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| Soft Core | STS 504: ACTUARIAL STATISTICS | No. of credits: 3 |
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#### Course Outcomes:

CO1: To understand how actuarial science is used in finance, investments, banking and insurance.

CO2: Explain the concept of survival models

CO3: Describe estimation procedures for lifetime distributions.

CO4: To understand the statistical behaviour of actuarial indicators

CO5: To solve the problems related to the benefit amounts in insurance, annuities, premiums and reserves.

#### Unit 1

Introduction to life Insurance, insurance contracts, survival models. Future lifetime random variable, force of mortality, actuarial notation, curtate future lifetime, complete and curtate expected future lifetimes, Life tables, Fractional age assumptions, Uniform distribution of deaths, constant force of mortality, Select life tables. (14 hrs)

#### Unit II

Compound interest and discounting, force of interest, benefit payable at the time of death, term life insurance. Whole life insurance: the continuous case, the annual case, the 1/mthly case. Recursions, term insurance, pure endowment, endowment insurance.

Annuities-certain, annual life annuities, whole life annuity-due, term annuity-due, whole life immediate annuity, term immediate annuity. Annuities payable continuously. Annuities payable  $m$  times per year. (14 hrs)

#### Unit III

Loss at issue random variable, principles of premium calculation. Fully continuous premiums, fully discrete premiums, true mthly payment premiums. Gross premiums. Reserves, Fully continuous reserves, fully discrete reserves. (14 hrs)

#### References:

1. David C.M.Dickson, Mary R. Hardy and Howard R Waters (2009) "Actuarial Mathematics for Life Contingent Risks", Cambrigge University Press.
2. Shailaja R Deshmukh (2009) "Actuarial Statistics", University Press (India) Private Limited, Hyderabad.
3. N.L. Bowers, H.U. Gerber, J.C. Hickman, D.A. Jones and C.J. Nesbitt (1997), "Actuarial Mathematics", Second Edition, The Society of Actuaries

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| Soft Core | STS 505: TIME SERIES ANALYSIS | No. of credits : 3 |
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### Course Outcomes:

- CO1: Understand the concept of time series and its components
- CO2: Understand the bases of different models of time series analysis including decomposition
- CO3: To learn proper model identification and its estimation.
- CO4: To learn several ways of identifying the forecasting methods with the least forecasting error.

### Unit I

Simple Descriptive Techniques: time series plots, trend, seasonal effect. Tests for trend and seasonality: estimation and elimination of trend and seasonal components. Exponential and moving average smoothing.

Time Series as discrete parameter stochastic process. Stationarity, autocovariance and autocorrelation function and their properties. Partial autocorrelation function. (10 hrs)

### Unit II

Probability Models: White noise model, random walk, linear processes, Moving Average (MA), Autoregressive (AR), ARMA and ARIMA, seasonal ARIMA models. Invertibility. ACF and PACF of these processes. Sample ACF and PACF. Model identification. (12 hrs)

### Unit III

Model Building: Estimation of mean, autocovariance function and autocorrelation function. Estimation of AR models – Yule-Walker equations, estimation of MA model and ARMA models. Order selection in AR and MA models. (10 hrs)

### Unit IV

Forecasting: Forecast mean square error (FMSE), Least squares prediction. BLUP. Box-Jenkins forecasting. Forecasting through exponential smoothing and Holt-Winters smoothing. Residual analysis and diagnostic checking. Nonstationary time series models and their identification. (10hrs)