Plan of Written Examination

*All the aspirants are informed as under with respect to the written test to be conducted for the recruitment of **Milk Recorder** :-*

(i)   The Exam will be conducted in MCQ (Multiple Choice Questions) format. OMR sheets will be used for answering the questions.

*(ii)   There will be negative marking. Each question carries 1 mark. **For every wrong answer, 1/4th mark would be deducted. The question(s) not attempted will receive no credit or discredit.***

(iii)   The test would be of 2 hours duration.

iv)   Pattern of the written competitive examination is as follows:-

Sr. No.	Topic	No. of Questions	Marks (Each Question carries 1 mark)	Type of Questions
1.	Questions from the Subject (Part A of Syllabus)	90	90	MCQs (Multiple Choice Questions)
2.	Questions from General Knowledge, English, Punjabi, Logical Reasoning and Mental ability (Part B of Syllabus)	30	30	
Total		**120**	**120**	

v)   Part A contains questions from the four subjects Economics, Statistics, Mathematics and Commerce. Candidate can attempt any one of the subjects mentioned above.

*vi)   Tentative syllabus for the written examination for the recruitment of **Milk Recorder** is annexed at Annexure-1 and 2.*

Annexure- I Syllabus

Part-A

(Post- Milk Recorder)

I. Economics

1. Advanced Micro Economics :

(a) Marshallian and Walrasian Approaches to Price determination.

(b)Alternative Distribution Theories : Ricardo, Kaldor, Kalecki.

(c)Markets Structure : Monopolistic Competition, Duopoly, Oligopoly.

(d)Modern Welfare Criteria : Pareto Hicks and Scitovsky, Arrow's Impossibility Theorem, A. K. Sen's Social Welfare Function.

2. Advance Macro Economics :

Approaches to Employment Income and Interest Rate determination : Classical, Keynes (IS-LM) curve, Neo-classical synthesis and New classical, Theories of Interest Rate determination and Interest Rate Structure.

3. Money-Banking and Finance :

(a) Demand for and Supply of Money : Money Multiplier Quantity Theory of Money (Fisher, Pigou and Friedman) and Keynes' Theory on Demand for Money, Goals and Instruments of Monetary Management in Closed and Open Economies. Relation between the Central Bank and the Treasury. Proposal for ceiling on growth rate of money.

(b)Public Finance and its Role in market economy : in stabilization of supply, allocation of resources and in distribution anddevelopment. Sources of Government revenue, forms of Taxes and Subsidies, their incidence and effects. Limits to taxation, loans, crowding-out effects and limits to borrowings. Public expenditure and its effects.

4. International Economics :

(a)Old and New theories of International Trade.

(i) Comparative advantage,

(ii)Terms of Trade and offer curve.

(iii)Product cycle and Strategic trade theories.

(iv)Trade as an engine of growth and theories of underdevelopment inan open economy.

(b)Forms of protection : Tariff and quota.

(c)Balance of Payments Adjustments : Alternative Approaches.

(i)Price versus income, income adjustments under fixed exchange rates.

(ii)Theories of Policy mix.

(iii)Exchange rate adjustments under capital mobility.

(iv)Floating Rates and their implications for developing Countries: Currency Boards.

(v)Trade Policy and Developing Countries.

(vi)BOP, adjustments and Policy Coordination in open economy macro-model.

(vii)Speculativeattacks.

(viii)Trade Blocks and Monetary Unions.

(ix) WTO : Trims, TRIPS, Domestic Measures, Different Rounds of WTO talks.

5.Growth and Development:

(a) (i)Theories of growth : Harrod's model;

(ii)Lewis model of development with surplus labour.

(iii)Balanced Unbalanced Growth.

(iv)human capitals and Economic Growth.

(v)Research and Development and Economic Growth.

(b)Process of Economic Development of less developed countries: Myrdal and Kuznets on economic development and structural change: Role of Agriculture in Economic Development of less developed countries.

(c)Economic Development and International Trade and Investment, Role of Multinationals.

(d)Planning and economic Development: changing role of Markets and Planning, Private-Public Partnership.

(e)Welfare indicators and measures of growth—Human development indices. The basic needs approach.

