

ਡਾਇਰੈਕਟਰ, ਸਿੱਖਿਆ ਭਰਤੀ ਡਾਇਰੈਕਟੋਰੇਟ, ਪੰਜਾਬ

ਸਰਕਾਰੀ (ਮਾਡਲ) ਸੀਨੀਅਰ ਸੈਕੰਡਰੀ ਸਕੂਲ, (ਮਾਈਕਰੋਸਾਫਟ ਬਿਲਡਿੰਗ)

ਫੇਜ਼-3ਬੀ-1, ਐਸ.ਏ.ਐਸ. ਨਗਰ, ਮੋਹਾਲੀ

(ਵੈਬਸਾਈਟ www.educationrecruitmentboard.com)

ਵਿਗਿਆਪਨ ਨੰ: 08/23-2022 ਭਡ(4)/2022/01008

ਮਿਤੀ : 27-04-2022

ਪਬਲਿਕ ਨੋਟਿਸ

ਸਿੱਖਿਆ ਵਿਭਾਗ, ਪੰਜਾਬ ਵੱਲੋਂ 343 ਲੈਕਚਰਾਰ ਦੀਆਂ ਨਵੀਆਂ/ਬੈਕਲਾਗ ਅਸਾਮੀਆਂ ਦੀ ਭਰਤੀ ਸਬੰਧੀ ਮਿਤੀ 08-01-2022 ਨੂੰ ਵਿਗਿਆਪਨ ਦਿੱਤਾ ਗਿਆ ਸੀ। ਵਿਗਿਆਪਨ ਦੀ ਸ਼ਰਤ ਅਨੁਸਾਰ ਇਸ ਭਰਤੀ ਲਈ ਲਿਖਤੀ ਟੈਸਟ ਲਿਆ ਜਾਣਾ ਹੈ। ਇਸ ਮੰਤਵ ਲਈ ਉਕਤ ਵਿਸ਼ਿਆਂ ਦਾ ਸਿਲੇਬਸ ਅੱਪਲੋਡ ਕੀਤਾ ਜਾਂਦਾ ਹੈ।

ਸਹਾਇਕ ਡਾਇਰੈਕਟਰ

ਸਿੱਖਿਆ ਭਰਤੀ ਡਾਇਰੈਕਟੋਰੇਟ, ਪੰਜਾਬ।

COMMERCE

Part A: Accounting

Introduction to accounting

Accounting, objectives, advantages and limitations, types of accounting information, uses of accounting information and their needs. Basic accounting terms, accounting concepts, capital and revenue cash basis and accrual basis accounting standards and IFRS.

Accounting Principles, recording of transactions, origin of transactions, source documents, books of original entry

-Journal, cash books and subsidiary books ledger & trail balance, depreciation, provisions & reserves. Accounting for Bills of exchange, rectification of errors, bank reconciliation statement Financial statements of sole proprietorship, complete & incomplete records, profit & loss accounts, gross profit, net profit, balance sheet, adjustments in preparation of financial statements.

Financial statements of not for profit organization, receipt & payment account & Income and expenditure account & balance sheet.

Introduction to computer & accounting information system

Introduction to operating software, utility software & application software. Stages in automation, accounting for partnership firms; Admission, retirement, death, & dissolution & cash distribution.

Advance Company Accounts

Accounting for share capital & debentures (share capital, issue & allotment, fore feature, purchase of business, liquidations, valuation of shares amalgamation, absorption & reconstruction, holding company accounts.

Cost & Management Accounting

Ratio analysis, Funds flow analysis, cash flow analysis, Marginal costing & break even analysis, standard costing budgetary control, costing for decision making, responsibility accounting.

Capital structure, financial and operating leverage, cost of capital, capital budgeting, Working capital management, dividend policy, hire purchase, consignment & joint venture.

Balance sheet of a company in the prescribed form with major heading (Schedule VI) Financial analysis.

