transmission with noise; signal to noise ratio. Linear CW modulation : Amplitude modulation : DSB, DSB-SC and SSB. Modulators and Demodulators; Phase and Frequency modulation : PM & FM signals; narrows band FM; generation & detection of FM and PM, Deemphasis, Preemphasis. CW modulation system : Superhetrodyne receivers, AM receivers, communication receivers, FM receivers, phase locked loop, SSB receiver Signal to noise ratio calculation or AM and FM receivers.

PAPER II

1. Control Systems :

Elements of control systems; block-diagram representations; open-loop & closed-loop systems; principles and applications of feed-back. Control system components. LTI systems : time-domain and transform-domain analysis. Stability : Routh Hurwitz criterion, root-loci, Bode-plots and polor plots, Nyquist's criterion; Design of lead-lad compensators. Proportional, PI, PID controllers. State-variable representation and analysis of control systems.

2. Microprocessors and Microcomputers :

PC organisation; CPU, instruction set, register settiming diagram, programming, interrupts, memory interfacing, I/O interfacing, programmable peripheral devices.

3. Measurement and Instrumentation :

Error analysis; measurement of current voltage, power, energy, power-factor, resistance, inductance, capacitance and frequency; bridge measurements. Signal conditioning circuit; Electronic measuring instruments : multimeter, CRO, digital voltmeter, frequency counter, Q-meter, spectrum-analyser, distoration-meter. Transducers : thermocouple, thermistor, LVDT, strain-guage, piezo-electric crystal.

4. Power Systems: Analysis and Control :

Steady-state performance of overhead transmission lines and cables; principles of active and reactive power transfer and distribution; per-unit quantities; bus admittance and impedance matrices; load flow; voltage control and power factor correction; economic operation; symmetrical components, analysis of symmetrical and unsymmetrical faults. Concepts of system stability : swing curves and equal area criterion. Static VAR system. Basic concepts of HVDC transmission.

5. Power System Protection :

Principles of overcurrent, differential and distance protection. Concept of solid state relays. Circuit brakers. Computer aided protection : introduction; line, bus, generator, transformer protection; numeric relays and application of DSP to protection.

6. Digital Communication :

Pulse code modulation (PCM), defferential pulse code modulation (DPCM), delta modulation (DM), Digital modulation and demodulation schemes : amplitude, phase and frequency keying schemes (ASK, PSK, FSK). Error control coding : error detection and correction, linear block codes, convolation codes. Information measure and source coding. Data networks, 7-layer architecture.

GEOGRAPHY

PAPER I

PRINCIPLES OF GEOGRAPHY

Physical Geography :

1. **Geomorphology :** Factors controlling landform development; endogenetic and exogenetic forces; Origin and evolution of the earth's crusts; Fundamentals of geomagnetism; Physical conditions of the earth's interior; Geosynclines; Continental drift; Isostasy; Plate tectonics; Recent views on mountain building; Volcanicity; Earthquakes and Tsunamis; Concepts of geomorphic cycles and Land scape development; Denudation chronology; Channel morphology; Erosion surfaces; Slope development; Applied Geomorphology; Geomorphology, economic geology and environment.
2. **Climatology :** Temperature and pressure belts of the world; Heat budget of the earth; Atmospheric circulation; Atmospheric stability and instability. Planetary and local winds; Monsoons and jet streams; Air masses and fronto; Temperate and tropical cyclones; Types and distribution of precipitation; Weather and Climate; Koppen's Thornthwaite's and Trewar Tha's classification of world climate; Hydrological cycle; Global climatic change, and role and response of man in climatic changes Applied climatology and Urban climate.
3. **Oceanography :** Bottom topography of the Atlantic, Indian and Pacific Oceans; Temperature and salinity of the oceans; Heat and salt budgets, Ocean deposits; Waves, currents and tides; Marine resources; biotic, mineral and energy resources; Coral reefs coral bleaching; Sea-level changes; Law of the sea and marine pollution.
4. **Biogeography :** Genesis of soils; Classification and distribution of soils; Soil profile; Soil erosion, Degrada-tion and conservation; Factors influencing world distribution of plants and animals; Problems of deforestation and conservation measures; Social forestry, agro-forestry; Wild life; Major gene pool centres.
5. **Environmental Geography :** Principle ecology; Human ecological adaptations; Influence of man on ecology and environment; Global and regional ecological changes and imbalances; Ecosystem their management and conservation; Environmental degradation, management and conservation; Biodiversity and sustainable development; Environmental policy; Environmental hazards and remedial measures; Environmental education and legislation.

Human Geography :

1. **Perspectives in Human Geography :** Areal differentiation; Regional synthesis; Dichotomy and dualism; Environmentalism; Quantitative revolution and locational analysis; Radical, behavioural, human and welfare approaches; Languages, religions and secularisation; Cultural regions of the world; Human development indix.
2. **Economic Geography :** World economic development: measurement and problems; World resources and their distribution; Energy crisis; the limits to growth; World agriculture: typology of agricultural regions; Agricultural inputs and productivity; Food and nutritions problems; Food security; famine: causes, effects and remedies; World industries: location patterns and problems; Patterns of world trade.
3. **Population and Settlement Geography :** Growth and distribution of world population; Demographic attributes; Causes and consequences of migration; Concepts of over-under-and optimum population; Population theories, world population problems and policies, Social well-being and quality of life; Population as social capital.

