Syllabus for written examination for PGT(CHEMISTRY)

S.No.	Topic (Details of the syllabus)
1.	**Some Basic concepts of Chemistry:** Scope of chemistry- Historical approach to nature of matter - states of matter, properties of matter and its measurement, S. I system of units, Uncertainty in measurements, dimensional analysis, Laws of chemical combination, atomic and molecular masses, Mole concept and molar masses, percentage composition, empirical and molecular masses, equivalent weight, concept of limiting reagent
2	**States of Matter:** Gases, liquids and solids, three states of matter, types of intermolecular forces. The laws governing ideal gas behaviour, Dalton's law of partial pressure, Kinetic molecular theory of ideal gases, Maxwell Boltzmann distribution law on molecular motion, real gases – deviation from ideal behaviour, vander Waals equation. *Liquid* and their properties. *Solids*: Classification of solids, fundamental types of lattices, two and three dimensional lattice types, Simple crystal structures, Transformation of crystal structure on varying temperature, Bragg's law, density in solids, energy band, band gaps, semiconductors, magnetic and dielectric properties, stoichiometric and non-stoichiometric defects in solids.
3	**Structure of Atom:***Structure of Atom (Classical Theory),* Dalton's atomic theory, Bohr's model of atom, *Structure of atom (modern theory),* de Broglie's relationship, Heisenberg's uncertainty principal, Classical wave equation, Schrödinger's wave equation, Probability distribution curve, Quantum numbers, Pauli's exclusion principle, Aufbau principle, Hund's rule of maximum multiplicity.
4	**Equilibrium:** Reversible reactions, criteria of equilibrium, Law of mass action, equilibrium constant, K_c and K_p , Le Chatelier principle, Ionic equilibrium, Ostwald's dilution Law, solution of acids, bases, ionic equilibria in solution, Common ion effect – its application to qualitative analysis, acids and bases, Bronsted- Lowry theory of acids and bases, Lewis concept of acid and bases, relative strengths of acids and bases, their quantitative estimation, buffer solution and its use, determination of pH, theories of indicators, conductometric titration, Solubility product, hydrolysis.
5.	**Surface Chemistry:**Adsorption, absorption, sorption, Physical adsorption, Chemisorption adsorption, isotherms (Freundlich, Langmuir), application of adsorption, types of Catalysis theories of catalysis, classification of colloids, preparation of Colloidal Solution (lyophobic and lyophilic), Special characteristics of colloidal solutions , electrophoresis, Precipitation of colloids – Hardy Schulze law, multimolecular and macromolecular colloids, Emulsion and Gels.
6	**Chemical Kinetics:** Theories of reaction rates, rate of reaction , molecularity and order of reaction, Fast reactions- Luminescence and energy transfer process, reaction mechanisms(Simple and complex reactions).
7	**Redox Reaction and Electrochemistry:** Oxidation and reduction, redox reaction and its application, oxidation number, Strong and weak electrolytes, activity coefficient, conductance and conductivity, Kohlrausch law, resistance and resistivity molar conductivity, equivalent conductivity, Qualitative and quantitative aspect of electrolysis, electrochemical cell and electrolytic cell, Electrode and electrode potential and standard electrode potential, Electrochemical series and its applications, Nernst equation and its application, Equilibrium constant and EMF of the cell.
8	**Solutions:**Solution and its types, expression of concentration of solution, solubility and factors affecting the solubility of a solid in a liquid (temperature and pressure), Vapour pressure of a liquid, Raoult's law for both volatile and non volatile solute,Ideal and non ideal solution, Colligative properties, abnormal molecular masses and Van't Hoff factor.
9	**Chemical bonding and Molecular Structure:** Valence electrons and Lewis structures, Ionic bond, Covalent bond, Bond parameters ,Co-ordinate bond, polarity and dipole moment, Quantitative idea of – valence bond theory, molecular orbital theory

	(LCAO), Concept of hybridization involving s, p, d orbitals, Hydrogen bond, Resonance.
10.	**Thermodynamics:**Macroscopic properties of the system, modes of transfer of energy between system and surrounding, Phase transition, phase rule and phase diagram, First Law, second law and third law, of thermodynamics. Internal energy and enthalpy of the reaction, their measurement and application, spontaneity of process, Entropy and spontaneity, Helmholtz and Gibb's free energy, Thermodynamics of electrochemical cells.
11.	**Classification of elements and periodicity in properties:** Significance of classification, brief history of the development of periodic table, periodic laws, name of the elements with Z>100 according to IUPAC system, classification of elements into s, p, d, f –block elements and their characteristics, Periodic trends in the properties of elements – Ionization enthalpy, Electron gain enthalpy, electronegativity, atomic radii, ionic radii, periodicity of valency or oxidation state.
12.	**Hydrogen:**Position of Hydrogen in periodic table, occurrence, isotopes, Preparation of hydrogen, on small and commercial scale, hydrides, water, hard and soft water, heavy water, hydrogen peroxide, hydrogen economy, hydrogen as a fuel.
13.	**General principles and processes of isolation of elements and s – block elements:** Principles and methods of extraction, oxidation and reduction as applied to the extraction procedures of Al, Cu, Zn and Fe. s – block elements, general introduction – Electronic configuration, occurrence, Anomalous properties of the first element of each group, diagonal relationship,

	Trends in variation of the properties, reaction of alkali and alkaline earth metals. Preparation and properties and uses of some important compounds: - sodium carbonate, sodium bicarbonate, sodium chloride, sodium hydroxide, calcium hydroxide and calcium carbonate, industrial uses of lime and lime stone, biological importance of sodium, potassium, magnesium and calcium.
14.	**p − Block Elements:** Electronic configuration, variation in physical and chemical properties of groups 13 to 18, physical and chemical properties of borax, boric acid, boron hydride, silicones, preparation and uses, preparation, properties and uses of nitrogen, ammonia, nitric acid and oxides of nitrogen, phosphorus – allotropic forms, preparation and properties of phosphine, phosphorus pentachloride and phosphorus trichloride, preparation, properties and uses of oxygen and ozone, hydrides and halides of 16 group elements, their structure and nature, allotropic forms of sulphur- their preparation, preparation, properties and uses of sulphur dioxide, industrial preparation of oxo-acids of sulphur, preparation and properties of halogen and halogen acids, inter halogen compounds, pseudohalide ions. Oxo-acids of halogens, their structure and nature, preparation, properties and uses of xenon fluorides, oxides of xenon and xenon oxo fluorides.
15.	**The d – and f- Block Elements:** General introduction, electronic configuration and general trend in the properties of first row transition metals like metallic character, ionization enthalpy, oxidation states, ionic radii, coloured ion formation, catalytic properties, magnetic properties, oxides, halides and sulphides of first row transition metals, complex compound formation etc. Preparation, properties and structures of $KMnO_4$ and $K_2Cr_2O_7$, lanthanoids and actinoids.
16.	**Co-ordination Compounds and organometallics:** Meaning of co-ordination compounds, Werner's theory, ligands – their types, IUPAC nomenclature of co-ordination compounds, isomerism, bonding in co-ordination compounds, colour, magnetic properties and, stabilities of co-ordination compounds. Chemical and biological importance of co-ordination compounds, metal carbonyls: preparation, properties and bonding, organometallic compounds and their classification.
17.	**Organic Chemistry : Some Basic Principles and Techniques:** General Classification of organic compounds, Shapes of organic compounds-Hybridisation(sp, sp^2,sp^3), Structural representation of organic molecules, Functional groups, Homologous, series. Common or trivial names, nomenclature of aliphatic, aromatic and substituted aromatic compounds.
	Isomerism : Structural and Stereo isomerism **Fundamental Concepts in Reaction Mechanism:** Cleavage of covalent bond, Types of attacking species, electron movement in organic reactions, electronic displacement in a covalent bond and types of organic reactions. **Methods of purification of organic compounds:** Qualitative analysis, Quantitative analysis., estimation of the elements and determination of empirical and molecular formula.

