RESERVE BANK OF INDIA SERVICES BOARD, MUMBAI

Addendum – Direct Recruitment for the post of Officers in Grade 'B' (Direct Recruit-DR) (On Probation-OP) (General/DEPR/DSIM) Streams - Panel Year 2023

(Advertisement no. 3A/2023-24 dated May 09, 2023).

In reference to Syllabi as given under Para-B of Appendix-III of the Detailed Notice of the Advertisement no. 3A/2023-24 dated May 09, 2023 on the captioned recruitment, detailed syllabus for the post of Grade B (DR) DSIM - PY 2023 is given in Appendix-VII.

Note: All other terms & conditions as mentioned in Advertisement no. 3A/2023-24 dated May 09, 2023 remain unchanged. Corrigendum, if any, on this advertisement will be issued only on the Bank's website www.rbi.org.in.

Appendix-VII

Officers in Grade 'B' (DR) – DSIM – 2023 - Detailed Syllabus

1. Theory of Probability and Probability Distributions

Classical and axiomatic approach of probability and its properties, Bayes theorem and its application, strong and weak laws of large numbers, characteristic functions, central limit theorem, probability inequalities.

Standard probability distributions – Binomial, Poison, Geometric, Negative binomial, Uniform, Normal, exponential, Logistic, Log-normal, Beta, Gamma, Weibull, Bivariate normal etc.

Exact Sampling distributions - Chi-square, student's t, F and Z distributions and their applications. Asymptotic sampling distributions and large sample tests, association and analysis of contingency tables.

Sampling Theory:

Standard sampling methods such simple random sampling, Stratified random sampling, Systematic sampling, Cluster sampling, Two stage sampling, Probability proportional to size etc. Ratio estimation, Regression estimation, non-sampling errors and problem of non-response, and Correspondence and categorical data analysis.

2. Linear Models and Economic Statistics

Simple linear regression - assumptions, estimation, and inference diagnostic checks; polynomial regression, transformations on Y or X (Box-Cox, square root, log etc.), method of weighted least squares, inverse regression. Multiple regression - Standard Gauss Markov setup, least squares estimation and related properties, regression analysis with correlated observations. Simultaneous estimation of linear parametric functions, Testing of hypotheses; Confidence intervals and regions; Multicollinearity and ridge regression, LASSO.

Definition and construction of index numbers, Standard index numbers; Conversion of chain base index to fixed base and vice-versa; base shifting, splicing and deflating of index numbers; Measurement of economic inequality: Gini's coefficient, Lorenz curves etc.

3. Statistical Inference: Estimation, Testing of Hypothesis and Non-Parametric Test

Estimation: Concepts of estimation, unbiasedness, sufficiency, consistency and efficiency. Factorization theorem. Complete statistic, Minimum variance unbiased estimator (MVUE), Rao-Blackwell and Lehmann-Scheffe theorems and their applications. Cramer-Rao inequality.

Methods of Estimation: Method of moments, method of maximum likelihood estimation, method of least square, method of minimum Chi-square, basic idea of Bayes estimators.

Principles of Test of Significance: Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test, uniformly most powerful test, Neyman Pearson theory of testing of hypothesis. Likelihood ratio tests, Tests of goodness of fit. Bartlett's test for homogeneity of variances.

Non-Parametric Test: The Kolmogorov-Smirnov test, Sign test, Wilcoxon Signed-rank test, Wilcoxon Rank-Sum test, Mann Whitney U-test, Kruskal-Walls one way ANOVA test, Friedman's test, Kendall's Tau coefficient, Spearman's coefficient of rank correlation.

4. Stochastic Processes

Poisson Processes: Arrival, interarrival and conditional arrival distributions. Non-homogeneous Processes. Law of Rare Events and Poisson Process. Compound Poisson Processes.

Markov Chains: Transition probability matrix, Chapman- Kolmogorov equations, Regular chains and Stationary distributions, Periodicity, Limit theorems. Patterns for recurrent events. Brownian Motion - Limit of Random Walk, its defining characteristics and peculiarities; Martingales.

5. Multivariate Analysis

Multivariate normal distribution and its properties and characterization; Wishart matrix, its distribution and properties, Hotelling's T^2 statistic, its distribution and properties, and its applications in tests on mean vector, Mahalanobis' D^2 statistics; Canonical correlation analysis, Principal components analysis, Factor analysis and cluster analysis.

6. Econometrics and Time Series

General linear model and its extensions, ordinary least squares and generalized least squares estimation and prediction, heteroscedastic disturbances, pure and mixed estimation. Auto correlation, its consequences and related tests; Theil BLUS procedure, estimation and prediction; issue of multi-collinearity, its implications and tools for handling it; Ridge regression.

Linear regression and stochastic regression, instrumental variable regression, autoregressive linear regression, distributed lag models, estimation of lags by OLS method. Simultaneous linear equations model and its generalization, identification problem, restrictions on structural parameters, rank and order conditions; different estimation methods for simultaneous equations model, prediction and simultaneous confidence intervals.

Exploratory analysis of time series; Concepts of weak and strong stationarity; AR, MA and ARMA processes and their properties; model identification based on ACF and PACF; model estimation and diagnostic tests; Box-Jenkins models; ARCH/GARCH models.

Inference with Non-Stationary Models: ARIMA model, determination of the order of integration, trend stationarity and difference stationary processes, tests of non-stationarity.

7. Statistical Computing

Simulation techniques for various probability models, and resampling methods jack-knife, bootstrap and cross-validation; techniques for robust linear regression, nonlinear and generalized linear regression problem, tree-structured regression and classification; Analysis of incomplete data – EM algorithm, single and multiple imputation; Markov Chain Monte Carlo and annealing techniques, Gibbs sampling, Metropolis-Hastings algorithm; Neural Networks, Association Rules and learning algorithms.

8. Data Science, Artificial Intelligence and Machine Learning Techniques

Introduction to supervised and unsupervised pattern classification; unsupervised and reinforcement learning, basics of optimization, model accuracy measures.

Supervised Algorithms: Linear Regression, Logistic Regression, Penalized Regression, Naïve Bayes, Nearest Neighbour, Decision Tree, Support Vector Machine, Kernel density estimation and kernel discriminant analysis; Classification under a regression framework, neural network, kernel regression and tree and random forests.

Unsupervised Classification: Hierarchical and non-hierarchical methods: k-means, k-medoids and linkage methods, Cluster validation indices: Dunn index, Gap statistics.

Bagging (Random Forest) and Boosting (Adaptive Boosting, Gradient Boosting) techniques; Recurrent Neural Network (RNN); Convolutional Neural Network**;** Natural Language Processing.