BUSINESS STUDIES

Nature & Purpose of Business:

Concept & Characteristics

Business profession & Employment-Distinctive Features

Objectives of Business-Economic, Social & Human

Business Risks- Nature & Causes

Role of profit in Business

A brief outline of the evolution of Business Activities in India

STRUCTURE OF BUSINESS

Classifications of Business activities, Industry & Commerce

Signature

Industry & Types: Primary & Secondary

E-Commerce- Meaning, Opportunities & benefits, Resources required for successful E-Commerce implementation, Security & safety for Business Transactions.

Outsourcing of Services: Nature, Need & Types, Financial services, Advertising, Customer Support services.

SERVICE SECTOR & BUSINESS

Banking: Types of Banks & Functions of Commercial banks.

Insurance : Principles, Types : Life & General, Fire & marine and Insurance of other Risks, Health Insurance, Fidelity Insurance.

Communication : Postal & Telecommunications

Warehousing : Types & Functions

SOCIAL RESPONSIBILITY OF BUSINESS AND BUSINESS ETHICS

Concept of Social Responsibility.

Case of Social Responsibility & Human Rights.

Responsibility towards Consumers, Government & community in General.

Business & Environment Protection.

Business Ethics: Concepts & Elements.

FORMS AND FORMATION OF BUSINESS ENTERPRISES

Meaning, Features, Merits & Limitations of following Forms:

Sole Proprietorship

Joint Hindu Business

Partnership: Partnership Deed (main clauses), Types of Partners
& Partnership formation, Registration.

Co-operative Societies.

Company : Types of Companies- Private, Public & Deemed public Company, Privileges of private Company.

Choice of Form of Business Enterprise

Factors to be considered for starting a Business

Scope of setting up a Small Business Enterprises

SECTORAL ORGANISATION OF BUSINESS

Meaning, Features, Merits & Limitations of Following:

- Private Sector, Public Sector & Joint Sector.

Forms of public Sector Enterprises

Departmental Undertaking

Co-Operative Organisation

Government Company

Global Enterprise (Multi national Company)

Business economics and quantitative methods:

BUSINESS STATISTICS:

Introduction to Statistics:

Statistics: Meaning, Definition; Its Need and Importance in Business, Functions and Distrust of Statistics.
Statistical tools used in economical analysis.

Collection of Data:

Meaning of Data, Sources of Data, types of data, Methods of Collecting Data, Construction of Questionnaire

Theory of Sampling:

Census and Sampling Methods, Principles of Sampling, Qualities of Good Sampling, Methods or Techniques of Sampling, need and error of sampling, normal distribution, hypothesis testing, analysis and interpretation of data, Census of India and National Sample Survey Organisation

Organisation of Data:

Meaning and types of variables; Frequency Distribution

Presentation of Data:

Tabular Presentation and Diagrammatic Presentation of Data:

- (i) Geometric forms (bar Diagrams and pie diagrams)
- (ii) Frequency diagrams (histogram, polygon and ogive)
- (iii) Arithmetic line Graphs (time series graph).

Statistical Tools and Interpretation:

Measures of Central Tendency - mean (simple and weighted), median and mode.

Measures of Dispersion - absolute dispersion (range Deciles, Percentile, quartile deviation, mean deviation and standard Deviation)

Relative dispersion (co-efficient of quartile-deviation, co-efficient of mean deviation, co-efficient of Variation)

Lorenz Curve: Meaning and its application.

Skewness:

Meaning of Measures of Skewness

Difference between Dispersion & Skewness

Measures of Skewness:

a) Absolute measures

b) Relative Measures & Coefficient of Skewness

(i) Bowley's Coefficient of Skewness

(ii) Kelly's Coefficient of Skewness

(iii) Karl Pearson's Coefficient of Skewness

Introduction to Index Numbers:

Meaning, types, features and uses of index numbers

Wholesale price index

Consumer price index and index of industrial production

Problems of construction of index numbers

Inflation and index numbers.

Methods of Construction of Index Number, Cost of Living Index Numbers,

Choice of base for Computing Index Numbers, Base Shifting.

Some Mathematical tools used in Economics: Equation of a line, slope of a line, slope of a curve.