18.	**Hydrocarbons:** Classification of hydrocarbons.
	      Alkanes: Conformations (Newmann and Sawhorse formulae), Physical properties, Chemical reactions
	      Cycloalkanes: Preparation, physical and chemical properties, stability of cycloalkanes(Bayer strain theory), chair and boat forms of cyclohexane.
	      Alkenes:, structure of double bond, geometrical isomerism, physical properties, methods of preparation, chemical reactions**.**
	      Alkadienes: Classification of dienes, Preparation of conjugated dienes, Chemical properties(1,2 and 1,4- addition to conjugated dienes).
	      Alkynes:, structure of triple bond, physical properties, methods of preparation Chemical properties, Acidic nature of alkynes
	Aromatic Hydrocarbons:, Structure of benzene, resonance, aromaticity (Huckel's rule) Chemical properties, mechanism of electrophilic substitution direct influence of substituents in monosubstituted benzene.

19.	**Environmental Chemistry:** Environmental pollution, Atmospheric pollution, Tropospheric pollution(Air pollution), Major air pollutants, Control of air pollution, Smog(Chemical and Photochemical smog), Stratospheric pollution: Ozone layer and

its depletion, Acid rain, Green House Effect and Global warming, Water pollution, Soil pollution and Industrial waste.

20. **Haloalkanes and Haloarenes:** Classification, methods of preparation of haloalkanes and haloarenes, their physical properties, tests to distinguish between alkyl and aryl halides, **mechanism of SN^1 and SN^2 reactions**, elimination reactions (**Saytzeff Rule, E_1 & E_2 mechanism**) **Poly halogen compounds:** Preparation and properties.

21. **Alcohols, Phenols and Ethers:** Classification, preparation, properties and uses, tests to distinguish between primary, secondary and tertiary alcohols**.** Distinctions between alcohols and phenols. Preparation of ethers , physical and chemical properties.

22. **Aldehydes, Ketones and Carboxylic Acids:** Structure of carbonyl group, preparation of aldehydes and ketones, physical , Chemical properties and uses, tests to distinguish between aldehydes and ketones .Preparations of carboxylic acids preparation properties and uses.

23.	**Amines (Organic compounds containing nitrogen):** Classification, Structure of amino group, preparation, Physical, Chemical properties, tests to distinguish between primary, secondary and tertiary amines
24.	**Polymers:** Polymerization, Classification of polymers based on : origin, structure, molecular forces, mode of polymerization. **Addition polymerization Condensation polymerization(Step-growth polymerization)** Preparation of condensation polymers Synthetic and natural rubber and vulcanization, Determination of molecular mass of polymers:. Poly dispersity index(PDI). **Bio-degradable polymers like PHBV.**
25.	**Biomolecules(Biochemistry):Carbohydrates:** Classification of carbohydrates , Structural determination of glucose and fructose on the basis of their chemical properties, Open chain (Fischer) structure, cyclic structure(**Haworth form**), **and forms of glucose, Mutarotation, anomers and epimers**, Chemical reactions of glucose, Reducing and non-reducing sugars, Configuration of glucose and fructose.
	Disaccharides Sucrose, **Haworth representation of disaccharides**, Polysaccharides, Starch, Cellulose, and amylopectin structures, Functions of Carbohydrates in living organisms. Carbohydrate metabolism, glycolysis, electron-transport chain, **Proteins:** Amino acids, Zwitter ion, Iso-electric point, peptides and peptide bond, Fibrous proteins, Globular proteins and their functions, Primary, Secondary(Helix and pleated sheet structures) and tertiary structure of proteins, denaturation and renaturation, Enzymes, specificity and mechanism of enzyme activity , coenzymes, applications of enzymes. **Nucleic acids :** Nucleosides, Nucleotides, Structure of ATP, Photosynthesis(Light and dark reactions) Primary and Secondary structure of DNA(Double Helix structure) , biological functions of nucleic acids, Replication, Protein synthesis (Transcription, Translation, mutation), genetic code, genetic errors, Vitamins, classification, diseases caused by the deficiency of vitamins, Hormones (steroid hormones and non-steroid hormones) and their functions.

26. **Chemistry in Everyday life: Drugs and medicines -** designing a drug, drug metabolism, classification of drugs, enzymes as drug targets, action of drug through drug
receptor interaction, types of drugs: Antipyretics, Analgesics, antiseptics, disinfectants,
tranquilizers, antimicrobials, antibiotics(Narrow spectrum and broad spectrum antibiotics),
antacids. Chemicals food, Food antifertility drugs, antihistmmines, in preservatives, artificial sweetening agents, Soaps and detergents, Preparation soaps(Saponification) and
detergents, cleansing action of advantages of detergents over soaps, soaps, Deodorants, Edible colours, antioxidants.

Syllabus for written examination for PGT (Biology)

Diversity of living world

Taxonomic aids, keys, specimen management ; Systematic and binomial system of nomenclature; Classification of living organisms(five kingdom classification, major groups and principles of classification within each group) ; General description of monera, protozoa, fungi, algae, bryophytes, pteridophyes, gymnosperms, angiosperms (major groups of angiosperms upto sub class) ; Botanical gardens ,herbaria, zoological parks and museums .Salient features of animal (nonchordates up to phylum level and chordates up to class level).

Structural organisation in plants and animals

Morphology, Anatomy and histology of angiosperms: Root , stem , leaf, flower , inflorescence, fruits and seeds, Tissues : Meristamatic and permanent (epidermal,

ground, vascular). Cambial activity, secondary growth, type of wood. Animal tissues ; Morphology, Anatomy and histology of annelids , insects , amphibians.

Structural and functional organization of cell

Cell cycle , detailed study of Cell division (mitosis , meiosis) ; Cell death ; Structure and function(metabolism) of carbohydrates, proteins, lipids and nucleic acids ; Enzymology : Classification and nomenclature of enzymes ; Structure ; Mechanism of action, single substrate and bisubstrate enzyme ; Activators and inhibitors of enzymes ; Factors affecting the activity of enzymes.