(f)Development and Environmental Sustainability—Renewable and Non Renewable Resources, Environmental Degradation, Intergenerational equity development.

6. Indian Economy in Pre-Independence Era :

Land System and its changes, Commercialization of agriculture Drain theory, Laissez faire theory and critique. Manufacture and Transport: Jute, Cotton, Railways, Money and Credit.

7. Indian Economy after Independence :

A. The Pre-Liberalization Era :

(i) Contribution of Vakil, Gadgil and V.K.R.V. Rao.

(ii)Agriculture: Land Reforms and land tenure system, Green Revolution and capital formation in agriculture.

(iii)Industry Trends in composition and growth, Role of public and private sector, Small scale and cottage industries.

(iv)National and Per capita income : patterns, trends, aggregate and Sectoral composition and changes therein.

(v) Broad factors determining National Income and distribution, Measures of poverty, Trends in poverty and inequality.

B. The Post Liberalization Era :

(i)New Economic Reform and Agriculture: Agriculture and WTO, Food processing, subsidies, Agricultural prices and public distribution system, Impact ofpublic expenditure on agricultural growth.

(ii)New Economic Policy and Industry: Strategy of industrialization, Privatization, Disinvestments, Role of foreign direct investment and multinationals.

(iii)New Economic Policy and Trade: Intellectual property rights : Implications of TRIPS, TRIMS, GATS and new EXIM policy.

(iv)New Exchange Rate Regime: Partial and full convertibility, Capital account convertibility.

(v)New Economic Policy and Public Finance : Fiscal Responsibility Act, Twelfth Finance Commission and Fiscal Federalism and Fiscal Consolidation.

(vi)New Economic Policy and Monetary system. Role of RBI under the new regime.

(vii)Planning: From central Planning to indicative planning, Relation between planning and markets for growth and decentralized planning: 73rd and 74th Constitutional amendments.

(viii)New Economic Policy and Employment: Employment and poverty, Rural wages, Employment Generation, Poverty alleviation schemes, New Rural, Employment Guarantee Scheme.

II. Statistics

1. Probability :

Sample space and events, probability measure and probability space, random variable as a measurable function. distribution function of a random variable, discrete and continuous-type random variable, probability mass function, probability density function, vector-valued random variable, marginal and conditional distributions, stochastic independence of events and of random variables, expectation and moments of a random variable, conditional expectation, convergence of a sequence of random variable in distribution, in probability, in path mean and almost everywhere, their criteria and inter-relations, Chebyshev's inequality and Khintchine's weak law of large numbers, strong law of large numbers and Kolmogoroffs theorems, probability generating function, moment generating function, characteristic function, inversion theorem, Linderberg and Levy forms of central limit theorem, standard discrete and continuous probability distributions.

2. Statistical Inference:

Consistency, unbiasedness, efficiency, sufficiency, completeness, ancillary statistics, factorization theorem, exponential family of distribution and its properties, uniformly minimum variance unbiased (UMVU) estimation, Rao Blackwell and Lehmann-Scheffe theorems, Cramer-Rao inequality for single Parameter. Estimation by methods of moments, maximum likelihood, least squares, minimum chisquare and modified minimum chisquare, properties of maximum likelihood and other estimators, asymptotic efficiency, prior and posterior distributions, loss function, risk function, and minimax estimator. Bayes estimators. Non-randomised and randomised tests, critical function, MP tests, Neyman-Pearson lemma, UMP tests, monotone likelihood ratio: similar and unbiased tests, UMPU tests for single paramet likelihood ratio test and its asymptotic distribution. Confidence bounds and its relation with tests. Kolmogorov's test for goodness of fit and its consistency, sign test and its optimality. Wilcoxon signedranks test and its consistency, Kolmogorov-Smirnov two sample test, run test, Wilcoxon-MannWhitney test and median test, their consistency and asymptotic normality. Wald's SPRT and its properties, Oc and ASN

functions for tests regarding parameters for Bernoulli, Poisson, normal and exponential distributions. Wald's fundamental identity.