CORRELATION & REGRESSION ANALYSIS

Small sample test - T-test, f-test and chi-square test.

Data processing - elements, data entry, data processing and computer applications.

BUSSINESS ECONOMICS:

Nature and uses of business economics: Concept of profit and wealth maximisation, Definition, Characteristics of Managerial Economics Difference between Managerial Economics and Economics- Its Scope, Uses and Role & Responsibility of Managerial Economics.

Microeconomics

Meaning of microeconomics and macroeconomics

What is an economy

Central problems of an economy, what, how and for whom to produce.

Concepts of production possibility frontier and opportunity cost.

Consumer Equilibrium and Demand

Consumer's equilibrium - meaning of utility, marginal utility, law of diminishing marginal utility, law of equi-marginal utility, conditions of consumer's equilibrium using marginal utility analysis.

Indifference curve analysis of consumer's equilibrium-the consumer's budget (budget set and budget line), preferences of the consumer (indifference curve, indifference map) and conditions of consumer's equilibrium (one and two commodity cases).

Demand, market demand, determinants of demand, law of demand, demand schedule, demand curve, movement along and shifts in the demand curve; price elasticity of demand - factors affecting price elasticity of demand; measurement of price elasticity of demand - (a) percentage-change method and (b) geometric method (linear demand curve); relationship between price elasticity of demand and total expenditure.

Producer Behaviour and Supply

Production function: returns to factor and returns to scale;

Total Product, Average Product and Marginal Product.

Returns to a Factor.

Cost and Revenue: Short run costs - total cost, total fixed cost, total variable cost; Average fixed cost, average variable cost and marginal cost-meaning and their relationship.

Revenue - total, average and marginal revenue.

Producer's equilibrium-meaning and its conditions in terms of marginal revenue-marginal cost.

Supply, market supply, determinants of supply, law of supply, supply schedule, supply curve, movements along and shifts in supply curve, price elasticity of supply; measurement of price elasticity of supply - (a) percentage change method and (b) geometric method.

Forms of Market and Price Determination

Forms of Market-Perfect Competition, Monopoly, Monopolistic Competition-Their Meaning and Features, Price Determination in different market situations: Perfect competition, monopolistic competition, monopoly, price discrimination and oligopoly, pricing strategies.

Macroeconomics:

NATIONAL INCOME AND RELATED AGGREGATES.

Basic Concepts and Measurement of National Income.

- (i) Macro Economics-Meaning, Circular Flow of Income, Concepts of GDP, GNP, NDP, NNP, (At Market Price and Factor Cost) National Disposable Income (Gross and Net) Private Income, Personal Income and Personal Disposable Income.
- (ii) Measurement of National Income-Value Added Method, Income Method and Expenditure Method.
- Money and Banking:**
- (i) Money- Meaning, Evolution and Functions. Supply of money – Currency held by the public and net demand deposits held by commercial banks. Money creation by the commercial banking system.
- (ii) Central Bank- Meaning and Functions
- (iii) Commercial Banks- Meaning and Functions
- (iv) Recent Significant Reforms and Issue in Indian Banking System, Privatization and Modernization.
- Government budget and Economy:**
- (i) Government Budget- Meaning and its Components, Objectives of Government Budget.
- (ii) Classification of Receipts- Revenue and Capital
- (iii) Classification of Expenditure-Revenue and Capital, Plan and Non-Plan and Developmental and Non-Developmental.
- (iv) Balanced Budget-Surplus Budget and Deficit Budget; Meaning and Implications.
- (v) Revenue Deficit, Fiscal Deficit and Primary Deficit; Meaning and Implications; Measures to correct different Deficits. Fiscal Policy and its role
- Balance of Trade and Balance of payments:**
- (i) Foreign Exchange Rate- Meaning (Flexible and Fixed and managed floating) Merits and Demerits, Determination in a free market.
- (ii) Balance of Payment Accounts-Meaning and Components,
A Brief Analysis about recent Exchange Rate issues.