   Types and patterns of rural settlements; Environmental issues in rural settlements;

Hierarchy of urban settlements; Urban morphology; Concept of primate city and rank-size rule; Functional classification of towns; Sphere of urban influence; Rural-urban fringe; Satellite towns; Problems and remedies of urbanization; Sustainable development of cities.

4. **Regional Planning :** Concept of a region; Types of regions and methods of regionalisation; Growth centres and growth poles; Regional imbalances; Regional development strategies; Environmental issues in regional planning; Planning for sustainable development.
5. **Models, Theories and Laws in Human Geography :** System analysis in Human geography; Malthusian, Marxian and demographic transition models; Central Place theories of Christaller and Losch; Perroux and Boudeville; Von Thunen's model of agricultural location; Weber's model of industrial location; Ostov's model of stages of growth. Heart-land and Rimland theories; Laws of international boundaries and frontiers.

PAPER II

GEOGRAPHY OF INDIA

1. **Physical Setting :** Space relationship of India with neighbouring countries; Structure and relief; Drainage system and watersheds; Physiographic regions; Mechanism of Indian monsoons and rainfall patterns; Tropical cyclones and western disturbances; Floods and droughts; Climatic regions; Natural vegetation, Soil types and their distributions.
2. **Resources :** Land, surface and ground water, energy, minerals, biotic and marine resources, Forest and wild life resources and their conservation; Energy crisis.
3. **Agriculture :** Infrastructure: irrigation, seeds, fertilizers, power; Institutional factors; land holdings, land tenure and land reforms; Cropping pattern, agricultural productivity, agricultural intensity, crop combination, land capability; Agro and social-forestry; Green revolution and its socio-economic and ecological implications; Significance of dry farming; Livestock resources and white revolution; Aqua-culture; Sericulture, Agriculture and poultry; Agricultural regionalisation; Agro-climatic zones; Agro-ecological regions.
4. **Industry :** Evolution of industries; Locational factors of cotton, jute, textile, iron and steel, aluminium, fertiliser, paper, chemical and pharmaceutical, automobile, cottage and ago-based industries; Industrial houses and complexes including public sector underkings; Industrial regionalisation; New industrial policy; Multinationals and liberalisation; Special Economic Zones; Tourism including ecotourism.
5. **Transport, Communication and Trade :** Road, railway, waterway, airway and pipeline net works and their complementary roles in regional development; Growing importance of ports on national and foreign trade; Trade balance; Trade Policy;Export processing zones; Developments in communication and information technology and their impacts on economy and society; Indian space programme.
6. **Cultural Setting :** Historical Perspective of Indian Society; Racial linguistic and ethnic diversities; religious minorities; Major tribes, tribal areas and their problems; Cultural regions; Growth, distribution and density of population; Demographic attributes: sex-ratio, age structure, literacy rate, work-force, dependency ratio, longevity; migration (inter-regional, interaregional and international) and associated problems; Population problems and policies; Health indicators.
7. **Settlements :** Types, patterns and morphology of rural settlements; Urban developments; Morphology of Indian cities; Functional classification of Indian cities; Conurbations and

metropolitan regions; Urban sprawl; Slums and asssociated problems; Town planning; Problems of urbanisation and remedies.

8. **Regional Development and Planning:** Experience of regional planning in India; Five Year Plans; Integrated rural development programmes; Panchayati Raj and decentralised planning; Command area development; Watershed management; Planning for backward area, desert, drought-prone, hill tribal area development; Multi-level planning; Regional planning and development of island territories.
9. **Political Aspects :** Geographical basis of Indian federalism; State reorganisation; Emergence of new states; Regional consciousness and inter-state issues; International boundary of India and related issues; Cross-border terrorism; India's role in world affairs; Geopolitics of South Asia and Indian Ocean realm.
10. **Contemporary Issues :** Ecological issues: Environmental hazards: landslides, earthquakes, Tsunamis, floods and droughts, epidemics; Issues related to environmental pollution; Changes in patterns of land use; Principles of environmental impact assessment and environmental management; Population explosion and food security; Environmental degradation; Deforestation, desertification and soil erosion; Problems of agrarian and industrial unrest; Regional disparities in economic development; Concept of sustainable growth and development; Environmental awareness; Linkage of rivers; Globalisation and Indian economy.

NOTE : Candidates will be required to answer one compulsory map question pertinent to subjects covered by this paper.

GEOLOGY

PAPER I

1. General Geology :

The Solar System, meteorites, origin and interior of the earth and age of earth; Volcanoes—causes and products, Volcanic belts. Earthquakes—causes, effects, seismic of zone of India; Island arcs, trenches and mid-ocean ridges; Continental drift; Seafloor spreading, plate tectonics. Isostasy.

2. Geomorphology and Remote Sensing :

Basic concepts of geomorphology. Weathering and soil formations; Landforms, slopes and drainage. Geomorphic cycles and their interpretation. Morphology and its relation to structures and lithology; Coastal geomorphology; Applications of geomorphology in mineral prospecting, civil engineering; hydrology and environmental studies; Geomorphology of Indian sub-continent.

Aerial photographs and their interpretation—merits and limitations; The Electromagnetic spectrum. Orbiting
Satellites and Sensor Systems. Indian Remote Sensing Satellites. Satellite data products; Applications of remote sensing in geology; The Geographic Information System (GIS) and Global Positioning System (GPS)—its applications.

3. Structural Geology :