3. Linear Inference and Multivariate Analysis :

Linear statistical models, theory of least squares and analysis of variance, Gauss-Markoff theory, normal equations, least squares estimates and their precision, test of significance and interval estimates based on least squares theory in oneway, two-way and three-way classified data, regression analysis, linear regression, curvilinear regression and orthogonal polynomials, multiple regression, multiple and partial correlations, estimation of variance and covariance components, multivariate normal distribution, Mahalanobis's D2 and Hotelling's T2 statistics and their applications and properties, discriminant analysis, canonical correlations, principal component analysis.

4. Sampling Theory and Design of Experiments :

An outline of fixed-population and super-population approaches, distinctive features of finite population sampling, propability sampling designs, simple random sampling with and without replacement, stratified random sampling, systematic sampling and its efficacy, cluster sampling, two stage and multi-stage sampling, ratio and regression methods of estimation involving one or more auxiliary variables, two-phase sampling, probability proportional to size sampling with and without replacement, the Hansen-Hurwitz and the HorvitzThompson estimators, non-negative variance estimation with reference to the HorvitzThompson estimator, non-sampling errors. Fixed effects model (two-way classification) random and mixed effects models (two-way classification with equal observation per cell), CRD, RBD, LSD and their analyses, incomplete block designs, concepts of orthogonality and balance, BIBD, missing plot technique, factorial experiments and 24 and 32, confounding in factorial experiments, split-plot and simple lattice designs, transformation of data Duncan's multiple range test.

5. Industrial Statistics

Process and product control, general theory of control charts, different types of control charts for variables and attributes, X, R, s, p, np and charts,

cumulative sum chart. Single, double, multiple and sequential sampling plans for attributes, OC, ASN, AOQ and ATI curves, concepts of producer's and consumer's risks, AQL, LTPD and AOQL, Sampling plans for variables, Use of Dodge-Romin tables. Concept of reliability, failure rate and reliability functions, reliability of series and parallel systems and other simple configurations, renewal density and renewal function, Failure models: exponential, Weibull, normal, lognormal. Problems in life testing, censored and truncated experiments for exponential models.

6. Optimization Techniques :

Different types of models in Operations Research, their construction and general methods of solution, simulation and Monte-Carlo methods formulation of Linear Programming (LP) problem, simple LP model and its graphical solution, the simplex procedure, the two-phase metbod and the M-technique with artificial variables, the duality theory of LP and its economic interpretation, sensitivity analysis, transpotation and assignment problems, rectangular games, two-person zerosum games, methods of solution (graphical and algebraic). Replacement of failing or deteriorating items, group and individual replacement policies, concept of scientific inventory management and analytical structure of inventory problems, simple models with deterministic and stochastic demand with and without lead time, storage models with particular reference to dam type. Homogeneous discrete-time Markov chains, transition probability matrix, classification of states and ergodic theorems, homogeneous continuous-time Markov chains, Poisson process, elements of queuing theory, M/MI, M/M/K, G/M/I and M/G/1 queues. Solution of statistical problems on computers using wellknown statistical software packages like SPSS.

7. Quantitative Economics and Official Statistics:

Determination of trend, seasonal and cyclical components, Box-Jenkins method, tests for stationary series, ARIMA models and determination of orders of autoregressive and moving average components, fore-casting. Commonly used index numbers - Laspeyre's, Paasche's and Fisher's ideal index numbers, cham-base index number, uses and limitations of index numbers, index number of wholesale prices, consumer price, agricultural production and industrial production, test fot index numbers -proportionality,

time-reversal, factor-reversal and circular. General linear model, ordinary least square and generalized least squares methods of estimation, problem of multi-collinearity, consequences and solutions of multi-collinearity, autocorrelation and its consequences, heteroscedasticity of disturbances and its testing, test for independence of disturbances concept of structure and model for simultaneous equations, problem of identification-rank and order conditions of identifiability, two-stage least sauare method of estimation. Present official statistical system in India relating to population, agriculture, industrial production, trade and prices, methods of collection of official statistics, their reliability and limitations, principal publications containing such statistics, various official agencies responsible for data collection and their main functions.