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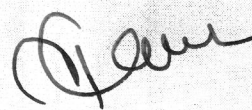
Economics

1. Meaning & Scope of statistics in Economics
2. Collection of data & organisation of data--- sources & collection & methods of collecting data, Presentation of data, sources of data.
3. Collection & methods of collecting data: Presentation of data Geometric forms, frequency Diagrams, Arithmetic Graphs
4. Statistic tools--Mean, Median, Quartile and Mode
5. Common goals of five year plans in India
6. Punjab Economy--- Manpower and Physical Resources of Punjab. Agriculture & Industrial Development of Punjab since 1966. (Structure, Location and industrial policy, Revenue & Expenditure & financial position of Punjab-Govt.)
7. Economic Planning in Punjab- Aims, objective and Strategy of planning in Punjab.
8.
 - a. Measures of Dispersion-> Range, Quartile, Deviation, Mean Deviation and standard Deviation and their co-efficient.
 - b. Correlations->Measures of Correlation->Karl Pearson's and spearman's ranks correlation.
 - c. Index Numbers-> Wholesale & consumer price index, inflation and index numbers
9. Economic reforms since 1991-> Need and main features->Liberalization, Globalization, privatization and WTO.
10. Current Challenges facing Indian Economy
 - a) Poverty->Main Programmes for poverty Alleviation
 - b) Rural finance and credit facility-> Problem of undebtness. Different sources of Rural Finance (Role of cooperative societies, Banks, NABARD and RBI)
11. Rural marketing facilities->Problem of storage and Marketing of Agriculture produce in Rural Areas. Role of Regulated and unregulated markets.

Micro Economics

1. The nature & importance of Micro Economics->

Basic problems of Micro Economic Theory ---The allocation of resources. The distributive of the product & maintenance & Expansion to productive capacity of economy, Market Economy & the treatment of basic economic problems. The relative importance of market.
2. The theory of consumer behaviour-> The utility behaviour, analysis of indifference curve & analysis, consumer behaviour, consumer equilibrium income substitution & price effect of a Normal inferior, Giffen good, Revnoled preference theory, price income & cross elasticities of demand & their measurement.
3. The theory of production costs & Revenues-> The concept of production function.
4. The theory of firm behaviour & market organization-> perfect competition, equilibrium of firm & industry during short & long periods. Nature & extent of monopoly, monopolitics competition & their characteristics.
5. Marginal productivity theory-> The modern theory of resource price & employment. The input demand curve of firm with one variable resource, several variable resources. The Market demand curve, the supply curve of resources.
6. Macro Economics->Micro vs Macro Economics
7. Determinants of National Income (two sector economy) investment, capital determinants of ~~Investment~~ Marginal efficiency capital (MEC) marginal efficiency of Investment (MEI)
8. General Equilibrium in Good & Money Market
9. Fluctuation in National Income->Business cycles & their main features.



10. Monetary policy-> its nature, objectives & instruments, influence of policy on income, inflation stagflation.

11. Main features of developing economy

12. . Agriculture & Industry

13 Economics Planning

14 Basic Mathematics functions, Deviation and Maxima & Minima of function.

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History

Part-A History of Punjab

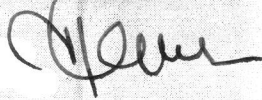
1. Physical Features of the Punjab and their Influence on its History.
2. Sources of History of the Punjab.
3. Expansion and Consolidation of Sikhism during the period of Ten Gurus.
4. Banda Bahadur- Establishment of independent rule, his achievements.
5. Abdus Samad Khan. Zakariya Khan and Mir Mannu: their Relations with the Sikhs.
6. Rise of Dal Khalsa.
7. Origin and growth of the Sikh Misals.
8. Maharaja Ranjit Singh's Career and achievements.
9. Anglo-Sikh Relations 1800-1839 A.D.
10. Civil and Military Administration of Ranjit Singh
11. The First Anglo Sikh War, Second Anglo Sikh-war.

