

Total No. of Printed Pages—8

5 SEM TDC DSE STS (CBCS) 2 (H) (N/O)

2024

(November)

STATISTICS

(Discipline Specific Elective)

(For Honours)

Paper : DSE-2

(Time Series Analysis)

*The figures in the margin indicate full marks
for the questions*

(New Course)

Full Marks : 55

Pass Marks : 22

Time : 3 hours

1. Choose the correct answer from the given alternatives : 1×5=5
- (a) What is the primary characteristic of time series data?
- (i) Measured at random intervals
 - (ii) Measured at successive points in time
 - (iii) Measured across different individuals
 - (iv) Measured over a single variable

(2)

- (b) Variance in a time series is associated with
- (i) the level of stationarity
 - (ii) the magnitude of fluctuations around the mean
 - (iii) the trend component
 - (iv) the cyclical component
- (c) The process of estimating the parameters of ARIMA models is called
- (i) model fitting
 - (ii) model identification
 - (iii) model selection
 - (iv) None of the above
- (d) You are given the following seasonal indices for four quarters :
1.2, 0.9, 1.1, 0.8
- What is the ratio-to-trend for the first quarter?
- (i) 1.15
 - (ii) 1.2
 - (iii) 1.1
 - (iv) 0.9
- (e) In exponential smoothing method, which parameter controls the smoothing level?
- (i) Alpha (α)
 - (ii) Beta (β)
 - (iii) Gamma (γ)
 - (iv) Delta (δ)

P25/288

(Continued)

(3)

2. Answer the following questions in brief :

2×5=10

- (a) Why we need separate analysis for time series data?
- (b) What is the difference between deterministic and stochastic trends?
- (c) Differentiate between seasonal and cyclical fluctuations in time series data with examples.
- (d) What is detrending? Why is it used in time series?
- (e) What is exponential smoothing and when is it used?

3. (a) Apply the method of link relatives to the following data and calculate seasonal indices :

10

Quarter	Quarterly figures				
	1995	1996	1997	1998	1999
I	6.0	5.4	6.8	7.2	6.6
II	6.5	7.9	6.5	5.8	7.3
III	7.8	8.4	9.3	7.5	8.0
IV	8.7	7.3	6.4	8.5	7.1

Or

- (b) What is Box-Jenkins method? Explain its procedure and applications in time series forecasting.

P25/288

(Turn Over)

(4)

4. (a) Discuss the role of autocorrelation function and correlogram in analysing time series data. How are they useful for forecasting? 10

Or

- (b) What are the various methods used for estimating trend in time series? Discuss their advantages and limitations.
5. (a) Discuss the methods for estimating the seasonal component of a time series using simple averages and the ratio to trend method. 10

Or

- (b) Discuss the harmonic analysis for cyclic components in time series. How is it used to identify cycles in data?
6. Answer any two of the following : $5 \times 2 = 10$

- (a) What is the random component in a time series? Explain the role of the variate component method.
- (b) Define and differentiate between moving average (MA) and autoregressive (AR) processes.
- (c) Define stationary time series and distinguish between weak and strong stationarity.

P25/288

(Continued)

(5)

(Old Course)

Full Marks : 50

Pass Marks : 20

Time : 3 hours

1. Choose the correct answer from the following alternatives : $1 \times 5 = 5$

- (a) What does autocorrelation measure in a time series?

- (i) The strength of the trend
(ii) The correlation between different time series
(iii) The similarity between a time series and a lagged version of itself
(iv) The seasonal variation of the data

- (b) Which type of time series component represents regular, repeated patterns in data within specific periods, like months or quarters?

- (i) Trend
(ii) Seasonal
(iii) Cyclic
(iv) Random

P25/288

(Turn Over)

(c) The Autoregressive Integrated Moving Average (ARIMA) model is best suited for which of the following?

- (i) Data with a strong seasonal component
- (ii) Stationary time series data
- (iii) Non-stationary time series data
- (iv) Data with no trend

(d) Which statistical test is commonly used to check for stationarity in a time series?

