	Lamps : incandescent, discharge and solid-state types, their efficacies, features and applications. Magnetic choke and glow starter operation in TL circuit. Difference between electronic and magnetic ballast. Luminaire – its functions. General indoor lighting design by Lumen method.
GEOGRAPHY :	
Paper – I :	**PRINCIPLES OF GEOGRAPHY (GROUP - A : PHYSICAL GEOGRAPHY)** **Geomorphology** Nature and composition of earth's crust; Structure of earth's interior; Origin, distribution and permanency of Continents and Ocean Basins; Theories of isostasy, continental drift, and plate tectonics; Earth movements - types and effects; Fundamental concepts in geomorphology; Gradational processes - weathering and masswasting; Landforms due to fluvial. glacial. aeolian, coastal and karst processes; Evolution of landscape - cyclic and non-cyclic models; Global hydrological cycle. **Climatology** Atmosphere - nature, composition and structure; Elements and factors of weather and climate; Insolation and Heat-budget; General circulation of winds, Jet Streams and Monsoons; Condensation and Precipitation; Airmass and fronts; Tropical and Extra-tropical cyclones; Thunderstorm and tornado; Climatic classification - principles and application(Koppen, Thorntwaite, Trewartha); Global climatic changes. **Oceanography** Origin of continents and ocean basins; Bottom topography of ocean basins: Indian, Pacific & Atlantic Oceans; Nature, origin and characteristics of continental shelves and slopes, submarine canyons and coral reefs and atolls; Ocean currents: Indian, Pacific and Atlantic oceans; Physical and Chemical properties of ocean water: temperature, salinity and density; TS Diagram and Watermass; Ocean Deposits; Marine Resources. **Environmental Geography** Nature and composition of Biosphere; Concepts relating to Ecosystem - production and decomposition, homoeostasis, energy environment, productivity, food chain, food web, trophic structure, ecological niche, ecological pyramids, and ecological crisis; Ecosystem - principles and components; Components, Bio-energy Cycles and Biogeochemical cycles; Major Ecosystems of the world; Environmental degradation and conservation; Environmental pollution - land, water, air and noise; Natural hazards and natural disaster characteristics, mitigation and global efforts. **Cartography** The Earth as a Cartographic Problem - size and shape; co-ordinate system; scale and map projection; Principles and properties of Polar Zenithal. Conical. Cylindrical and Conventional projections (all normal case); Thematic mapping - types and techniques; Principles of Surveying and Levelling with Chain, Plane Table, Dumpy level and GPS; Remote Sensing nature and principles; Geographical Information System - evolution, components, and functionality. **GROUP - B : HUMAN GEOGRAPHY** **Economic Geography** Concepts and theories of resources; Locational analysis of agriculture (intensive subsistence in monsoon lands, extensive commercial farming in temperate lands, plantation farming in the tropics and dairy farming in the temperate grasslands), lumbering, fishing, mining (coal, petroleum and iron ore), power production (hydel and nuclear) and manufacturing (iron & steel, aluminium, and cotton textile); Economic models - landuse (Von Thunen), industry (Weber, Hoover, Pred). Economic systems and economic landscape - characteristics and evolution (Rostow, Myrdal, and Isard). Global economic blocks - patterns and functions. **Population Geography** Factors and measures of population growth; Malthus, Neo-Malthusianism, Optimum, Social and economic, Biological and natural and Demographic transition theories of population growth; Pattern of World population growth; Migration - nature, theories and consequences on society; Population distribution - density and global pattern; Global patterns and trends of population composition (age-sex structure and occupational structure).

	Social & Political Geography Concept of space: absolute & relative; Social structure: stratification and differentiation; Social Processes; segregation, adaptation, assimilation and integration; Heartland and Rimland theories; Principles of boundaries and frontiers **Settlement Geography** Origin and Growth of Settlements; Function, morphology, types and patterns of Rural settlements; Urban growth and urbanization; Classification, functions, and morphology of towns and cities; Models of urban growth - Burgess, Hoyt, Harris and Ullman, Mann. Urban gradients and densities; Residential areas - patterns and processes; The Central Business District - characteristics, delimitation and changes; The Central Place Theory and the Ranksize rule, The Urban field and inter-urban movement. **Regional Development and Planning** Regions - concepts, types and methods of regionalization; Regional diversity and disparities in development; Regional development - role of resource base, technology and information system, agriculture and industry, transport and communication, trade and commerce; Regional development theory - Perroux and Isard; Regional planning - basic principles and types; Environmental issues in regional planning and planning for sustainable development; Planning regions - concepts and delineation; State as a planning unit and micro-level planning with special reference to India.