Part-B History of India

1. Indus Valley Civilization: Origin, Date, Extent, main features and causes of its decline.
2. Rig Vedic Civilization: Original home of Aryans, their social political, economic and religious life.
3. Later vadic Civilization: Political, social and religious life.
4. Life of Mahavira and Mahatma Budha: Main teachings and their impact.
5. Establishment and Expansion of the Empire under Chandragupta Maurya and Ashok: Polity and administration, Ashoka's Dharma, Ashoka's achievements and his place in history, decline of the Mauryan Empire.
6. Establishment of the Gupta Empire: its expansion under samundragupta and chandragupta II, Decline of Gupta Empire.
7. Establishment of the Vardhana Kingdom, Harsha's Campaigns and Political relations, Literature and education.
8. Origin of Rajputs and Administration.
9. The Sultanate of Delhi under Iltutmish and Balban
10. Alaudin Khalji: victories, administration and reforms
11. Muhammad Bin Tughlaq's administrative experiments and Feroz shah Tughlaq's reforms.
12. Vijayanagar Kingdom: establishment, administration.
13. Formation of Mughal Empire under Babur, Akbar and Aurangzab
14. Sher Shah Suri and his administration.
15. The Mughal Administration and decline of Mughal Empire.
16. Foundation of British Empire: Battles of Plassay and Buxer.
17. Reforms of Cornwallis, William Bentick and Dalhousie.
18. The uprising of 1857: causes, nature, results and failure.
19. Socio-Cultural Movement: Brahmo Samaj, Arya Samaj, Allgarh Movement, Dr. B. R. Ambedkar's efforts for uplift of the scheduled castes.
20. Growth of Political consciousness : moderates, extremists and revolutionary, Ghadar Party.
21. Freedom Struggle 1919-1947: Jallianwala Bagh, Massacre, Non co-operation Movement, Civil Disobedience Movement, Quit India Movement and causes of Partition of India.
22. Making of Constitution; integration of Princely States.

Part-C World History

1. Rise of Modern Age: Renaissance of Reformation.
2. French Revolution of 1789: Its causes and effects.
3. Industrial Revolution and its effects.
4. First World War and Second World war: their causes and its impacts.

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UNIT - 1

Math

Analysis: Elementary set theory, Sets:

Sets and their representations. Empty set, Finite & Infinite sets, Equal sets. Subsets, Subsets of the set of real numbers especially intervals (with notations). Power set. Universal set. Venn diagrams. Union and Intersection of sets. Difference of sets. Complement of a set, Properties of complement sets.

Finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum.

Sequence and series:

Sequence and Series, Arithmetic Progression (A.P), Arithmetic Mean (A.M), Geometric Progression (G.P), general term of a G.P, sum of n terms of a G.P. Arithmetic and Geometric series, infinite G.P. and its sum. Geometric mean (G.M), relation between A.M and G.M, Sum to n term of the special series $\sum n$, $\sum n^2$ and $\sum n^3$. Convergence, Sequences and series of functions, uniform convergence.

Binomial Theorem:

History, statement and proof of the binomial theorem for positive integral indices. Pascal's triangle, general and middle term in binomial expansion, simple applications. Bolzano Weierstrass theorem, Heine Borel theorem.

Continuity and Differentiability:

Continuity, uniform continuity. Continuity and Differentiability, derivative of composite functions, chain rule, derivative of inverse trigonometric functions, derivative of implicit function.

Concepts of exponential and logarithmic functions. Derivatives of $\log_e x$ and e^x . Logarithmic differentiation. Derivative of functions expressed in parametric forms.

Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretations.

Applications of Derivatives:

Applications of derivatives: rate of change, increasing/decreasing functions, tangents and normal, approximation, maxima and minima. Simple problems (that illustrate basic principles and understanding of the subject as well as real life situations).

Limits and Derivatives:

Derivative introduced as rate of change both as that of distance function and geometrically, intuitive idea of limit, \limsup , \liminf . Definition of derivative, relate it to slope of tangent of the curve, derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions. Mean value theorem.

