[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2913 **L**

Unique Paper Code : 2372574801

Name of the Paper : DSC: Fundamentals of Econometrics (NEP)

Name of the Course : **B.A. (P) / B.Sc. (P)**

Semester : VIII

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Answer **Six** questions in all. Q. No. **1** is compulsory.
3. **All** questions carry equal marks.
4. Use of non-programming scientific calculator is allowed.

1. (a) Fill in the blanks.

   i. The ratio scale has a meaningful _____ point, unlike the interval scale.

   ii. The adjusted R^2 penalizes the addition of _____ variables to the model.

   iii. The total sum of squares (TSS) can be decomposed into _____ and _____.

   iv. Using OLS in the presence of autocorrelation leads to _____ of R^2.

   v. When the determinant of the correlation matrix of explanatory variables is close to zero, it indicates _____.

(b) State whether True or False.

i. The first step in building an econometric model is the estimation of parameters.

ii. The stochastic error term in a regression model accounts for the variables omitted from the model.

iii. The assumption that error terms follow normal distribution is required for point estimation.

iv. R^2 can never decrease when a new variable is added to the regression model.

v. Model mis-specification (e.g., omitting a variable) can create apparent autocorrelation in residuals.

(c) i. For the variable X_2 and X_3, R^2(auxillary) is 0.90 and 0.85 respectively. Calculate Variance Inflation Factor, comment on severity and suggest remedies.

ii. For the given models:

$$Y = \beta_1 + \beta_2 X + u \quad (1)$$

$$\ln Y = \alpha_1 + \alpha_2 X + u \quad (2)$$

- Interpret coefficients β_2 and α_2 according to model (1) and model (2) respectively.
- Can R^2 be compared?
- Under what circumstances, we use model (1) and model (2). **[5,5,5]**

Section I

2. (a) Discuss, in brief, the methodology of developing an econometric model.

(b) For a General linear model $Y_{n\times 1}=X_{n\times p}\,\beta_{p\times 1}+\varepsilon_{n\times 1}$ with usual assumptions. Develop the test of significance for individual regression coefficient. Also obtain $100(1-\alpha)\%$ confidence interval for β_1.

[7,8]

3. Consider the general linear model $Y_{n\times 1}=X_{n\times p}\,\beta_{p\times 1}+\varepsilon_{n\times 1}$ with $E(\varepsilon)=0$, $V(\varepsilon)=\sigma^2 I_n$ and $\rho(X)=k<p<n$. Let $\psi=c'\beta$ be an estimable function. Obtain the BLUE of ψ in the class of all linear unbiased estimators of ψ by the method of least squares. Also obtain an unbiased estimator of σ^2. **[15]**

4. (a) What is multicollinearity? Explain the consequences of multicollinearity for the least square estimation technique.

(b) Develop a prediction interval for the future observation y_0 corresponding to a specified level x_0 of the regressor variable x in the simple linear regression model. **[9,6]**

Section II

5. (a) Define auto-correlation. Given the model $y = \alpha + \beta x + u$. Discuss the consequences of autocorrelation assuming the first order autoregressive scheme $u_t = \rho\, u_{t-1} + \varepsilon_t$ where ε_t satisfies the assumptions of the classical linear regression model.

(b) For the generalized least square model $Y = X\beta + u$, with $E(uu') = \sigma^2\Omega$, σ^2 being unknown and Ω being known, symmetric positive definite matrix, Compute Aitken's estimator for β, its variance and σ^2. **[7½, 7½]**

6. (a) Describe Ferrar-Glaubar test for detecting the presence of multicollinearity.

(b) Discuss the Goldfeld- Quandt test for heteroscedasticity. How do you proceed with the test when there is more than one variable in the model. **[8,7]**

7. For the simple linear regression model $y_i = \beta_0 + \beta_1 x_i + \epsilon_i$, $(i = 1, 2, \ldots, n)$, where $\epsilon_i \sim$ NID $(0, \sigma^2)$. Obtain the least squares estimator of β_1 and its variance. Also, develop a test for lack of fit. [15]