Plant physiology

Water relations: Properties of water, water in tissues and cells, Transport of water and solutes(food, nutrients, gases) : Transport across cell membrane ; soil-plant-atmosphere continuum ; Minerals required by plant, their absorbable form, functions, deficiency symptoms, essentiality of mineral, N_2 metabolism, biological fixation ; Cellular Metabolism: Gluconeogenesis, Glycogenesis and glycogenolysis, hormonal regulation ; Oxidation of food, respiratory efficiency of various food components ; transport and detoxification of ammonia , Lipid Metabolism ; Photosynthesis: Basic principles of light absorption, excitation energy transfer, electron transports, cycles (C_2 , C_3, C_4, CAM), plant productivity, measurement of photosynthetic parameters ; Physiological responses to abiotic stresses ; Sensory photobiology
; Plant growth regulators : Growth ,differentiation / de-differentiation and re-differentiation, development ; Physiological affects and mechanism of action of plant growth hormones, Flowering : Photoperiodism and its significance, endogenous clock and its regulation, floral induction and development, vernalisation ; Plant movements.

Human biology

Morphology, Anatomy, Histology, Physiology, Control and Disorders of Digestion, Respiration, Body fluids and Circulation**,** Excretion, Skeleton system & muscle, Nervous; Physiology of high altitude.

Sexual Reproduction

Plants**:** Structural details of angiospermic flower, development of gametophytes, pollination and its types, agencies of pollination, pollen- pistil interaction, fertilization, Artificial hybridization (emasculation and bagging) development of seed and fruit ; Apomixis and Polyembryony ; Self incompatibility: Structural and biochemical aspects; methods to overcome incompatibility; Experimental Embryology; Human Reproduction**:** Morphology, Anatomy, Histology and Physiology of reproduction ; Neuro-endocrine control **;** Sexual behavior in infancy, pre-adolescence, adolescence and of adult ; Implantation, Pregnancy and Parturition ; Mammary gland and Lactation ; Infantile mammary gland, pubertal changes in mammary gland; Structure of adult mammary gland, galactopoiesis, milk let down ; Menopause. Senescence – Impact of age on reproduction.Foetal and Embryonic Gonads and Genital ducts ;Hormonal basis of sex differentiation ; Disorders of sexual differentiation development ;Reproductive Health**:** Problems and strategies, Population explosion –causes and effects, birth control measures- natural methods, physical / barrier, bio-chemical, hormonal, immunological, surgical methods, IUD's , amniocentesis, female feticide, MMR, IMR, MTP, STD's, infertility Disorders of female and female reproductive systems – Sexual dysfunction; Infertility – Causes and curative measures ; Reproductive toxicology of environmental and industrial chemicals, drug and alcohol ;Medically assisted human reproductive technologies, GIFT, IUT, ZIFT, TET ; Embryo culture.
Genetics

Principles of Inheritance and Variation: Mendelian genetics, Inheritance of one gene, two genes, post mendelian inheritance; Recombination frequency, chromosomal theory of inheritance ; Drosophila genetics, linkage and recombinations ; Mutation :General properties of mutations ; Adaptation versus mutation ; molecular basis of gene mutation : DNA repair mechanisms ; Pedigree analysis ; Human karyotype-banding ; genetic and environmental basis of sex determination, Y- and X-linked genes; Numerical and Structural abnormalities of human chromosomes and related syndromes ; Human metabolic disorders.;Molecular Basis of Inheritance**:** Chemical nature of DNA and RNA,

Biological functions of nucleic acids ; Search for genetic material, RNA world ; Replication ; Transcription and processing of RNA, Genetic code ; Translation, post-translational modifications ; Ribosomes and Proteins ; Regulation of Gene

expression ; DNA Fingerprinting ; Gene mapping ; Chromosome banding; Restriction enzyme, nucleotide sequence comparisons and homologies ; Molecular clocks ; Genetics in modern agriculture ,animal breeding, medicine, human behaviour ; Misuse of genetics ; Genetic Counseling ; Gene therapy ; HGP ; Gene Activity in prokaryotes and eukaryotes ; Signals for gene control – Hormones and growth factors ; Totipotency & Pleuripotency ; Stem cell and Gene therapy ; Bacterial transformation, transduction and conjugation, Bacterial chromosome
; Bacteriophages : Types, structure and morphology ;Evolutionary biology: Cosmic evolution – Physical basis of life ; Theories of origin of life ; Origin of life through biochemical evolution ; Experimental evidences for origin of life ; The origin of natural selection ; Extraterrestrial life ; Evolution of the eukaryotic cell : Evolution of the Metazoa ; Evolution of chordata and the evolution of the major vertebrate classes; Origin and evolution of man : Population Genetics; Genetic variations ; Polymorphism ; Gene frequency; Hardy Weinberg equilibrium ; Genetic drift, founder effect ; adaptive radiations, ecological significance of molecular variations.

Biology in Human welfare

Health and disease ; types of diseases, common diseases in humans ; Immunology – Innate and Acquired immunity ; Passive and active immunization ; Organization and structure of lymphoid organ ; Cells of the immune system and their differentiation ; Lymphocyte traffic ; Nature of immune response ; Structure and Functions of antibodies : Antigen-Antibody interactions ; Humoral immune response ; Cell mediated immunity ; Immunological memory **;** Auto-immunity **;** Allergies; HLA system in human :MHC haplotypes ; Transplantation types and problems ; Immunodeficiency disorders ;etiology of HIV ; types, genetics and biochemistry of cancer ; Drugs and alcohol abuse, Addiction , drug dependence, ill effects, prevention, its abuse in adolescents and its management;Strategies for food production and enhancement: Animal husbandry, management of farm animals, breeding strategies (natural and artificial) and their types, economic importance of each ; Plant breeding, method of release of new variety, HYV of common cereals and pulses, bio-fortification, SCP ; Tissue culturing, somatic hybridization;Microbes in Human Welfare**:** Technology associated and use of Microbes in household, industries, medicine, bio-active molecules, sewage treatment and STP, Ganga and Yamuna action plan, biogas production, biocontrol agents, biofertilizers.

Principles of Biotechnology

Genetic engineering tools and technique, technique of separation and isolation of DNA, cloning vectors ,electrophoresis, bio reactors, processing of its products. Tissue engineering ; Cryopreservation ; Fusion methods, detection and applications of monoclonal antibodies, DNA vaccines, Edible vaccines.;Application in agriculture : GMO for pest resistance, RNAi and dsRNA technology,Application in Medicine, genetically engineered products, gene therapy.

Molecular diagnosis : serum and urine analysis, PCR, ELISA ; Transgenic animals : their physiology, biological products and their use for testing the safety of vaccine and chemicals ; Bioethics issues ; biopyracy.

Ecology

Organism and its environment, distribution of biomes, major physical factors and the physiological responses shown by organisms ; Physical adaptation of plants and animals, rules governing adaptations ; Population attributes and growth, logistic curves, Darwinian fitness ; Population interactions and their theories ; Ecosystem structure and functions, ecosystem productivity and standing crop, decomposition in nature, energy flow in GFC / DFC, ecological pyramids, succession of community ; Nutrient cycle ; ecosystem services ; Biodiversity types and its patterns, importance of diversity, its loss and their causes, conservation strategies ; Environmental issues : Types of pollution, their indicators, causes, effects, prevention and treatment ; Deforestation, recommended forestation, reforestation, case studies of people's participation in conservation.