Integrals: Integration as inverse process of differentiation. Integration of a variety of functions by

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substitution, by partial fractions and by parts. Definite integrals as a limit of a sum. Fundamental Theorem of Calculus, Basic properties of definite integrals and evaluation of definite integrals.

Applications of the Integrals:

Applications in finding the area under simple curves, especially lines, areas of circles/parabolas/ellipses, area between the two above said curves. Riemann sums and Riemann integral, Improper Integrals.

Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral. Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation, inverse and implicit function theorems. Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.

Linear Algebra:

Vector spaces: Vectors and scalars, magnitude and direction of a vector. Direction cosines/ratios of vectors. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Scalar (dot) product of vectors, projection of a vector on a line. Vector (cross) product of vectors, scalar triple product.

Linear Inequalities:

Linear inequalities, Algebraic solutions of linear inequalities in one variable and their representation on the number line. Graphical solution of linear inequalities in two variables. Solution of system of linear inequalities in two variables - graphically.

Subspaces, linear dependence, basis, dimension, algebra of linear transformations.

Matrices & Determinant:

Concept, notation, order, equality, types of matrices, zero matrix, transpose of a matrix, symmetric and skew symmetric matrices. Addition, multiplication and scalar multiplication of matrices, simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2). Concept of elementary row and column operations. Invertible matrices and proof of the uniqueness of inverse, if it exists.

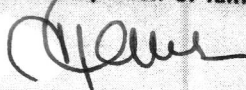
Determinant of a square matrix (up to 3×3 matrices), properties of determinants, minors, cofactors and applications of determinants in finding the area of a triangle.

Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equation by examples, solving system of linear equations in two or three variables using inverse of a matrix. Rank and determinant of matrices, linear equations. Eigen values and eigen vectors, Cayley-Hamilton theorem.

Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms

Straight Lines :

Brief recall of 2-D from earlier classes, Shifting of origin. Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axes, point-slope form, slope-intercept form, two-point form, intercept form and normal form, General equation of a line. Equation of family of lines passing



through the point of intersection of two lines. Distance of a point from a line.

Conic Sections:

Sections of a cone ; circles , ellipse , parabola , hyperbola , a point , a straight line and a pair of intersecting lines as a degenerated case of a conic section. Standard equations and simple properties of parabola, ellipse and hyperbola. Standard equations of a circle.

Introduction to Three-dimensional Geometry:

Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points and section formula.

Three-dimensional Geometry:

Direction cosines/ratios of a line joining two points. Cartesian and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes, (iii) a line and a plane. Distance of a point from a plane.

UNIT - 2

Complex Numbers and Quadratic Equations:

Need for complex numbers, especially $\sqrt{-1}$, to be motivated by inability to solve every quadratic equation. Brief description of algebraic properties of complex numbers. Argand plane and polar representation of complex numbers. Statement of Fundamental Theorem of Algebra, solution of quadratic equations in the complex number system. Square-root of a Complex number.

Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions.

Trigonometric Functions:

Positive and negative angles. Measuring angles in radians and in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Truth of the identity $\sin^2 x + \cos^2 x = 1$, for all x . Signs of trigonometric functions and sketch of their graphs. Expressing $\sin(x \pm y)$ and $\cos(x \pm y)$ in terms of $\sin x$, $\sin y$, $\cos x$ & $\cos y$.

Identities related to $\sin 2x$, $\cos 2x$, $\tan 2x$, $\sin 3x$, $\cos 3x$ and $\tan 3x$. General solution of trigonometric equations of the type $\sin \theta = \sin \alpha$, $\cos \theta = \cos \alpha$ and $\tan \theta = \tan \alpha$.

Analytic functions, Cauchy-Riemann equations. Contour Integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations.

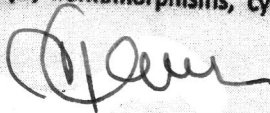
Algebra:

Permutations & Combinations:

Fundamental principle of counting, Factorial $n(n!)$ Permutations and combinations, derivation of formulae and their connections, simple applications. Pigeon-hole principle, inclusion-exclusion principle.

