The Sol	letail Ba Fwo out bottler best production of there is erstand the proceess: the point of the proceess of the proceed	of Three is interest uced by ly fills ea variation ne source es engine percent co bottles peed are ea	e (10 mar) ted in obta his manu ch bottle around the s of this veer can co arbonation broduced pasy to con	ks each) ining monage to the cornistarget, variability introl three in (A), the per minute trol, but the	re uniform process rect targe and the better are e variable operating e or the li-	The filling of height, but bottler would ad eventually es during the g pressure in the speed (<i>C</i>). It carbonation	20 marks	
Q.4	Explain in a Solve any The A soft drink in the bott machine the in practice, like to undereduce it. The filling proceed the filler (B) The pressur is more difference of the filler (B) and the filler (B) the pressur is more difference of the filler (B) the filler (B) the pressur is more difference of the filler (B) the f	detail Ba Fwo out bottler best production is created there is created the proceess: the plant is and the proceess: the plant is considered to the procees in the procees in the procees in the procees in the proceed i	of Three is interest uced by ly fills ea variation ne source ess engine percent co e bottles peed are ea control	ted in obtation in the distribution in the din	ks each) unining monage if acturing to the corn is target, variability introl three in (A), the per minute trol, but the trul man	re uniform process rect targe and the label better are e variable operating e or the li-	The filling at height, but bottler would ad eventually es during the g pressure in the speed (<i>C</i>). It carbonation g because it	20 marks	
Q.4	Explain in a Solve any Taxon A soft drink in the bott machine the in practice, like to undereduce it. T filling proceed the filler (B) The pressure is more different varies with	letail Ba Two out bottler best berstand the process: the poly, and the eand specificall to a produce the produc	of Three is interest uced by ly fills ea variation ne source ss engine percent co e bottles peed are ea control et tempe	ted in obtation his manuach bottle around the sof this veer can coarbonation or oduced pasy to conduring accorature.	ks each) nining monafacturing to the cornis target, variability ntrol thre on (A), the per minute trol, but the tetual man lowever,	re uniform process rect targe and the libetter are e variable operating e or the libete percen- ufacturing for purp	The filling of height, but bottler would ad eventually es during the g pressure in the speed (<i>C</i>). It carbonation	20 marks	
Q.4	Explain in a Solve any Table A soft drink in the bott machine the in practice, like to undereduce it. T filling proceed the filler (B) The pressure is more difficulty varies with experiment,	letail Ba Two out bottler best berstand the proceess: the poly, and the eand specificall to produce the engine the eng	of Three is interest uced by ly fills ea variation ne source es engine cercent ce e bottles peed are ea control et tempe ineer car	ted in obtation which bottle around the softhis ware can control or during activation. He control of the contro	ks each) ining monafacturing to the cornistarget, variability introl thre in (A), the ber minute trol, but the ctual man lowever, carbonatio	re uniform process rect targe and the better are e variable operating or the lime percenture or purpon at three	The filling of theight, but bottler would ad eventually es during the g pressure in the speed (C). It carbonation g because it poses of an	20 marks	

						18-72-18-18-18-18-18-18-18-18-18-18-18-18-18-	50 8 18 18 18 18 18 18 18 18 18 18 18 18 1		
	two replicates of a	a factoria	l design :	in these t	hree facto	rs, with all 24	19 W. C.		
	runs taken in random order. The response variable observed is the								
	average deviation from the target fill height observed in a production								
	_	un of bottles at each set of conditions. The data that resulted from this							
	experiment are shown in Table Positive deviations are fill heights								
	above the target, whereas negative deviations are fill heights below the								
	target.				7 20 6				
	Percent	Operating pressure(B)					P. 00 8 8		
	Carbonation(A)	25		30psi		14.601.62	K K D C		
		Line speed (c)		Line speed (c)		32726	State of the		
		200	250	200	250	15 3 5 7 4 6 6 8			
		-3	<u>-1</u>	-1	0 2509	14 1 1 2 2 2 4 6 6 C	60143		
	10	_		U 3/10 9	3, 2, 2, 0, 0, 1		F-2600		
	12	-1	0	0	2.94.10	3,45,63,45,60	35 7 25		
		0	2,8%	2	3.56°	800 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1000 P. L.		
		1	1	5 × 30 C	\$ 35 m	12 12 0 0 1 12 0 0 0 0 0 0 0 0 0 0 0 0 0	12 DO		
	14	5	8 F. C.	\$7.87 S	0.10		5 07 CT		
	14	4	6	9	SHO		OK PO		
	Do the Analysis of Variance for Battery Life Data and find Sum of						500		
	Square, Degrees of Freedom								
В	Write and explain the stapes to be consider while Using Statistical								
	Techniques in Experimentation.								
С	What are the po			a single	large, c	comprehensive			
	experiment in contrast to a sequential approach?								