Pattern of Examination

1. Duration of Written Examination per paper – 3 Hours

2. Written Examination will consist of 2(two) papers:

(i)	***General English & General Knowledge***		***– 150marks***
	(a)	General English	– 50 marks
	(b)	General Knowledge & Current Affairs	– 100 marks
(ii)	***One Optional Subject***		– ***150 marks***
	(a)	MCQ	– 50 marks
	(b)	Descriptive	– 100 marks

3. Oral – 30 marks

4. Academic records – 20 marks

i.	HSLC	15% of the aggregate marks (3 marks)
ii.	HSSLC	15% of the aggregate marks (3 marks)
iii.	Degree	25% of the aggregate marks (5 marks)
iv.	Post Graduate	25% of the aggregate marks (5 marks)
v.	B.Ed.	20% of the aggregate marks (4 marks)

Total – 20 marks

**M.Phil/PhD.* *5 marks bonus*

Syllabus for GENERAL ENGLISH, GENERAL KNOWLEDGE & CURRENT AFFAIRS

I. General English - 50 marks

1. Essay (20 marks)
2. Amplification (10 marks)
3. Grammar (20 marks)

II. General Knowledge & Current Affairs - 100 marks

Short answer questions carrying 1(one) mark each. No Multiple Choice Questions (MCQs).

a) Indian History

Broad general understanding of the subject in its social, economic, political aspects; social and cultural heritage of India, emphasizing unity in diversity.

b) Indian Polity

Country's political, Executive, Judicial System, Local Bodies, Rural and Community Development.

c) General Science & Technology

General appreciation and understanding of science, including matters of every day observation and experience as may be expected of a well educated person who has not made a special study of any scientific discipline

d) Indian Economy & Commerce

Broad general understanding of the subject Economics, Indian economy, Economic planning in India

e) Geography & Current events

Geography of India including the physical, social, economic geography and on the main features of Indian agriculture and natural resources

Latest development on all the fields detailed above including science and technology and environmental awareness

f) General Mental Ability

Analysis of classified data, logical and behavioural reasoning, analogies, basic arithmetic, numerical ability and basic concept of computers

g) Nagaland

Social, culture and heritage of its people

Syllabus for PHYSICS

1. **Mechanics:**
   Laws of motion (1-D and 2-D), conservation of energy and momentum. Velocity and acceleration in different coordinate systems. Rotational motion. Free body diagram and its application. Law of gravitation, gravitational field and potentials due to spherical bodies. Kepler's laws and its application. Collisions in centre of mass and laboratory frame of reference. Hooke's law, elastic constants and their relationships. Bernoulli's theorem and its applications, Poiseuille's equation. Pascal's law, capillarity. Lorentz transformation equations in relativity and its applications. Hamilton's principle, Lagrangian and the Euler-Lagrange equations, constraints.

2. **Thermal and Statistical Physics:**
   Maxwell-Boltzmann law of distribution of velocities in an ideal gas. Mean, RMS and most probable speeds. Mean free path, Calorimetry. Degrees of freedom. Law of equipartition of energy. Specific heats of gases. Van der Waal's equation of state for real gases and values of Critical Constants. Laws of thermodynamics. Isothermal and adiabatic processes. Heat engine and heat pump. Thermal conductivity. Clausius Theorem and Clausius inequality, Entropy of a perfect gas. Principle of increase of entropy. Black body radiation and its related laws. Statistical basis of thermodynamics, probability calculations, thermodynamic probability, macrostates and microstates, statistical definition of entropy, Boltzmann relation for entropy and Gibb's paradox. Fermi-Dirac distribution and Bose Einstein's distribution

3. **Waves and Optics:**
   Longitudinal and transverse waves. Plane progressive waves. Wave equations. Particle and wave velocities. Doppler effect and beats. Simple Harmonic Motion, differential equation of SHM and its solutions for free, forced and damped vibrations. Formation of standing waves in stretched strings, open and closed organ pipe. Velocity of longitudinal waves in a fluid. Newton's formula for velocity of sound. Laplace's correction. Refraction and Dispersion of light. Electromagnetic nature of light. Huygens principle. Superposition of light waves. Interference of light. Theory of interference fringes for Young's double slit experiment. Diffraction of light: Fresnel and Fraunhofer diffraction at single slit and at straight edge, half period zone. Polarisation of light: Brewster's and Malus law. Principle of LASER, He-Ne laser, population inversion.