- (i) t-test
- (ii) Z-test
- (iii) Augmented Dickey-Fuller test
- (iv) Chi-square test

(e) In an MA model, the current value is expressed as a function of

- (i) past values of the series
- (ii) future values of the series
- (iii) past forecast errors
- (iv) current trend of the series

2. Answer the following questions in brief (any five) : 2×5=10

- (a) What do you mean by the stationarity of a time series?
- (b) Which component of time series can not be detected and why?
- (c) Define ARIMA (4, 1, 2).
- (d) Why is the term 'exponential' used in the exponential smoothing technique of forecasting?
- (e) What is time series? Define with example.
- (f) What are the components of time series? Define with example for each.

3. (a) Explain each step of ARIMA model. 10

Or

(b) Write about the double-exponential smoothing or Holt's forecasting method.

4. Write short notes on the following (any three) : 5×3=15

- (a) Autocorrelation and correlogram
- (b) Time series decomposition
- (c) MA process and AR process
- (d) Weak stationary and strong stationary
- (e) Estimation of trend

5. (a) The table below shows the data of sale of nine years :

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales (in Lakh unit)	65	95	115	63	120	100	150	135	172

Fit the trend using free-hand curve method. Also write the merits and demerits of this technique. $6+4=10$

Or

- (b) Describe any two methods for estimating the seasonal component of time series. $5+5=10$

Total No. of Printed Pages—8

5 SEM TDC DSE STS (CBCS) 3 (H) (N/O)

2024

(November)

STATISTICS

(Discipline Specific Elective)

(For Honours)

Paper : DSE-3

(**Econometrics**)

*The figures in the margin indicate full marks
for the questions*

(New Course)

Full Marks : 55

Pass Marks : 22

Time : 3 hours

1. Choose the correct answer from the following alternatives : 1×5=5

(a) In the general linear model in usual notation, the simplest set of assumption is

- (i) $E(u) = 0$
- (ii) X has rank $k < n$
- (iii) $E(uu') = \sigma^2 I$
- (iv) All of the above

(2)

- (b) What is the range of values that the autocorrelation coefficient can take?
- (i) -1 to 0
 - (ii) 0 to 1
 - (iii) -1 to 1
 - (iv) 0 to ∞
- (c) Specification bias or specification error means
- (i) leaving out important explanatory variables
 - (ii) including unnecessary variables
 - (iii) choosing the wrong functional form between y and x variables
 - (iv) All of the above
- (d) When error terms across cross-section data are correlated, it is known as
- (i) cross-correlation
 - (ii) cross autocorrelation
 - (iii) serial correlation
 - (iv) spatial autocorrelation
- (e) Estimating the coefficient of regression model in the presence of autocorrelation leads to _____ being not valid.
- (i) t -test
 - (ii) F -test
 - (iii) Chi-square test
 - (iv) All of the above

(3)

2. Answer the following questions in brief: $3 \times 4 = 12$

- (a) What are the assumptions of general linear model?
- (b) What is the difference between OLS and GLS estimators? Which one is better?
- (c) Write in brief about autoregressive and lag model.
- (d) What are the main causes of heteroscedasticity?

3. (a) Describe the Aitken's estimator and find its mean and variance. Show that it has least variance in the class of all unbiased linear estimators. $3+4+4=11$

Or

- (b) For general linear model,

$$Y_{(n \times 1)} = X_{n \times (k+1)} \beta_{(k+1)} + \epsilon_{(n \times 1)}$$

with usual assumptions, develop the test of significance for individual regression coefficient. Also obtain $100(1-\alpha)\%$ confidence interval for β_i . 11

4. (a) Explain an example of simultaneous equation model using economic variable in structural form. 9

(4)

Or

- (b) Explain in detail the remedial measures to tackle the problem of multicollinearity.