Fundamental theorem of arithmetic, divisibility in \mathbb{Z} , congruences, Chinese Remainder Theorem, Euler's ϕ -function, primitive roots.

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation



groups, Cayley's theorem, class equations, Sylow theorems.

Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain.

Polynomial rings and irreducibility criteria. Fields, finite fields, field extensions, Galois Theory. Dense sets, subspace and product topology, separation axioms, connectedness and compactness.

UNIT - 3

Ordinary Differential Equations (ODEs):

Differential Equations:

Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given.

Solution of differential equations by method of separation of variables, homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type:

$$\frac{dy}{dx} + py = Q$$

where P and Q are functions of x or constant.

$$\frac{dx}{dy} + px = Q$$

where P and Q are functions of y or constant

Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs.

General theory of homogeneous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

Partial Differential Equations (PDEs):

Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs.

Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Numerical Analysis:

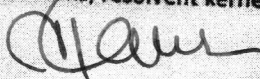
Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

Calculus of Variations:

Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema. Variational methods for boundary value problems in ordinary and partial differential equations.

Linear Integral Equations:

Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigenfunctions, resolvent kernel.



Classical Mechanics:

Generalized coordinates, Lagrange's equations, Hamilton's canonical equations, Hamilton's principle and principle of least action, Two-dimensional motion of rigid bodies, Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations.

UNIT - 4

Descriptive statistics, exploratory data analysis

Mathematical Reasoning:

Mathematically acceptable statements. Connecting words/phrases—consolidating the understanding of "if and only if (necessary and sufficient) condition", "implies", "and/or", "implied by", "and", "or", "there exists" and their use through variety of examples related to real life and Mathematics, Validating the statements involving the connecting words—difference between contradiction, converse and contrapositive.

Statistics:

Measure of dispersion: mean deviation, variance and standard deviation of ungrouped/grouped data. Analysis of frequency distributions with equal means but different variances.

Probability:

Random experiments: outcomes, sample spaces (set representation). Events: Occurrence of events, 'not', 'and' & 'or' events, exhaustive events, mutually exclusive events. Axiomatic (set theoretic) probability, connections with the theories of earlier classes.

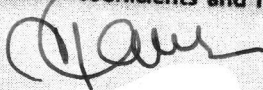
Probability of an event, probability of 'not', 'and' & 'or' events. Multiplication theorem on probability. Conditional probability, independent events, total probability, Baye's theorem, Random variable and its probability distribution, mean and variance of haphazard variable. Repeated independent (Bernoulli) trials and Binomial distribution. Sample space, discrete probability, Independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate); expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Probability inequalities (Tchebyshef, Markov, Jensen). Modes of convergence, weak and strong laws of large numbers, Central Limit theorems.

Markov chains with finite and countable state space, classification of states, limiting behaviour of n-step transition probabilities, stationary distribution, Poisson and birth-and-death processes.

Standard discrete and continuous univariate distributions. sampling distributions, standard errors and asymptotic distributions, distribution of order statistics and range.

Methods of estimation, properties of estimators, confidence intervals. Tests of hypotheses: most powerful and uniformly most powerful tests, likelihood ratio tests. Analysis of discrete data and chi-square test of goodness of fit. Large sample tests. Simple non-parametric tests for one and two sample problems, rank correlation and test for independence. Elementary Bayesian inference.

Gauss-Markov models, estimability of parameters, best linear unbiased estimators, confidence intervals, tests for linear hypotheses. Analysis of variance and covariance. Fixed, random and mixed effects models. Simple and multiple linear regression. Elementary regression diagnostics. Logistic regression. Multivariate normal distribution, Wishart distribution and their properties. Distribution of quadratic forms. Inference for parameters, partial and multiple correlation coefficients and related tests. Data reduction



Techniques: Principle component analysis, Discriminant analysis, Cluster analysis, Canonical correlation.

Simple random sampling, stratified sampling and systematic sampling. Probability proportional to size sampling, Ratio and regression methods.