8. Demography and Psychometry :

Demographic data from census, registration, NSS other surveys, their limitations. and uses, definition, construction and uses of vital rates and ratios, measures of fertility, reproduction rates, morbidity rate, standardized death rate, complete and abridged life tables, construction of life tables from vital statistics and census returns, uses of life tables, logistic and other population growth curves, fitting a logistic curve, population projection, stable population, quasi-stable population, techniques in estimation of demographic parameters, standard classification by cause of death, health surveys and use of hospital statistics. Methods of standardisation of scales and tests, Z-scores, standard scores, T-scores, percentile scores, intelligence quotient and its measurement and uses, validity and reliability of test scores and its determination, use of factor analysis and path analysis in psychometry.

III. Mathematics

(1) Linear Algebra :

Vector spaces over R and C, linear dependence and independence, subspaces, bases, dimensions, Linear transformations, rank and nullity, matrix of a linear transformation. Algebra of Matrices; Row and column reduction, Echelon form, congruence's and similarity; Rankof a matrix; Inverse of a matrix; Solution of system of linear equations; Eigenvalues and eigenvectors, characteristic polynomial, Cayley-Hamilton theorem, Symmetric, skew-symmetric, Hermitian, skewHermitian, orthogonal and unitary matrices and their eigenvalues.

(2) Calculus :

Real numbers, functions of a real variable, limits, continuity, differentiability, mean-value theorem, Taylor's theorem with remainders, indeterminate forms, maxima and minima, asymptotes; Curve tracing; Functions of two or three variables; Limits, continuity, partial derivatives, maxima and minima, Lagrange's method of multipliers, Jacobian. Riemann's definition of definite integrals; Indefinite integrals; Infinite and improper integral; Double and triple integrals (evaluation techniques only); Areas, surface and volumes.

(3) Analytic Geometry :

Cartesian and polar coordinates in three dimensions, second degree equations in three variables, reduction to Canonical forms; straight lines, shortest distance between two skew lines, Plane, sphere, cone, cylinder, paraboloid, ellipsoid, hyperboloid of one and two sheets and their properties.

(4) Ordinary Differential Equations :

Formulation of differential equations; Equations of first order and first degree, integrating factor; Orthogonal trajectory; Equations of first order but not of first degree, Clairaut's equation, singular solution. Second and higher order liner equations with constant coefficients, complementary function, particular integral and general solution. Section order linear equations with variable coefficients, Euler-Cauchy equation; Determination of complete

solution when one solution is known using method of variation of parameters. Laplace and Inverse Laplace transforms and their properties, Laplace transforms of elementary functions.Application to initial value problems for 2nd order linear equations with constant coefficients.

(5) Dynamics and Statics :

Rectilinear motion, simple harmonic motion, motion in a plane, projectiles; Constrained motion; Work and energy, conservation of energy; Kepler's laws, orbits under central forces. Equilibrium of a system of particles; Work and potential energy, friction, Common catenary; Principle of virtual work; Stability of equilibrium, equilibrium of forces in three dimensions.

(6) Vector Analysis :

Scalar and vector fields, differentiation of vector field of a scalar variable; Gradient, divergence and curl in cartesian and cylindrical coordinates; Higher order derivatives; Vector identities and vector equation. Application to geometry : Curves in space, curvature and torsion; Serret-Furenet's formulae. Gauss and Stokes' theorems, Green's indentities.

(7) Algebra :

Groups, subgroups, cyclic groups, cosets, Lagrange's Theorem, normal subgroups, quotient groups, homomorphism of groups, basic isomorphism theorems, permutation groups, Cayley's theorem. Rings, subrings and ideals, homomorphisms of rings; Integral domains, principal ideal domains, Euclidean domains and unique factorization domains; Fields, quotient fields.

(8) Real Analysis :

Real number system as an ordered field with least upper bound property; Sequences, limit of a sequence, Cauchy sequence, completeness of real line; Series and its convergence, absolute and conditional convergence of series of real and complex terms, rearrangement of series. Continuity and uniform continuity of functions, properties of continuous functions on compact sets. Riemann integral, improper integrals; Fundamental theorems of integral calculus. Uniform convergence, continuity, differentiability and

integrability for sequences and series of functions; Partial derivatives of functions of several (two or three) variables, maxima and minima.

(9) Complex Analysis :

Analytic function, Cauchy-Riemann equations, Cauchy's theorem, Cauchy's integral formula, power series, representation of an analytic function, Taylor's series; Singularities; Laurent's series; Cauchy's residue theorem; Contour integration.