4. **Electricity and Magnetism:**
   Kirchhoff's laws. Electric field: Electric field lines. Area vector, Electric flux. Gauss' Law and its applications to charge distributions with spherical, cylindrical and planar symmetry. Electrostatic Potential. Divergence of a vector field, Gauss's divergence theorem and differential form of Gauss's law. Potential and Electric Field of a dipole. Torque on a dipole. Capacitance of an isolated conductors, Parallel-plate capacitor without and with di-electric medium. Spherical and cylindrical capacitors filled with dielectric. Biot-Savart's Law and its applications. Ampere's Circuital Law and its applications. Magnetic flux and magnetic field. Faraday's laws of electromagnetic induction. Maxwell's Equations. Energy density of electric and magnetic fields. Series and parallel LCR circuits

5. **Mathematical Physics:**
Scalar and vector products. Gradient, divergence, curl and their significance. Vector Integration; line, surface and volume integrals of vector fields. Limits, continuity, average and instantaneous quantities, differentiation. First order and second order differential equations: First order differential equations and integrating factor. Homogeneous equations with constant coefficients. Partial derivatives, exact and inexact differentials. Ordinary integrals of vectors. Multiple integrals. Orthogonal curvilinear coordinates. Gradient, divergence, curl and Laplacian in cartesian, spherical and cylindrical coordinate systems. Complex numbers and their graphical representation. Euler's formula, De Moivre's theorem, Roots of complex numbers. Functions of complex variables. Analyticity and Cauchy-Riemann conditions.

6. **Electronics:**
P and N type semiconductors. PN Junction diode. Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency. n-p-n and p-n-p transistors , transistor in CB, CE and CC Configurations. Current gains α and β and their relation. Transistor as an amplifier. H-parameter model of a transistor. Two stage RC-coupled amplifier, its frequency response and bandwidth. Voltage gain in mid, low and high frequency range. De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Logic gates. Applications of Op-Amps: (1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Log amplifier, (7) Zero crossing detector (8) Wein bridge oscillator. Computer Organization: Input/Output Devices. Data storage (idea of RAM and ROM).

7. **Quantum Mechanics:**
Photo-electric effect, Einstein’s photoelectric equation. De Broglie wavelength and matter waves. Compton effect. Wave amplitude and wave functions, properties and requirements of wave function. Wave mechanical atom model; particle in a box. Basic postulates of wave mechanics. Schrodinger equations. Eigen function and eigen values. Heisenberg uncertainty principle. Momentum and Energy operators; stationary states, commutator of position and momentum operators. Probabilities and Normalization; Relation between probability density and probability current density in one dimension. One dimensional infinitely rigid box-energy eigenvalues and eigenfunctions, normalization. Quantum mechanical scattering and tunnelling in one dimension-across a step potential & rectangular potential barrier.

8. **Nuclear and Particle Physics:**
Size and structure of atomic nucleus and its relation with atomic weight; Mass defect, Binding energy and binding energy per nucleon. Natural radioactivity, Properties of alpha, beta and gamma rays. Law of radioactive decay; Mean life, half life and decay constant; Law of successive disintegration. Radioactive dating: the age of the Earth. Alpha decay: Gamow’s theory of alpha decay. Nuclear Fission and Fusion. Nuclear reactions, Q-value of a nuclear reaction, threshold energy and cross section for a nuclear reaction. Primary and secondary cosmic rays, cosmic ray shower. Discovery of positron, muon, pion, lepton, baryon and mesons, concept of anti particles and the Quark Model

9. Solid State Physics:

Free electron theory, valence band, conduction band, forbidden energy gap, Fermi energy and classification of solids on the basis of band theory. Solids: Amorphous and crystalline materials. Lattice translation vectors. Lattice with a Basis – Central and non-central elements. Unit cell. Coordination number and packing density. Miller indices. Reciprocal lattice. Types of lattices. Brillouin Zones. Diffraction of X-rays by crystals. Bragg's law. Lattice vibrations and phonons. Dulong and Petit's law, Einstein and Debye theories of specific heat of solids, T^3 law. Meissner effect. Type I and type II superconductors, London's equation and penetration depth