5. (a) What is meant by autocorrelation? What are the consequences of the presence of autocorrelation? Describe any one method of detecting autocorrelation. 9

Or

- (b) What are the differences between Simple linear regression and Classical linear regression model? Obtain an estimate of $\hat{\beta}$ of the vector of unknown coefficient β in a matrix form. Also find the mean of $\hat{\beta}$.

6. (a) Describe two tests for heteroscedasticity. 9

Or

- (b) What is meant by specification bias? What are the main causes of specification bias? Explain briefly any one of them.

(5)

(Old Course)

Full Marks : 50

Pass Marks : 20

Time : 2 hours

1. Choose the correct answer from the following alternatives : $1 \times 5 = 5$

- (a) In the general linear model in usual notation, the simplest set of assumption is

(i) $E(u) = 0$

(ii) X has rank $k < n$

(iii) $E(uu') = \sigma^2 I$

(iv) All of the above

- (b) What is the range of values that the autocorrelation coefficient can take?

(i) -1 to 0

(ii) 0 to 1

(iii) -1 to 1

(iv) 0 to ∞

- (c) Specification bias or specification error means

(i) leaving out important explanatory variables

(ii) including unnecessary variables

(iii) choosing the wrong functional form between y and x variables

(iv) All of the above

- (d) When error terms across cross-section data are correlated, it is known as

- (i) cross-correlation
- (ii) cross autocorrelation
- (iii) serial correlation
- (iv) spatial autocorrelation

- (e) Estimating the coefficient of regression model in the presence of autocorrelation leads to _____ being not valid.

- (i) t-test
- (ii) F-test
- (iii) Chi-square test
- (iv) All of the above

2. Answer the following questions in brief: $3 \times 4 = 12$

- (a) What are the assumptions of general linear model?
- (b) What is the difference between OLS and GLS estimators? Which one is better?
- (c) Write in brief about autoregressive and lag model.
- (d) What are the main causes of heteroscedasticity?

3. (a) Describe the Aitken's estimator and find its mean and variance. Show that it has least variance in the class of all unbiased linear estimators. $3+3+3=9$

Or

- (b) For general linear model,

$$Y_{(n \times 1)} = X_{n \times (k+1)} \beta_{(k+1)} + \epsilon_{(n \times 1)}$$

with usual assumptions, develop the test of significance for individual regression coefficient. Also obtain $100(1-\alpha)\%$ confidence interval for β_i . 9

4. (a) Explain an example of simultaneous equation model using economic variable in structural form. 8

Or

- (b) Explain in detail the remedial measures to tackle the problem of multicollinearity.

5. (a) What is meant by autocorrelation? What are the consequences of the presence of autocorrelation? Describe any one method of detecting autocorrelation. 8

Or

- (b) What are the differences between Simple linear regression and Classical linear regression model? Obtain an estimate of $\hat{\beta}$ of the vector of unknown coefficient β in a matrix form. Also find the mean of $\hat{\beta}$.

6. (a) Describe two tests for heteroscedasticity. 8

Or

- (b) What is meant by specification bias? What are the main causes of specification bias? Explain briefly any one of them.

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5 SEM TDC DSE STS (CBCS) 4 (H) (N/O)

2024

(November)

STATISTICS

(Discipline Specific Elective)

(For Honours)

Paper : DSE-4

(Demography and Vital Statistics)

*The figures in the margin indicate full marks
for the questions*

(New Course)

Full Marks : 55

Pass Marks : 22

Time : 3 hours

1. Choose the correct answer from the following alternatives : 1×5=5

(a) According to Malthus, which of the following is an example of preventive checks?

- (i) Infanticide
- (ii) Abortion
- (iii) Adultery
- (iv) All of the above

(2)

(b) Which of the following is not a probability rate of vital events?

- (i) Crude death rate
- (ii) Crude birthrate
- (iii) General reproduction rate
- (iv) None of the above

(c) What does infant mortality mean?