(10) Linear Programming :

Linear programming problems, basic solution, basic feasible solution and optimal solution; Graphical method and simplex method of solutions; Duality. Transportation and assignment problems.

(11) Partial Differential Equations :

Family of surfaces in three dimensions and formulation of partial differential equations; Solution of quasilinear partial differential equations of the first order, Cauchy's method of characteristics; Linear partial differential equations of the second order with constant coefficients, canonical form; Equation of a vibrating string, heat equation, Laplace equation and their solutions.

(12) Numerical Analysis and Computer Programming :

Numerical methods: Solution of algebraic and transcendental equations of one variable by bisection, Regula-Falsi and Newton-Raphson methods, solution of system of linear equations by Gaussian Elimination and Gauss-Jorden (direct), Gauss-Seidel (iterative) methods. Newton's (forward and backward) and interpolation, Lagrange's interpolation. Numerical integration: Trapezoidal rule, Simpson's rule, Gaussian quadrature formula. Numerical solution of ordinary differential equations : Eular and Runga Kutta methods. Computer Programming : Binary system; Arithmetic and logical operations on numbers; Octal and Hexadecimal Systems; Conversion to and from decimal Systems; Algebra of binary numbers. Elements of computer systems and concept of memory; Basic logic gates and truth tables, Boolean algebra, normal forms. Representation of unsigned integers, signed integers and reals, double precision reals and

long integers. Algorithms and flow charts for solving numerical analysis problems.

(13) Mechanics and Fluid Dynamics :

Generalised coordinates; D'Alembert's principle and Lagrange's equations; Hamilton equations; Moment of inertia; Motion of rigid bodies in two dimensions. Equation of continuity; Euler's equation of motion for inviscid flow; Stream-lines, path of a particle; Potential flow; Two-dimensional and axisymmetric motion; Sources and sinks, vortex motion; NavierStokes equation for a viscous fluid.

IV Commerce

1. Financial Accounting :

Accounting as a Financial Information System; Impact of Behavioural Sciences. Accounting Standards e.g., Accounting for Depreciation, Inventories, Research and Development Costs, Long-term Construction Contracts, Revenue Recognition, Fixed Assets, Contingencies, Foreign Exchange Transactions, Investments and Government Grants, Cash Flow Statement, Earnings Per Share.

Accounting for Share Capital Transactions including Bonus Shares, Right Shares,

Employees Stock Option and Buy- Back of Securities.Preparation and Presentation of Company Final Accounts.Amalgamation, Absorption and Reconstruction of Companies.

2. Cost Accounting :

Nature and Functions of Cost Accounting. Installation of Cost Accounting System. Cost Concepts related to Income Measurement, Profit Planning, Cost Control and Decision Making.

Methods of Costing: Job Costing, Process Costing, Activity Based Costing.

Volume-cost-Profit Relationship as a tool of Profit Planning.

Incremental Analysis/ Differential Costing as a Tool of Pricing Decisions, Product Decisions, Make or Buy Decisions, ShutDown Decisions etc.

Techniques of Cost Control and Cost Reduction: Budgeting as a Tool of Planning and Control. Standard Costing and Variance Analysis. Responsibility Accounting and Divisional Performance Measurement.

3. Taxation :

Income Tax: Definitions; Basis of Charge; Incomes which do not form Part of Total Income. Simple problems of Computation of Income (of Individuals only) under Various Heads, i.e., Salaries, Income from House Property, Profits and Gains from Business or Profession, Capital Gains, Income from other sources, Income of other Persons included in Assessee's Total Income .

Set - Off and Carry Forward of Loss.Deductions from Gross Total Income.

Salient Features/Provisions Related to VAT and Services Tax.

4. Auditing :

Company Audit: Audit related to Divisible Profits, Dividends, Special investigations, Tax audit.

Audit of Banking, Insurance, Non-Profit Organizations and Charitable Societies/ Trusts/Organizations.

5. Financial Management :

Finance Function: Nature, Scope and Objectives of Financial Management: Risk and Return Relationship.

Tools of Financial Analysis: Ratio Analysis, Funds-Flow and Cash-Flow Statement.Capital Budgeting Decisions: Process, Procedures and Appraisal Methods. Risk and Uncertainty Analysis and Methods.