Syllabus for written examination for PGT(BIOTECH)

Introduction to Bio-technology

Historical perspectives, scope and importance, commercial potential , interdisciplinary challenge, a quantative approach-scale up – stages in commercialization of product and process, the fermenter , aseptic operation. Manufacturing quality control, good manufacturing practices, good laboratory practices, product safety, bio safety principles-environment and health risk , assessment, bio safety regulatory guidelines and controlling agency, environmental law for hazardous drugs , microbes and GMO'S , Biotechnology related issues of Public concern, Bioethics. Marketing, Biotechnology in India and global trends.

Fundamentals of Biochemical engineering-Concept of pH , buffer , physical variables , dimensions and units , measurement conventions , physical and chemical properties, data , stoichiometry , errors in data and calculation, absolute and relative un certainty and types of error statistical analysis presentation of experimental data , data analysis , trends , testing mathematical models, goodness to fit , use of graph paper with logarithmic coordination and plotting of data process flow diagrams, material balance, fluid flow and mixing , mass transfer , heat transfer, unit operations, homogenous reactions , microbial growth , substrates utilization and product formation kinetics, reactor engineering

– rheology of fermentation fluids , scale up concepts, design of fermenting media, aseptic transfer, various microbial and enzyme reactors, instrumentation in bio reactors. **Biotechnology and Society**-Public perception of Biotechnology intellectual property, patents, reading a patent, International scenario, National scenario, Varietals protection, ethical issues in agriculture and health care.

Biochemistry
Biomolecules- Structure and Dynamics; Thermodynamics**:** concept of free energy, entropyBuilding blocks of carbohydrates – sugars and their derivatives , chemical properties of sugar , polysaccharides – glycogen , cellulose, chitin etc.Building blocks of proteins – Amino acids, Chemical properties of amino acids, regulation of amino acid metabolism and inborn errors of metabolism determination of sequencing of amnino acids , fragmentation of polypeptide chain , 3D structure of proteins, secondary , tertiary and quarternary structure of proteins, vitamins and enzymes. Lipids – simple fatty acids , Sphingosine, Glycerol and cholesterol and their chemical properties , lipid metabolism and its regulation. Nucleic acids-Nucleo tides, chemical properties , optical activities and stereo chemistry of bio molecules, polarimetry , conformations and configuration, RNA, DNA, 3D model of DNA , chromosome structure , circular and super coiled DNA. Biochemical transformations-carbohydrates metabolism-glycolytic path way, krebs cycle, homo fermentative path way. KH , PPP, photosynthesis- light reaction Kelvin cycle, nitrogen fixtation , nitrogen cycle, nitrogenase , gluconeogenesis, electron transport and oxidative phosphorylation , precursor-product relationship, supramolecular assembly, biomolecular database, biomembranes, structure and function of liposomes and their applications

Techniques, Instrumentation and principles

Techniques based on molecular weight or size- Centrifugation and ultra centrifugation, gel permeation
, osmotic potential.Techniques based on polarity- Ion exchange chromatography, elctrophoresis, isoelectric focusing , hydro phobic interaction , partition chromatography.Techniques based on spectroscopy- Colorimetry, UV visible , spectro photometry, fluorescence , spectroscopy , x-ray crystallography , mass spectrometry , radio isotopes techniques; Techniques based on solubility – Salt perceipitation , precipitation with organic solvent.
Cellular techniques- Microscopy-LM,TEM,SEM cell sorting , cell fractionation , cell growth determination , electronic particle counter, culture based counting methods **Genetical techniques**-Chromosomal techniques- Staining , bending, pattern, Karyotyping, chromosomal painting. Mutagenic techniques- Bacterial and seed mutagenesis , recombination in bacteria, conjugation, transduction, breeding methods in plants, pedigree analysis, DNA isolation.

Cell Biology

Cell structure and components- Cell membrane – composition, Structure, membrane , associated receptors, artificial membrane, membrane proteins, principals of membrane

organization, cell junction, membrane lipids. Cell organellels – Golgi bodies, Endoplasmic reticulum, lysosomes, per oxisomes, ribosomes, internatilsation of macro molecules , endo and exocytosis , mitochondrial structure and oxidative phosphorylation. Cytoskeleton- Micro tubules , micro filaments, lattice and cytosol ;Nucleus – nuclear envelope , nucleolus , chromosome tissue and organs , evolution and population , speciation , biodiversity , adaptation, natural selection, organization of life, size and complexity , interaction with environment .**Cell growth and development** - Cell division, cell cycles, cell communication and signal transduction , movement, nutrition, gaseous exchange , internal transport, maintaining the internal environment, reproduction, animal and plant development, immune response, apoposis, plant-pathogen relation, secondary metabolism, defence strategy in microbes and insects.

Genetics and Molecular Biology

Principles of Genetics- Mendelian genetics, role of chromosome in inheritance, multiple alleles , linkage and crossing over , genetic recombination, genetic mapping, gene interaction , sexed linked inheritance , extra nuclear inheritance, quantitative inheritance, genes at the population level, discovery of DNA as genetic material-Griffiths experiment, Hershey and Chase experiment, mutagenesis , types of mutations, genome, chromosome and gene mutations, molecular mechanism
of mutation , DNA repair , genetic disorder, transposons, animal and plant breeding. **Genome function-** Genome organization, sequencing DNA replication, fine structure of gene, from gene to protein, transcription , genetic code , translation, regulation of gene expression, genetic basis of development, genetic of cancer, immuno genetics, evolutionary genetics.

Protein and gene manipulation

Protein Structure and engineering.-3D shape of proteins, non covalent bonds, hydrogen bonds, van der waals forces, hydro phobic interaction. Structure function relationships in proteins – Chymotrypsin, molecular disease. protein finger printing, 2D gel electrophoresis, purification of proteins, characterization of proteins , proteins based products, mass spectrometry, blood products and vaccine , therapeutic antibodies and enzymes, hormones and growth factor, regulatory factor , analytical application , industrial enzymes , functional non catalytic proteins, nutraceutical proteins, designing proteins, proteomics, genes and proteins type of proteomics .

Recombinant DNA Technology -Tools of recombinant DNA technology, restriction enzymes, making of recombinant DNA , DNA library, introduction of recombinant DNA into host cells-plasmid , cosmid, vectors, lambda, bacteriophage , identification of recombinants , PCR, DNA probes, hybridization techniques , DNA sequencing, site directed mutagenesis, cloning strategies.

Genomics and Bioinformatics- Structural and functional genomics, genome sequencing projects, genetic mapping, gene prediction and counting , genome similarity, SNPs and comapartive genomics , functional genomics-micro array techniques , fluorescence , in situ hybridization , comparative DNA hybridisation, history of bio informatics, sequences and nomenclature

, DNA and protein sequences, information sources-major databases, blast family search tools, resources for gene level sequences , analysis using bio informatics tools.

Cell culture technology

Microbial cell culture and its applications-nutrients , energy sources, sterilization procedures, environment for microbial growth, aeration and mixing , equipments for culture- bioreactors, Types of microbial culture, measurement and kinetics of microbial growth, scale up of microbial process, isolation of microbial products, strain isolation and improvement, application of microbial culture technology bioethics.