- (i) The number of deaths per 1000 live births of children under 1 year of age
- (ii) Death of children under the age of 5 years
- (iii) Death of children before the age of 6 months
- (iv) None of the above

(d) A life table is a profile of human population which exhibits

- (i) probability of dying at each age
- (ii) numbers living and dying
- (iii) expectation of life at each age
- (iv) All of the above

(3)

(e) If NRR is less than unity, then

- (i) the population has a tendency to increase
- (ii) the population has a tendency to decrease
- (iii) the population has a tendency to remain constant
- (iv) None of the above

2. Answer the following questions in brief :

2×5=10

- (a) Define the term 'demography'.
- (b) Define cohort and radix.
- (c) What is the maternal mortality rate?
- (d) Write two uses of a life table.
- (e) Distinguish between stationary population and stable population.

3. Explain Malthusian theory of population with its criticism.

4+2=6

Or

Discuss Chandrasekaran and Deming formula.

6

4. What do you mean by Myer's blended index of digit preference? What are its assumptions and limitations?

2+2+2=6

(4)

Or

Explain the theory of demographic transition. Analyze the demographic situations in India in the light of the theory of demographic transition. 3+3=6

5. Discuss the different sources with NRC and Aadhaar for obtaining demographic data in India. 5+2+2=9

Or

Why are basic measures of mortality adjusted to obtain standardized death rates? Describe the direct and indirect methods of standardized death rates. 2+3+4=9

6. Explain the various columns of a life table and relations between them. 7

Or

What is abridged life table? Describe the Greville's method of constructing abridged life table. 2+5=7

7. Define total fertility rate, gross reproduction rate and net reproduction rate. In what way they differ from one another? Discuss. 2+3+3+4=12

Or

What factors govern the growth of population? Discuss the various coefficients used for measuring population growth. 4+8=12

(Continued)

(5)

(Old Course)

Full Marks : 50

Pass Marks : 20

Time : 2 hours

1. Choose the correct answer from the following alternatives : 1×5=5

(a) Which of the following, disproved Malthusian theory?

(i) Malthusian Trap

(ii) Blue Revolution

(iii) Green Revolution

(iv) White Revolution

(b) Which of the following is not a probability rate of vital events?

(i) Crude death rate

(ii) Crude birthrate

(iii) General reproduction rate

(iv) None of the above

(6)

- (c) What is the maternal mortality rate?
- (i) Women's death occurred before 9th month of pregnancy
 - (ii) The annual number of female deaths per 100000 live births due to pregnancy
 - (iii) The death of women occurred within 2 years of child birth
 - (iv) None of the above
- (d) Life table has also been named as
- (i) mortality table
 - (ii) survival table
 - (iii) life expectancy table
 - (iv) All of the above
- (e) The relation between NRR and GRR is
- (i) NRR and GRR are usually equal
 - (ii) NRR can never exceed GRR
 - (iii) NRR is generally greater than GRR
 - (iv) None of the above

(7)

2. Answer the following questions in brief :

2×5=10

- (a) Define the term 'demography'.
- (b) Define cohort and radix.
- (c) What is gross reproduction rate?
- (d) Distinguish between stationary population and stable population.
- (e) Write two uses of a life table.

3. Explain Malthusian theory of population with its criticism.

4+2=6

Or

Discuss Chandrasekaran and Deming formula.

6

4. What do you mean by Myer's blended index of digit preference? What are its assumptions and limitations?

2+2+2=6

Or

Explain the theory of demographic transition. Analyze the demographic situations in India in the light of the theory of demographic transition.

3+3=6

5. Discuss the different sources for obtaining demographic data in India.

7

Or

Explain the purpose and procedure of standardized death rates.

2+5=7

6. State the meaning of various columns of a life table. Explain how a life table can be constructed from data usually available.

4+3=7

Or

What is abridged life table? Describe the Greville's method of constructing abridged life table.

2+5=7

7. Explain the different measures of fertility. Out of the age specific fertility and general fertility rates which one do you think better represents the general fertility situation of a place and why?

6+3=9

Or

What factors govern the growth of population? Discuss the various coefficients used for measuring population growth.

4+5=9

★ ★ ★