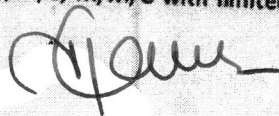
Completely randomized designs, randomized block designs and Latin-square designs. Connectedness and orthogonality of block designs, BIBD. 2K factorial experiments: confounding and construction.

Series and parallel systems, hazard function and failure rates, censoring and life testing.

Linear Programming Problem:

Introduction, definition of related terminology such as constraints, objectives function, optimization, different types of linear programming (L.P.) problems, mathematical formulation of L.P problems, graphical method of solution for problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints)

Simplex methods, duality. Elementary queuing and inventory models. Steady-state solutions of Markovian queuing models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space, M/G/1.



Political Science

1. Indian Constitution and Preamble
2. Political Parties-National and Important Regional Parties.
3. Interest groups
4. Federalism in India, Centre-State Relations
5. Public Opinion in Detail, (Mass Media) Factors and all.
6. Fundamental Rights in Detail with Comparisons of Rights in other countries.
7. Ideologies-Liberalism, Neo Liberalism Socialism, Gandhism, Facism and Nazism Utopian and Scientific Approach, Totalitiorism, Behaviouralism, Post Behaviourism
8. Traditional and Modern Approach of Politics.
9. Concept of Political System in Detail.
10. System Approach of David Eston, Marxism Approach.
Structural Functional Approach
 - Social Contract Theory.
 - Utilitazism (or) Theories of State.
11. Political Thinkers- Nehruji, Gandhi Ji, Arbindu Ghosh, Dr. Ambedkar Hobbes, Max Weber, Locke, Rousseau, Machavalli, Plato Aristotle, T.H. Green, Benthem, Karl Marx
12. Concepts- Law, Equality, Freedom Justice, State-Political Elite
13. Punjab Politics- Shromani Akali Dal, BJP- Akali Dal, Old Singh Sabha Movement, Punjabi Suba Movement, Re Organisation of Punjab Sarkaria Commission, Punjab Militancy.
14. Bureaucracy- Emerging Trends in India and U.S.A

Indian Political System

1. Centre Govt.- Parliament President,-Emergency Powers Article 356- Use and Misuse- Prime Minister, Council of Ministers
2. State Govt.- Governor, Chief Ministers, Governor as Agent- Powers
3. Indian Judiciary- i. Supreme Court
 - ii High Court
 - iii Judicial Review
4. Important Amendments
5. Right to education
6. Right to information

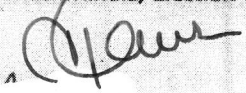
Political Parties- National and Regional Trend of Coalition Govt. in India Democracy at grass root level. 73rd, 74th Amendment

All organizations at grass root level.

Democracy- Problems, Emerging trends safeguards- All Democratic Institutions

- Fundamental Rights in Detail
- Fundamentals Duties in Detail
- Directive Principles in Detail

Election Procedure - Factors in India, Election Reforms in India, Election Commission, Election Trends in India, Election procedure.



Foreign Policy- Meaning, Importance Non Aligned Movement, Disarmament, Panchsheel, Commonwealth Countries, SAARC, U.N.O, NATo, SEATo, Colonism and Imperialism- Factors effecting Indian Foreign Policy.

Parliamentary/Presidential form of govt Debate-between two

Theories

1. Political Culture
2. Political Socialization
3. Political Development
4. Political Modernization
5. Political Participation
6. Comparative Politics

World Politics

- i. U.N.O- in Detail organs and Agencies- Human Rights in Detail
- ii. SAARC, League of Nations
- iii. Third world countries and politics
- iv. Imperialism, Neo-imperialism, colonism
- v. Internatinal Politics-Meaning, Importance and Emerging trends.
- vi. Cold war, super powers, New super power Blocks Nuclear Age
- vii. Constitution of United Kingdom

Features, Nature and Evolution of English Constitution

Kingship, cabinet Parliament and supremacy of Parliament, rule of law, political parties of U.K

2. Constitution of United States, Federal System, Division of Powers Separation of Powers
3. Constitution of USSR
4. Constitution of Switzerland (swiss)

Comparative study of different constitutions-