Plant Cell culture and applications- Cell and tissue culture techniques- Nutrient media, types of cultures, plant regeneration pathways, application of cell and tissue culture, gene transfer methods in plants, transgenic plants with beneficial traits, stress tolerance, herbicide tolerance, insect resistance, transgenic plant as bio reactor, diagnostics in agriculture and molecular breeding, morphological and molecular markers , bioethics.

Animal cell culture and applications- Primary cell culture, secondary cell culture and lines, types of cell lines , physical environment , osmolality , media , pH temperature cryopreservation, equipments required for animal cell culture, carbon dioxide incubators, Characterisation of cell lines- Scale up of animal culture, applicantions of animal cell culture-Tissue plasminogen activator, factor VIII , erythropoietin, hybridoma technology, mono colonal antibodies, therapeutic antibodies, stem cell technology- morphological approach, in vitro clonal assay, long term marrow culture, embryonic stem culture, cell and tissue engineering , bioethics in animal genetic engineering.

Immunology

Immune system , molecules of immune system, immuno globulins , MHCs, cytokines, T cell receptor, generation of antibodies and T cell receptor diversity , complement system, humoral and cell mediated immunity, immune regulation, vaccines , hybridoma, immuno deficiencies, AIDS, transplantation immunity and cancer.

Applied Biotechnology

Biotechnology industry , Bioinformatics, molecular technology for diagnosis of genetic disorders, onco viruses and immunity, lymphocyte, homoestasis, viral induced modulation of host immune response, HLA polymorphism, induction and maturation of B cells, safe limits for radiation determined , radiation carcinogenesis.

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SYLLABUS FOR WRITTEN EXAMINATION FOR PGT(COMMERCE)

PART – I
BUSINESS STUDIES AND MANAGEMENT

Introduction to Business– Concepts, characteristics, objectives. Classification of business as industry and commerce. Distinctive features of business - Business, profession and employment. Choice of Form of Organization .Large Scale and Small Scale Business-.Assistance by Government to Small Scale Sector.

Form of Business Organization – Sole Proprietors, Joint Hindu Family, Partnership, Joint Stock Company and its formation, Cooperative organization.

Business ownership– Private, public and Joint sector. Public Enterprises, Role-dynamics of Public Sector, Global Enterprises (Multinational Companies), Joint Ventures.

Business Services – banking, insurance, transportation, warehousing, communication, Impact of Technology on Business Services.

Trade: Internal Trade Retail and Wholesale trade, Emerging modes of business-franchisee, E-business and Outsourcing. International Business–Export-Import – Procedure and documentation, EPZ/SEZ . International Trade Institutions and Agreements – WTO, UNCTAD, World-Bank, IMF.

Business Finance: Sources – owners and borrowed fund, Sources of raising finance, Equity and preference Shares, GDR,ADR, Debentures, Bonds – Retained Profit, Public Deposits, Loan from Financial Institutions and commercial banks, Credit-rating and rating agencies, Trade credit, Micro-credit.

Social Responsibility of Business, Business Ethics, Environment protection.

Management – concept, objectives, nature of management as Science, Art and Profession, levels, Principles of Management general and scientific.

Business Environment – meaning, importance, dimensions, changing business environment–special reference to liberalization, privatization and globalization, Business - a Futuristic vision.

Management Function – Planning, organizing, staffing, directing, controlling and coordination

Business Finance: Financial Management – meaning, scope, role and objectives, financial planning, Capital structure, leverage, Fixed and working capital – meaning and factors affecting its requirements.

Financial Market – Money Market-nature, instruments, Capital Market- Primary and secondary, Stock exchange, NSEI, OTCEI, Procedures, SEBI.

Human Resource Management– meaning , importance, man-power estimation , Recruitment and selection, Training and development , Compensation, Performance Evaluation

Marketing – meaning, functions and role, Levels of Marketing , Changing facets of marketing , Product-mix, Models of Marketing.
Organizational Behaviors : Individual behaviors , Motivation–concepts and applications, Personality perception, Learning and attitude, Leadership and its approaches, Communication , Group dynamics.

Emerging Trends in Management – Business Process Reengineering, Total Quality Management, Quality Circles, Benchmarking, Strategic Management, Knowledge Management, Business Standardization and ISO.

Consumer Protection – Meaning, importance, consumers' rights, Consumers' responsibilities, Consumer awareness and Legal redressal with special reference to consumer Protection Act, Role of consumer organization and NGOs.

PART –II

FINANCIAL ACCOUNTING AND FINANCIAL STATEMENT ANALYSIS

Accounting: Meaning, objectives, qualitative characteristics of Accounting information, Accounting Principles, Accounting concepts, Accounting standards, Cash and Accrual Basis of Accounting.

Process of Accounting :Voucher, transaction ,Accounting Equation, Rules of Debit and Credit, Book of original entry-Journal and Special Purpose Books, Ledger ,posting from Journal and subsidiary books, Balancing of Accounts, Trial Balance and Rectification of Errors .Bank Reconciliation Statement.

Accounting for depreciation ,Provisions and Reserves ,Bills of Exchange, Non-Profit Organization , Partnership Firms - Reconstitution of Partnership (Admission ,Retirement ,Death and Dissolution),Account of Incomplete Records, Consignment and Joint ventures.

Accounting of Joint stock Companies: Share capital types of shares, accounting for issue, allotment forfeiture and re-issue of shares. Debentures –types, issue and method of redemption . Final Accounts of Sole proprietor and Joint Stock Companies. Emerging trends of presentation of Final Accounts.

Accounting for liquidation.

Financial Statement Analysis: Meaning, significance, limitation .Tools for Financial Statement Analysis-comparative statements, common size statements, Trend analysis, accounting ratios.

Fund Flow Statement and Cash Flow Statement: Meaning, objectives, preparation as per revised standard issued by ICAI.

Cost Accounting- Nature, functions . Job costing, Process costing, Marginal costing, Cost-volume-profit relationship. Cost control and cost reduction techniques

Computers In Accounting: Introduction to Computers and Accounting Information System, Application of Computers in Accounting, Automation of Accounting process, designing accounting reports, MIS reporting, data exchange with other information system. Ready made , customized and tailor made Accounting Systems.

Accounting And Database Management System –meaning, concept of entity and relationship in an accounting system, Data Base Management System(DBMS) in accounting.

Inflation accounting and Accounting for Human Resource of an Organization and Social Responsibility.

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COMPUTER SYSTEMS ARCHITECTURE

1. THE COMPUTER SYSTEM

    System buses: Computer Components, Computer function, Interconnection Structures, Bus Interconnection, PCI.

    Internal Memory: Computer Memory System Overview, Semiconductor Main Memory, Cache Memory, Advanced DRAM Organization.

    Input/ Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Producers, The External Interface.

    Operating System Overview.

2. THE CENTRAL PROCESSING UNIT

    Computer Arithmetic: The Arithmetic and Logic Unit (ALU), Integer Arithmetic, Floating-Point Representation, Floating-Point Arithmetic.

    Instruction Sets: Characteristics and Function, Machine Instruction Characteristics, Types of Operands, Types of Operation, Addressing Modes and Formats, Register Organization, The Instruction Cycle, Instruction Pipelining.

