BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2024)

CLASS: IMSC **SEMESTER : III**
BRANCH: CQEDS **SESSION : MO/2024**

SUBJECT: ED211 LINEAR STATISTICAL MODELS AND REGRESSION ANALYSIS
TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. t, F, and Z tables will be supplied to the candidates**
5. Calculator is allowed during the examination.

			CO	BL
Q.1	(a) For a simple linear regression (SLR), derive the OLS estimate for the intercept and the slope in usual notations.	[3]	1	2
	(b) Which test statistic is used to test the statistical significance of the slope in SLR? Mention the null and alternative hypotheses for this test and the formula for the test statistic.	[2]	1	3
Q.2	(a) For an SLR with 20 observations, the R^2 value is 0.21. Using appropriate test statistic, comment whether the regression model is significant at $\alpha = 0.05$? Explain.	[3]	1	3
	(b) For an SLR, show that the F-statistic is same as the square of the t-statistic i.e. $F = t^2$.	[2]	1	3
Q.3	A regression model is developed between corruption perception index (Y) and Gini Index (X; a measure of income inequality) for 20 countries. The Standard Error $(\hat{y})$= 18.76477578 and Regression sum of squares (SSR)=1738.09742. The regression output is shown below: [marks: 1+1+1+2]	[5]	1	4

	β Coefficients	*Standard Error*	*t Stat*	*Lower CL 95%*	*Upper CL 95%*
Intercept	106.69501	20.68222812	5.158	63.243	150.147
Gini Index(X)		0.582962831		-2.52	-0.0704

Answer the following:
(a) What proportion of the corruption perception index is explained by Gini Index (or income inequality)?
(b) What is the change in the value of the corruption perception index for one unit increase in Gini Index?
(c) Is there a statistically significant relationship between corruption perception index and Gini Index at $\alpha = 0.01$?
(d) For a Gini Index value of 30, what is the probability that the corruption perception index of this country is less than 50?

Q.4 An experiment is conducted to investigate the effect of the type of glass and the type of phosphor on the brightness of a television tube. The response variable is the brightness level (in microamps). The data are as follows: [5] 2 3

	Phosphor Type	
Glass Type	P1	P2
G1	28	30
G1	29	31
G1	28	29
G2	23	26
G2	23	24
G2	24	24

(a) Is there any indication that either factor influences brightness? Use $\alpha = 0.05$.
(b) Do the two factors interact? Use $\alpha = 0.05$.

PTO

Q.5 The sums of squares and products for a single-factor analysis of covariance are given below: [5] 2 4

		Sum of Squares and Products		
	df	xx	xy	yy
Treatments	2	66.13	96	140.4
Error		195.6	186.6	206
Total	14	261.73	282.6	346.4

Complete the ANCOVA table (as shown below) and draw appropriate conclusions regarding the treatment effects. Use $\alpha = 0.05$.

ANCOVA table					
Sources of variation	SS	df	MSS	F-test	F-critical
Regression					
Treatments					
Error					
Total					

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