Paper – II :	**REGIONAL GEOGRAPHY** **<u>GROUP</u>** - A: **<u>GEOGRAPHY OF INDIA</u>** **Physical Geography** Location and space relationship with neighboring countries; structure and Relief; Climate and Drainage; Soil and Natural Vegetation **Resource Base** Distribution, utilization and Conservation of Land (soil), Water (freshwater), Water Disputes interstate and neighboring countries, Mineral (iron ore, manganese, bauxite, mica), Energy (coal, oil, natural gas, and Non - Conventional sources like wind, tidal and solar power) and Biotic Resources **Economy** Indian agriculture - nature and characteristics; Development of Agriculture during the Plan periods; Green Revolution; Distribution and characteristics of cultivation of rice, wheat, jute cotton, tea, and coffee; Agricultural Regions, Industrial development and industrial policy during the Plan Period; Locational Dynamics, Growth and Development of the Iron & Steel, Aluminum, Engineering, Oil Refining, Cotton Textile, Jute, Sugar, Paper, cement and automobile industries; Growth and Development of Transport and Communication System (Road, Rail, Water, and Air); Nature and Development of Trade - national and foreign specially with the SARC and ASEAN countries; Trade Balance. **Population** Population as a Resource; Relation between Population and Socio-economic Development; Population Growth - spatial and temporal variations; Population Distribution and population - resource relationships; Population Composition and social implications age, sex, literacy, religion, and caste; Urban Growth and Urbanization - characteristics and patterns, factors and processes; Population Problems and Population Policy during the Plan periods. **<u>GROUP - B: GEOGRAPHY OF WEST BENGAL</u>** **Physical Geography** Location with Geographical Personality; Physiographic Divisions - structure and relief; Climate - seasonal weather conditions; Agro-climatic regions; Drainage systems and problems; Soil - types and fertility, erosion and conservation; Natural Vegetation - types and distribution, deforestation and afforestation. **Resource Base** Distribution, utilization and Conservation of Land, Water, Mineral, Energy (both Conventional and Non - Conventional) and Biotic Resources **Economy** Landuse - characteristics and correlates; Irrigation and Agriculture - development during the Plan periods; Rice, jute, and tea - cultivation, crop ecology, production and problems; Crop Combination Regions; Impact of Green Revolution; Industrial Regions - growth, development and problems; Trade and Transport - nature and status of development; issues of development

	Population Population as a Resource; Relation between Population and Socio-economic Development; Growth and Distribution (absolute, and density - crude, physiological and habitational); Population Composition - age, sex, literacy, occupation, religion, and caste; Urban Growth and Urbanisation - characteristics, patterns and factors; Population Problems and Population Policy during the Plan periods
GEOLOGY :	
Paper – I :	I. **General Geology:** Composition of the planets and meteorites. Abundance of elements in the universe and earth. Origin of the Earth. Internal constitution of Earth. Heat flow and geothermal gradient. Gravity, gravity anomalies on earth and Isostasy. Earth as a magnet, magnetic anomalies. Earth's internal processes, volcanism and global distribution of volcanoes. Earthquakes: causes, effects, earthquake belts. Seismic zones of India. II. **Structural Geology:** Stress and strain- basic concepts, analysis of stress-strain in two-dimension, stress and strain ellipse. Behavior of rocks under stress. Stress-strain relationships of elastic, plastic and viscous materials. Unconformity: different types and their recognition Fold and Fault: geometry and classifications, mechanisms. Fold and thrust belt. Shear zones and shear sense markers. Classification of joints, foliation, lineation and their relations with folds. III. **Geomorphology and Remote Sensing:** Basic concept of geomorphology, common landforms related to action of wind, river and glacier; coastal landforms. Geomorphology and its relation to structure and lithology. Aerial photographs and their interpretations. The Electromagnetic spectrum. Orbiting satellites and sensor systems. Indian remote sensing satellites. Applications of remote sensing in geology. Basic concepts of GIS and GPS. IV. **Geotectonics:** Continental drift and sea-floor spreading hypotheses, linear magnetic anomalies. Plate tectonics- types of plate-boundaries and their characteristic features. Island arc, continental rift system, active and passive continental margins. Palaeomagnetism. Mountain building and orogeny. V. **Palaeontology:** Definition, types and significance of fossils. Modes of preservation of fossils. Species concept in biology and binomial nomenclature. Index fossils and their significance. Description of hard-part morphology of brachiopoda, cephalopoda, pelecypoda and gastropoda. Evolutionary trend in Hominidae, Equidae and Proboscidae. Description and importance of Siwalik fauna, Gondwana flora and fauna. VI. **Stratigraphy:** Geologic time scale, Principles of determination of absolute and relative ages of rocks and geological events. Importance of unconformities in stratigraphy. Lithostratigraphic, biostratigraphic, magnetostratigraphic, chronostratigraphic and geochronologic units and their inter-relations. Geological evolution of Precambrian terrains of Dharwar, Singbhum and Rajasthan. Evolution of Proterozoic Cuddapah and Vindhyan basins. Geological evolution of the following Phanerozoic basins/ successions of India: Gondwana, Spiti, Kutch, Siwalik, Assam and Bengal. VII. **Hydrology and Engineering Geology:** Hydrologic cycle, vertical distribution of groundwater, porosity, permeability, hydraulic conductivity, transmissivity and storage coefficient. Aquifers: properties and classifications. Exploration for groundwater, groundwater recharge, rainwater harvesting. Groundwater provinces of India and West Bengal. Engineering properties of rocks. Geological investigations for dams, tunnels and reservoirs. Landslides: classification, causes and prevention.
Paper – II :	**I. Mineralogy:** Elements of crystal symmetry, Hermann-Mauguin symmetry notation. Crystal classes, crystal systems, crystallographic axes- interfacial angle and axial ratio. Crystal faces and linear directions, their nomenclature and interrelationship. Crystal forms in different crystal classes and crystal habits. Twining. Concept of space lattice, space group and unit cell. Physical properties of minerals. Classification of minerals on the basis of chemical composition.