    Assembly Language

    The Control Unit: Micro-operations, control of the CPU, hardwired Implementation, Micro program Controller, Basic Concepts, Microinstructions, Sequencing, Microinstruction Execution.

    Reduced Instruction Set Computer: An Introduction.

OPERATING SYSTEMS

Introduction: System software, resource abstraction, OS strategies; multiprogramming, batch, time sharing, personal computers and workstation, process control & real time systems, processes & threads using FORK, JOIN, QUIT.

Operating System Organization: Factors in operating system design, basic OS function, implementation consideration: process modes, kernels, methods of requesting system services, device drivers.

Device Management: Service management approaches, buffering, device drivers, performance tuning.

Process Management: System view of the process and resources, initiating The OS, process address space, process abstraction, resource abstraction, process hierarchy.

Scheduling: Scheduling Mechanisms, Strategy selection, non-pre-emptive and pre-emptive strategies.

Synchronization Principles: Interactive processes, critical section, deadlock, coordinating processes, semaphores, spread memory, multiprocessors, events, monitors and the inter-process communication.

Deadlocks: System deadlock model, prevention strategies, hold and wait, circular wait, allowing pre-emption, Banker's Algorithm, serially reusable resources, consumable resources, general resources system recovery.

Memory Management: Mapping address space to memory space, memory allocation strategies, fixed partition, variable partition, segmentation.

File Management: Directory structure, basic file operations and their implementation. Protection and Security: Policy mechanism, authentication, internal access authorization.

DIGITAL ELECTRONICS

Fundamental Concepts: Digital signal, NAND, NOR and Exclusive-OR operation, Boolean Algebra, Basic Digital Circuits.

Number system and Codes: Primary, Octal, Hexadecimal, Signed Numbers Codes, hamming codes.

Combinational Logic Design: K-map representation of logical functions and simplification using K-map of 4 and 5 variables, Quine- McCluskey's method.

Multiplexers, Demultiplexers, Adders and Subtracters, multipliers, Comparators, Parity generators and checkers, Code converters, Priority Encoders, Decoders.

Races, hazards, and asynchronous behavior

Flip-Flops: Clocked RS flip flop, D-type flip flop, Excitation table of flip flop, Edge triggered flip flop, Clocked flip flop design.

Sequential Logic Designs: Registers, Shift registers, Asynchronous counters, synchronous counters, RAM, ROM.

PROGRAMMING FUNDAMENTALS

Basic Computer Organization: Functional Units, basic I/O devices and storage devices; Representation of integers, real (fixed and floating point), characters (ASCII and Unicode); Basic operations of a programming environment.

Problem Solving Approaches: Notion of an algorithm, problem solving using top-down design and decomposition into sub-problems, stepwise methodology of developing an algorithm, methodology of developing an algorithmic solution from a mathematical specification of the problem, use of recursion for problems with inductive characterization.

Programming using a modern programming language such as Java, emphasizing the following notions: Building blocks: arithmetic and logical expression, variables, assignment; Specifying the input-output interface (type); control structures including sequencing, conditionals, loops, procedural abstractions (procedures, methods); basic data structures-integers, reals, strings and arrays-and internal representation of scalar and vector data; data abstraction and encapsulation-objects, classes and packages; input/ output of data.

Numerical and non-numerical applications using above concepts.

PROGRAMMING TOOL: VISUAL BASIC

Introduction to Programming –Modular Programming, Object Oriented Programming, Event Driven Programming:

About Visual Basic (Object Based Programming Language), Rapid Application Development using Visual Basic;

Concept of Project In Visual Basic, VB Project Options- Standard EXE, ActiveX DLL, ActiveX EXE, ActiveX Control, Active X Document EXE, Addin, VB Application Wizard, IIS Application, DHTML Application;

Getting Familiar with Visual Basic User Interface-Pull-Down menus, Toolbar, Toolbox, Project Explorer, Properties Window, Form Layout Window, Form, Immediate window;

Opening and Closing window, Resizing and moving windows, Docking windows; Quitting Visual Basic;

Visual Basic Tool Box (Standard Window Controls)- Pointer, Picture Box, Lbel, Text Box, Frame, Command Button, Check Box, Option Button, Combo Box, List Box, Horizontal Scrollbar, Vertical Scrollbar, Timer, Drive List box, Directory List box, File List Box, Shape, Line, Image, Data, OLE;

Object Naming Conventions, Event Procedures;

Data Types: Integer, Long, Single, Double, Currency, String, Byte, Boolean, Date, Object, Variant;

Variables: Need to use variable, Declaring Variables, Variable Naming Convention, Assigning value to Variables, Data Types of variable, Scope and lifetime of Variables (Public and Private);

Menu Editor : Concept of menus, Shortcut menus and Popup menus Designing Menu System, Menu Editor Dialog Box Options (Name, Index, Shortcut, Help Context ID, Negotiate Position, Checked, Enabled, Visible, Window List, Right Arrow, Left Arrow, Up Arrow, Down Arrow, Menu List, Next, Insert, Delete, OK, Cancel), To Create Menu Controls in the Menu Editor, Menu Naming Conventions, Setting the Name Property, Creating a Menu Control Array, Creating Sub Menus, Separating Menu Controls, Assigning Access Keys and Shortcut Keys, Controlling Menus at Runtime-Enabling and Disabling Menu Commands, Displaying a Checkmark on a Menu

Control, Making a Menu Control Invisible, Adding Menu Control at Runtime, Displaying Pop-Up Menu;

General Controls (Advance): Image List, Common Dialog Box, ADO DC, DB Combo, Media Player Control, DB Grid;

Adding a Toolbar: Creating an Image List, Adding Images to the Toolbar, To Add Code for the Toolbar Buttons;

Adding Status Bar: Adding Status Bar panels, Adding Time on the panel.

Dialog Boxes: Pre-defined dialog box, Custom dialog box;

DATA STRUCTURES

Introduction to the object-based and object-oriental programming paradigms; records, abstract data types and objects, data abstraction and internal representation; programming-in-the-large issues: modularity and code re-usability, classes and packages; graphical user interfaces; command-line arguments; interfacing with libraries and separate compilation; language support and OOP: Sub-typing, Inheritance, classes and subclasses, header files, function templates, overloading.

Programming with Data structures: Stacks, queues, lists, trees and balanced binary trees, specification of exception conditions and exception handling, notion of efficient algorithmic solution, efficient representations of data structures (e.g.sparse arrays), algorithms for searching and sorting.

PROGRAMMING IN C++

1. Object Oriented Programming: Concept of Object Oriented Programming- Data hiding, Data encapsulation, Class and Object, Abstract class and Concrete class, Polymorphism (Implementation of polymorphism using Function overloading as an example in C++); Inheritance, Advantages of Object Oriented Programming over earlier programming methodologies.