10. Atomic and Molecular Physics:

General properties of atom. Rutherford alpha particle scattering experiment. Bohr's atomic model and spectrum of hydrogen atom, Vector atom model: quantum numbers, selection rules, magnetic moments of an atom and Lande's g factor, spin-orbit coupling, spectral terms and selection rules. Fine structure of spectral lines. Spin angular momentum and spin magnetic moments. Normal and Anomalous Zeeman Effect. Raman effect. Types of molecular energy states and associated spectra, Electronic spectra, Pure rotational spectra: rotational energy levels of diatomic molecule as rigid rotator. Diatomic molecule as non-rigid rotator. Vibrational spectra: Vibrating diatomic molecule as a harmonic oscillator, Vibrational- rotational spectra, Vibrating diatomic molecule as anharmonic oscillator.

Syllabus for ECONOMICS

Unit 1: Micro Economics

Nature and scope of economics, concepts of demand and supply, equilibrium and disequilibrium, elasticity of demand and supply.

Theories of consumer demand: utility approach like cardinal and ordinal, revealed preference theory.

Indifference curve: consumer equilibrium (Hicks and Slutsky theorem).

Theories of production and cost: laws of variable proportions and returns to factors, Cobb Douglas production function, least cost combination of inputs, traditional and modern theory of cost.

Market structure and pricing: different types of markets, features and price-output determination, theories of wages and rents.

Welfare economics: Pareto optimality, value-judgement , Kaldor and Hicks compensation principle.

Unit 2: Macro Economics

Concepts and measurement of national income: theory of classical employment, Keynes theory of employment and its determination. Consumption function, Investment function. Equilibrium of saving and investment, general equilibrium:- IS-LM curves.

Trade cycle : Hawtreys and Keynes theory of trade cycle.

Concept of accelerator: Samuelson and Hicks model.

Theory of inflation: classical, Keynesian and monetarist, Philips curve, policies to control inflation.

Unit 3:- Money Banking and finance

Commercial Banks-Functions, credit creation, objectives and limitations

Central Banks- Role and functions of Reserve bank of India

Meaning and scope of public finance-Objectives of fiscal policy, the principle of maximum social advantage.

Public expenditure- Canons and effects of public expenditure. Trends in public expenditure, causes of growth in expenditure in India.

Public debt – sources and types of public borrowing.

Growth and burden of public debt in India.

Taxation – Kinds, impact and incidence of taxation.

Balance of payments- Components: equilibrium and disequilibrium adjustment under systems of gold standard, fixed and flexible exchange rate.

Unit 4 :- Growth and Development.

Economic growth – Harrod, Domar and Solow's model

Theories of Development- Classical, Marx and Schumpeter's theory

Approach to development-Balance growth, critical minimum effort and big push theory.

Unit 5 – International Economics

The basis of International Economics -Interregional and international trade. Theories of absolute advantage, comparative advantage.

Hicksher Ohlin theory and Leontief paradox, Gains from trade-trade as an engine of economic growth, International monetary system-functions and policies of IMF, World Bank, GATT/WTO.

Unit 6 – Quantitative methods in Economics.

Mathematical methods in economics: Differentiation and integration and their application in economics. Optimization techniques, sets, matrices and their application in economics. Linear algebra and linear programming in economics and input-output model of Leontief.

Statistical methods: measures of central tendency and dispersions, correlation and regression. Time series. Index numbers, sampling and sampling methods.

Econometric methods: Univariate and multivariate regression analysis. Problems and remedies of hetroscedasticity, autocorrelation and multicolinearity

Unit 7 – Industrial Economics.

Industrial finance – types and sources of finance, choice of finance.

External vs internal, Industrial financial institutions in India. Industrial growth and pattern.

Small and cottage industries.

Pricing decisions – Theories, Pricing and policies.

Industrial location analysis- determinants and approach of industrial location analysis.

