Semester	**FOUR**
Paper Number	**HSTCR4092T**
Paper Title	**Linear Models**
No. of Credits	**6**
Theory/Composite	**Composite**
No. of periods assigned	Th: 4 Pr: 3
Module	Single
Course description/objective	*At the end of the course, a student is expected to* o Extend the modelling of a response-predictor relationship to the case where there are more than 2 predictors. o Identify and classify Gauss Markov models. o Analyse ANOVA models to test for the differential effects of factors and interaction effects between two factors. o Deal with testing problems related to regression models. o Understand the use of concomitant variables in analysing ANOCOVA models.
Syllabus	**UNIT 1:** ***Multivariate Data:*** Multiple linear regression, multiple and partial correlation. [10L] **UNIT 2:** ***Gauss-Markov set-up:*** Theory of linear estimation, Estimability of linear parametric functions, Method of least squares, Gauss-Markov theorem, Estimation space and Error Space**,** Estimation of error variance. Tests of General Linear Hypotheses (statements only)**.** Classification of Linear Models. [10L] **UNIT 3:** ***Regression analysis:*** Hypothesis testing in case of simple and multiple regression models. [10L] **UNIT 4:** ***Analysis of variance:*** Analysis of Variance in one-way and two-way classified data (with equal number of observations per cell) for fixed effect models. [12L] ***Analysis of covariance:*** Analysis of covariance for one-way and two-way classified data with one concomitant variable. [10L]
List of Practical	1. Estimability in Gauss Markov Model. 2. Simple linear regression. 3. Multiple regression. 4. Tests for linear hypothesis. 5. Analysis of variance of one way classified data. 6. Analysis of variance of a two way classified data with one observation per cell.

	7. Analysis of variance of a two way classified data with equal number of observations per cell. 8. Analysis of covariance of a one way classified data with one concomitant variable. 9. Analysis of covariance of a two way classified data with one concomitant variable.	
Reading/Reference Lists	1. Goon, A.M., Gupta, M.K., and Dasgupta, B. (2002), Fundamental of Statistics, Volume 1, 8th Edn. The World Press, Kolkata. 2. Goon, A.M., Gupta, M.K., and Dasgupta, B. (2002), Fundamental of Statistics, Volume 2, 8th Edn. The World Press, Kolkata. 3. Scheffe, H, Linear Models 4. Rao, C.R., Linear Statistical Inference. 5. Mukhopadhyay, P. (2011): Applied Statistics, 2nd edition revised reprint, Books and Allied(P) Ltd. 6. Weisburg, S (2005) Applied Linear Regression (Third edition), Wiley. 7. Wu, C. F. J. and Hamada, M. (2009). Experiments, Analysis and Parameter Design Optimization (Second edition), John Wiley. 8. Renchner, A.C. and Schaalje, G.B. (2008). Linear Models in Statistics (Second edition), John Wiley and Sons.	
Evaluation	**Theory** CIA: 10 End-Sem: 50 Total: 60	**Practical** Continuous assessment: 40
Paper Structure for End Sem Theory	Short questions (5 marks each)	Long questions (15 marks each)
	4 out of 6	2 out of 3
List of Practical	1. Construction and Interpretation of statistical control charts X-bar & R chart X-bar & s-chart np- chart p-chart c-chart u- chart 2. Single sample inspection plan: Construction and interpretation of OC, AQL, LTPD, ASN, ATI, AOQ, AOQL curves. 3. Calculation of process capability and comparison of 3-sigma control limits with specification limits. 4. Use a case study to apply the concept of six sigma application in DMAIC: practical application.	
Reading/Reference Lists	1. Montgomery, D.C. (2009): Introduction to Statistical Quality control, 6th edition, Wiley India, Pvt Ltd 2. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol 2, 8th edition, The world	

<table>
<tr><td></td><td colspan="2">Press, Kolkata
3. Mukhopadhyay, P. (2011): Applied Statistics, 2nd edition revised reprint, Books and Allied(P) Ltd.
4. Montgomery, D.C. and Runger, G.C. (2008): Applied Statistics and Probability for Engineers, 3rd edition reprint, Wiley India Pvt Ltd.
5. Ehrlich, B. Harris (2002): Transactional Six sigma and Lean Servicing, 2nd edition, St Lucie Press
6. Hoyle, David (1995): ISO Quality systems Handbook, 2nd edition, Butterworth Heinemann Publication.</td></tr>
<tr><td>Evaluation</td><td>Theory
CIA: 10
End-Sem: 50
Total: 60</td><td>Practical
Continuous assessment: 40</td></tr>
<tr><td rowspan="2">Paper Structure for End Sem Theory</td><td>Short questions (5 marks each)</td><td>Long questions (15 marks each)</td></tr>
<tr><td>4 out of 6</td><td>2 out of 3</td></tr>
</table>