2. Implementation of Object Oriented Programming concepts in C++: definition of a class, Members of a class-Data Members AND Member Functions (methods), Using Private and Public visibility modes, default visibility mode (private); Member function definition: inside class definition and outside class definition using scope resolution operator (::); Declaration of objects as instances of a class; accessing members from object (s), Array of type class, Objects as function arguments-pass by value and pass by reference;

Constructor and Destructor:

Constructor: Special Characteristics, Declaration and Definition of a constructor, Default Constructor, Overloaded Constructors, Copy Constructor, Constructor with definition of destructor;

Destructor: Special Characteristics, Declaration and definition of destructor;

Inheritance (Extending Class): Concept of Inheritance, Base Class, Derived Class, Defining derived classes, protected visibility mode; Single level inheritance, Multilevel inheritance and Multiple inheritance, Privately derived, Publicly derived and Protectedly derived class, accessibility of members from objects and within derived class (es);

3. Data File Handling:

Need for a data file, Types of data files-Text file and Binary file;

Basic file operations on text file: Creating/ Writing text into file, Reading and Manipulation of text from an already existing text File (accessing sequentially);

Binary File: Creation of file, Writing data into file, Searching for required data from file, Appending data to a file, Insertion of data in sorted filed, Deletion of data from file, Modification of data in a file;

Implementation of above mentioned data file handling in

C++; Components of C++ to be used with file handling:

4. Pointers:

Declaration and Initialization of Pointers: Dynamic memory allocation/ deallocation operators: new, delete; Pointers and Arrays: Array of Pointers, Pointer to an array (1 dimensional array), Function returning a pointer. Reference variables and use of alias; Function call by reference. Pointer to structures: Deference operator: *,->; self referential structures;

RELATIONAL DATABASE MANAGEMENT SYSTEM

1. Database Management System

Introduction to database concepts: Relation/ Table, attribute, Tuple/ Rows, fields, Data, Concept of String, Number and Date values, Data type and Data Integrity (Domain and Referential Integrity). Candidate key, Alternate key, Primary Key, Foreign Keys; Data Normalization-first, second, third, BCNF normal form;

Examples of Commercially available Database Management System's (Back-End) – Oracle, MS-SQL Server, DB2, MySQL, Sybase, INGRES.
Examples of Front End Software's: Oracle Developer, Visual Basic, Visual C++, Power Builder, Delphi;

2. RDBMS Tools: Oracle

ORACLE: Introduction, Version, Two Tier and Three Tier

support; Interface with oracle, Login Screen, Entering Name

and Password;

Classification of SQL Statements: DML (SELECT, INSERT, UPDATE, DELETE), DDL (CREATE, DROP, ALTER, RENAME, TRUNCATE), DCL (GRANT, REVOKE), TCL (COMMIT, ROLLBACK);

SQL SELECT Statement: SQL SELECT statement, Selecting All the Columns, Selecting Specific Column, Column Heading Default, Using Arithmetic Operators, Operator Precedence, Significance of NULL value, NULL values in Arithmetic Expressions, Defining and using Column Alias, Concatenation Operator (ll), Duplicate rows and their Elimination (DISTINCT keyword), Role of SQL and SQL*Plus in interacting with RDBMS, Displaying Table Structure (DESC command);

SELECT Statement Continued: Limiting Rows during selection (using WHERE clause), Working with Character Strings and Dates, Using Comparison operators, BETWEEN Operator, IN Operator, LIKE Operator, is null comparison, Logical Operators, Use of Logical

Operators (AND/OR/NOT Operators), Logical Operator Precedence, ORDER BY Clause, Sorting in Ascending/Descending Order, Sorting By Column Alias Name, Sorting On multiple Columns;

Functions: SQL Functions, Types of SQL Function (Single Row/ Multiple Row), Single Row SQL Functions, Character Functions (Case Conversion/ Character Manipulation), Case Conversion Functions [lower (), InitCap (), UPPER ()] Character Manipulation Function [CONCAT (), INSTR (), LENGTH (), TRIM (), SUBSTR (), LPAD ()], Number Functions (ROUND (), TRUNC (), MOD()), Working with Dates [LAST_DAY(), MONTHS_BETWEEN(), NEXT_DAY(), ADD_MONTHS(), ROUND(), TRUNC()] Arithmetic Operation on Dates, Date Functions and their Usage, Data type Conversion Functions, Implicit and Explicit Conversion, TO_CHAR Function with Dates, TO_CHAR Function For Numbers, TO_NUMBER and TO_DATE Functions, NVL Function and its Usage, DECODE Function and its Usage;

Grouping Records: Concept of Grouping Records and Nested Grouping, Nested Grouping of records, Group Functions, Types of group functions [MAX (), MIN (), AVG (), SUM (), COUNT ()], using AVG and SUM Functions, Using MIN and MAX Functions, Using the COUNT Function, using COUNT(*), DISTINCT clause with Count, Group Functions and Null Values, Using NVL Function with Group Functions, Grouping Records: Group By Clause, Grouping By More than One Column, Illegal Queries with Group By Clause, Excluding Group Results: Having Clause, Nesting Group Functions.

Sub Queries: Concept of Sub-Query, Sub Query to solve a Problem, Guidelines for Using Sub Queries, Types of Sub-Queries (Single Row and Multiple Row) and (Single Column and Multiple Column); Single Row Sub-Query and its Execution;

Displaying Data From Multiple Tables: Concept of Join, Result of Join, Cartesian Product and Generating Cartesian Production example using Mathematical Set), Types of Joins (EQUL, SELF, NON-EQUI, OUTER (LEFT and RIGHT)), Equi-join, Additional Search Conditions using AND operator, Short Naming Convention for Tables (Table Aliases), Non-Equi join and its Implementation, Outer-Join and Its Usage, Self-Join (Joining a table to Itself);

Manipulating Data of A Table /Relation: Concept of DML (Data Manipulation Language), INSERT Statement, Inserting New Rows, Inserting New Rows, with Null Values, Inserting Date Values, Use OF substitution Variable to Insert Values, Copying Rows From Another Table, Update Statement to Change Existing Data of a Table, Updating Rows In A Table, Updating Rows Based on Another Table, Delete statement/ Removing Row/ Rows from a Table, Deleting, Rows Based on condition from another Table; Making Data Manipulation Permanent (COMMIT). Undo Data Manipulation Changes (ROLLBACK)

Database Objects: View, Table, Sequence, Index, and Synonyms, DDL (Data Definition Language), Naming Convention, Creating Views, Creating Synonyms, Simple Views and Complex Views, Retrieving Data From a View, Querying a View, Modifying a view.

Including Constraints: Constraints, Concept of using Constraints, Constraint Guidelines, Defining Constraints, NOT NULL, UNIQUE KEY, PRIMARY KEY, FOREIGN KEY, FOREIGN KEY Constraint Keywords, CHECK, Adding a constraint, Dropping a Constraint, Disabling Constraints, Enabling Constraints, Viewing Constraints, Viewing The Columns, Associated with Constraints;

Creation of a Table/ Relation: CREATE TABLE Statement, Data types, the DEFAULT option, Creating Tables, Referencing Another User's Tables, Querying the Database Dictionary to view all tables in the Oracle Database, Creating a Table by Using a Sub-Query;

Managing Existing Tables and other Database Objects: The ALTER TABLE Statement, Adding a New Column in a Table, Modifying Existing Column, Dropping a Column, Renaming an Object, Truncating a Table, Adding Comments to a Table, Dropping Views, Dropping Synonyms, Dropping Tables; giving permission to other users to work on Created Tables and Revoking it (GRANT and REVOKE statement).