Cost of capital: Concept, Computation of Specific Costs and Weighted Average Cost of Capital. CAPM as a Tool of Determining Cost of Equity Capital.

Financing Decisions: Theories of Capital Structure - Net Income (NI) Approach,

Net Operating Income (NOI) Approach, MM Approach and Traditional Approach. Designing of Capital structure: Types of Leverages (Operating, Financial and Combined) EBIT- EPS Analysis, and other Factors.

Dividend Decisions and Valuation of Firm: Walter's Model , MM Thesis, Gordan's Model Lintner's Model. Factors Affecting Dividend Policy.

Working Capital Management: Planning of Working Capital. Determinants of Working Capital. Components of Working Capital - Cash, Inventory and Receivables.

Corporate Restructuring with focus on Mergers and Acquisitions (Financial aspects only)

6. Financial Markets and Institutions :

Indian Financial System: An Overview

Money Markets: Participants, Structure and Instruments. Commercial Banks. Reforms in Banking sector. Monetary and Credit Policy of RBI. RBI as a Regulator.

Capital Market: Primary and Secondary Market. Financial Market Instruments and Innovative Debt Instruments; SEBI as a Regulator.

Financial Services: Mutual Funds, Venture Capital, Credit Rating Agencies, Insurance and IRDA.

7. Legal Aspects of Business

Indian Contract Act, 1872, Financial markets: Money market; Capital market, Companies Act, 2013, Information Technology Act, 2000, RTI Act, 2005.

Part B Syllabus

General Knowledge, English, Punjabi, Logical Reasoning and Mental Ability.

Sr. No.	Indicative Contents of Syllabus	Weightage (Approx.)
1	**General Knowledge and Current affairs of National and International importance including:** (i) Political issues, (ii) Environment issues, (iii) Current Affairs, (iv) Science and Technology, (v) Economic issues, (vi) History of Punjab-14th century onwards (vii) History of India with special reference to Indian freedom struggle movement. (viii) Sports, (ix) Cinema and Literature.	10
2	**Logical Reasoning & Mental Ability:** Verbal reasoning: Coding, Decoding, Analogy, Classification, Series, Direction sense test, relations, mathematical operations, time test, odd man out problems. Non Verbal reasoning: Series, Analogy and Classification. Basic numerical skills, Percentage, Number system, LCM and HCF, Ratio and Proportion, Number series, Average, Problems based on Ages, Profit & Loss, Partnership and Mixture, Simple and Compound Interest, Work and Time, Time and Distance. Mensuration and Data Interpretation.	10

3	**English:-** Basic Grammar, Subject and Verb, Adjectives and Adverbs, Synonyms, Antonyms, One Word Substitution, Fill in the Blanks, Correction in Sentences, Idioms and their meanings, Spell Checks, Adjectives, Articles, Prepositions, Direct and Indirect Speech, Active and Passive Voice, Correction in Sentences, etc.	*5*
4	**ਪੰਜਾਬੀ:-** ਸ਼ੁੱਧ-ਅਸ਼ੁੱਧ, ਸ਼ਬਦ ਜੋੜ, ਅਗੇਤਰ ਅਤੇ ਪਿਛੇਤਰ, ਸਮਾਨਾਰਥਕ/ਵਿਰੋਧੀ ਸ਼ਬਦ, ਨਾਂਵ, ਪੜਨਾਂਵ ਅਤੇ ਕਿਰਿਆ ਦੀਆਂ ਕਿਸਮਾਂ ਤੇ ਸਹੀ ਵਰਤੋਂ, ਲਿੰਗ ਅਤੇ ਵਚਨ, ਪੰਜਾਬੀ ਅਖਾਣ ਤੇ ਮੁਹਾਵਰੇ, ਅੰਗਰੇਜੀ ਤੋਂ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਅਤੇ ਬਹੁਤੇ ਸ਼ਬਦਾਂ ਦੀ ਥਾਂ ਇੱਕ ਸ਼ਬਦ ਆਦਿ।	*5*
	Maximum Marks	*30*

Note:-a) The distribution of marks/question in each section is indicative. It may vary slightly.

b) The syllabus is broadly classified as above but may vary to some extent.