

Reg. No.

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**STS 554**

**IV Semester M.Sc. Degree Examination, September/October 2022**  
**STATISTICS**  
**Financial Time Series**

Time : 3 Hours

Max. Marks : 70

**Instructions :** 1) Question No. 1 is **compulsory**.  
2) Answer **any four** questions from the **remaining**.

1. Answer **any six** subdivisions from the following. **(6×3=18)**

- a) Explain the special features of financial time series. How it is different from classical time series ?
- b) Explain the terms :
  - i) Continuously compounded multiperiod return
  - ii) Portfolio return
  - iii) Dividend payment.
- c) Define sample skewness and sample kurtosis of the return. Give the test statistics for
  - i) testing skewness of return is zero
  - ii) testing excess kurtosis of return is zero.
- d) Define sample autocorrelation function (ACF) of a stationary time series. Obtain autocorrelation function of the time series  $X_t = 0.9X_{t-1} + \varepsilon_t$ . Is it stationary ? Justify.
- e) Explain the test procedure for detecting unit root in a time series.
- f) Describe seasonal integrated autoregressive moving average model.
- g) Define volatility and state its properties.
- h) Explain co integration and error correction models.

2. a) Define ARCH(p) model. Explain a test procedure for testing the ARCH effect.

- b) Let  $Y_t$  follows ARCH(1) process. Show that  $\{Y_t\}$  is uncorrelated. Obtain ACF of  $Y_t^2$ . Show that marginal distribution of  $\{Y_t\}$  is heavy tailed.

c) Obtain the Yule-Walker equation for the ARCH(p) process.

**(4+5+4)**

P.T.O.



3. a) Define moving average process of order  $q$ . Obtain its variance and auto covariance function.

b) Let  $X_t$  follows AR(1) and  $\bar{X}_n = \frac{\sum_{t=1}^n X_t}{n}$  find  $\text{Var}(\bar{X}_n)$ .

- c) Suppose that the daily log return of a security follows the model  $r_t = 0.01 + 0.2r_{t-1} - 2 + a_t$ , where  $\{a_t\}$  is a Gaussian white noise series with mean zero and variance 0.02. What are the mean and variance of the return series  $r_t$ ? Compute the lag-1 and lag-2 autocorrelations of  $r_t$ . **(5+3+5)**

4. a) Explain Yule-Walker method of estimation for an AR( $p$ ) model.

- b) Write the model in backward shift operator  $X_t = 1.5X_{t-1} - 0.6X_{t-2} + \varepsilon_t$ . Examine for stationary. Obtain the Yule-Walker equations for this model and solve these equations to obtain  $\rho_1$  and  $\rho_2$ . **(5+8)**

5. a) Define GARCH ( $p, q$ ) model for the return series. Obtain the variance and kurtosis of return series which follows GARCH(1 1).

- b) Obtain the maximum likelihood estimates of parameters of ARCH(1) process. **(7+6)**

6. a) Define Exponential GARCH and GARCH in mean models. State elementary properties of these models.

- b) Explain how GARCH(1 1) is related to ARMA(1 1) process. Whether writing GARCH as ARMA solve the problem of estimation. Explain.

- c) Explain the order determination procedure of classical financial time series models. **(5+4+4)**

7. a) Explain residual analysis in time series modeling. Explain the related tests based on residuals.

- b) Obtain  $h$ -step ahead forecast of GARCH(1, 2) process.

- c) Explain the steps involved in building a financial time series model. **(4+5+4)**

8. a) Obtain the autocorrelation function of GARCH(1 1) process.

- b) Obtain Explicit expression for ACF of ARMA(1 1) process.

- c) Derive the  $L$ -step ahead forecast equation of ARCH ( $p$ ) process. **(4+4+5)**