Unit 8 – Agricultural Economics.

Role and importance of agriculture in economic development.

Globalization and its impact on Indian agriculture

Agricultural growth and productivity –trends in agricultural growth and productivity.

Land reforms – Programmes and performance since 1947

Technological changes in agriculture – Techniques and practices.HYV seeds, fertilizers, green revolution and emerging trends in Indian agricultural technology

Agricultural finance and marketing – Types, sources and failure.

Unit 9 – Environmental Economics:

Economy and environment linkages, population and environment linkages, Pareto optimality and market failure in the presence of externalities, property rights and Coase theorem, public goods and public bads market failure. Evolution of environmental regulation, environmental legislation/policies in India. Instruments for pollution control: command and control policy versus market-based instruments. Sustainable development.

Unit 10 – Indian Economy.

Basic features of Indian economy. Population – causes and effects, measures to control poverty. Unemployment- causes, effects and measures.

Planning- objectives, broad achievements and failures. Five year plans- objectives, achievements and failures.

New Economic Reforms - Liberalization, Privatization and Globalization.

NITI AAYOG.

G.S.T - objectives and performance.

Syllabus for COMPUTER SCIENCE

Unit 1: Fundamental of Computing
Introduction to Computer Systems and Software: Elements of Computer System, Hardware, software.

Unit 2: Basic of Programming Using C
Concepts of - variable, program statements and function calls, Iterations and sub-programs, Pointers and Strings, File handling.

Unit 3:- Object Oriented Programming using C++
Basic terms and ideas, Classes and objects, Inheritance and Polymorphism.

Unit 4 :- Data Structures using C.
Arrays, Linked Lists, Stacks and Queue, Searching and Sorting

Unit 5 – Digital Logic and Arithmetic Circuits
Introduction to number systems: Binary to decimal conversion, Decimal to binary conversion, Octal numbers, Hexadecimal numbers.
Logic gates: De-Morgan's Theorems – Universal building blocks (NOT, OR, AND) Binary addition and subtraction – 1's complement – 2's complement.
Boolean Algebra.
Multiplexer and demultiplexers.
Flip-flops: Types of flip-flop – RS (NAND and NOR) flip-flop.

Unit 6 – Theory of Automata
Deterministic and non deterministic finite automata, regular expression, two way finite automata, finite automata with output, properties of regular sets, pumping Lema closure properties.
Context free Grammars and Context free Language, Push down Automata.
Turing machines: Turing machines models.
Chomosky Hierarchy.

Unit 7 – Computer Organization & Architecture
Basic of Computer Organization: Instruction Codes, Computer register, Instruction cycle,
Central Processing Unit: Instruction formats, Addressing modes, Pipelining.
Memory organization: Memory hierarchy, Main Memory, Cache memory, Virtual Memory concept.

Unit 8 –Design & Analysis of Algorithms
Analysis of algorithm, Asymptotic analysis of complexity bounds – best, average and worst-case behavior,Time and space trade-offs.
Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming,
Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree.
Computability classes – P, NP, NP-complete and NP-hard.

Unit 9 – Operating System

Concept of Operating Systems - Types of Operating Systems, OS Services, System Calls, Structure of an OS, Virtual Machine.

Processes: Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching, Thread.

Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR.

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion.

Deadlock: Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Memory Management: Logical and Physical address map, Paging, Virtual Memory

Unit 10 – Database Management Systems

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Relational query languages: Relational algebra. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

SQL Query processing and optimization:

Transaction processing: Concurrency control, ACID property,

Unit 11 Computer Networks

OSI model, Transmission Media, LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division.

Data link layer: Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Sliding Window.

Network Layer: Switching, Logical addressing – IPV4, IPV6

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP)

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Basic concepts of Cryptography

Unit 12 Compiler Design

Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, from regular expressions to finite automata, scanner generator (lex, flex).

Analysis (Parser): LL(1) gram-mars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)

Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree.

Intermediate Code Generation: Code Improvement (optimization)

Unit 13 Python Programming Language

Basics of Python: Tuples, List, Dictionary, Strings.

Numpy, Interfacing, Data Visualization

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