BUSINESS COMPUTING

General concept, User interfaces (front End), Underlying Database (back End), Integration of User Interface and Database;

More application areas of Databases:

Inventory control, Financial Accounting, Pay-Accounting System, Invoicing Management System, Personal Management System/ hard system, Fees Management System, Result Analysis System, Admission Management System, Income Tax Management System;

Advance Program Development Methodology: System Development Life Cycle, Relational Database Concept, Relational Database, Management System, Data Models (Entity Relationship Model), Entity and Entity Set, Attributes (Single, Composite and Multi-Valued), Relationship (One-to-One, One-to-Many and Many-to-Many), Entity Relationship Modeling Conventions, Communicating with an RDBMS using SQL, Relational Database Management System, SQL Statements, About programming language in SQL.

Data Dictionary, Data Warehousing, Data Mining, Meta Data;

Object Modeling: Introduction to object oriented modeling using Unified Modeling Language (Concepts only).

Client Server Computing: Concept of Client Server Computing.

WEB DEVELOPMENT

1. HTML/ DHTML

Introduction, Objectives, Introduction to Universal Resource Identifier (URI) – Fragment Identifiers and Relative URI's, History of HTML, SGML, Structure of HTML/ DHTML Document, Switching between opened Windows and browser (Container tag, Empty tag, Attribute);

Basic Tags of HTML: HTML, HEAD, TITLE, BODY (Setting the Fore color and Background color, Background Image, Background Sound), Heading tag (H1 to H6) AND ATTRIBUTES (ALIGN), FONT tag and Attributes (Size: 1 to 7 Levels, BASEFONT, SMALL, BIG, COLOR), P, BR, Comment in HTML (<!>), Formatting Text (B, I, U, EM, BLOCKQUOTE, PREFORMATTED, SUB, SUP, STRIKE), Ordered List-OL (L1, Type-1, I, A, a; START, VALUE), Unordered List-UL (Bullet Type- Disc, Circle, Square, DL, DT, DD), ADDRESS Tag;

Creating Links: Link to other HTML documents or data objects, Links to other places in the HTML documents, Links to places in other HTML documents;

Anchor Tag<A HREF> AND <A NAME>, Inserting Inline Images <IMG ALIGN, SRC, WIDTH, HEIGHT, ALT, Image Link, Horizontal Rules <HR ALIGN, WIDTH, SIZE, NOSHADE>;

2. Web Page Authoring Using HTML

Tables: Creating Tables, Border, TH,TR, TD, CELLSPACING, CELLPADDING, WIDTH, COLSPAN, CAPTION, ALIGN, CENTER;

Frames: Percentage dimensions, Relative dimensions, Frame- Src, Frameborder, height and width, Creating two or more rows Frames <FRAMESET ROWS>, Creating two or more Columns Frames <FRAMESET COLS>, <FRAME NAME SRC MARGINHEIGHT MARGINWIDTH SCROLLING AUTO NORESIZE>, <NOFRAMES>, </NOFRAMES>;

Forms: Definition, Use- Written to a file, submitted to a database such as MS-Access or Oracle, E-mailed to someone in particular, Forms involve twoway communication;

From Tags: FORM, <SELECT NAME, SIZE, MULTIPLE/ SINGLE> <OPTION>…</SELECT>, <TEXTAREA NAME ROWS COLS>,, </TEXTAREA>, METHOD, CHECKBOX, HIDDEN, IMAGE, RADIO, RESET, SUBMIT, INPUT <VALUE, SRC, CHECKED, SIZE, MAXLENGTH, ALIGN>;

3. Document Object Model

Concept and Importance of Document Object Model, Dynamic HTML document and Document Object Model.

Cascading Style Sheets

Introduction to Cascading Style Sheet (CSS), three ways of introducing the style sheets to your document. Basic Syntax; Creating and saving cascading style sheets. <STYLE> tag. Examples showing the linking of external style sheet files to a document; Inline and Embed, <DIV>tag; COLOR, BACKGROUND-COLOR, FONT-FAMILY, FONT-STYLE, FONT-SIZE and FONT-VARIANT; FONT- WEIGHT, WORD-SPACING, LETTER-SPACING, TEXT-DECORATION, VERTICAL-ALIGN, TEXT-TRANSFORM; TEXT-ALIGN, TEXT-INDENT, line-height, Introduction to Margin, Padding and Border;

Margins (all values), MARGIN- PROPERTY, PADDIND (all values), PADDING-PROPERTY; BORDER (all values), BORDER-PROPERTY, BACKGROUND-IMAGE, BACKGROUND-REPEAT; Additional Features, Grouping Style Sheets, Assigning Classes; Introduction to Layers, <LAYER>, <ILAYER> tag;

4. Extensible Markup Language (XML)

XML: Introduction;

Features of XML: XML can be used with exiting protocols, Supports a wide variety of applications, Compatible with SGML, XML documents are reasonably clear to the layperson;

Structure of XML: Logical Structure, Physical Structure;

XML Markup: Element Markup i.e (<foo>Hello</foo>), Attribute Markup i.e. (<!element.name property="value">);

Naming Rules: used for elements and attributes, and for all the descriptors, Comments Entity

Declarations: <! ENTITY name "replacement text">;

Element Declarations: <! ELEMENT name content>;

Empty Elements: <! ELEMENT empty. element EMPTY>;

Unrestricted Elements: <! ELEMENT any. element ANY>;

Element Content Models: Element Sequences i.e. <! ELEMENT counting (first, second, third, fourth)>,

Element Choices <! ELEMENT choose (this.one/ that.one)>, Combined Sequences and Choices;

Element Occurrence Indicators:- Discussion of Three Occurrence Indicators

? (Question

Mark) *

(Asterisk Sign) +

(Plus Sign)

Character Content: PCDATA (Parseable Character data) <! ELEMENT text

(#PCDATA), Document Type Declaration (DTD) and Validation;

Developing a DTD: Modify and existing SGML DTD, Developing a DTD from XML Code, either automatically or manually;

Viewing: Viewing XML in Internet Explorer, Viewing XML Using the XML Data Source Object XSL (Extensible Style Sheet Language) or CSS (Cascading Style Sheet);

Browse the records: Single record at a time (Using buttons), Multiple record at a time (Using an HTML Table);

   5.   Active Server Pages (ASP)

Active Server Pages (ASP): Concept of ASP, features of ASP, other equivalent tools-JSP, PHP;

Constants: String and Numeric;

Data types: Integer, Floating Point (Single, Double), String, Date, Boolean, Currency, Variant, Object;

Variables: Explicit and Implicit Declaration;

Operators:

Arithmetic: +, - (Unary and Binary), *, /, \(integer division) mod,^;

Comparison: <, >, <=, >=, <>, =;

Logical: AND, OR, NOT, XOR, EQV, IMP;

String Operator: & or + (for Concatenation);

Functions:

Conversion functions: Abs (), Cbool (), CByte (), Cint(), CStr (), CSng (), CLng (), Cdate ();

String Manipulation Functions: Ucase (), Lcase (), Len (), Left (), Right (), Mid (), Ltrim (), InStr(), Rtrim (), Ltrim ();

Time & Date Functions: Date (), Day(), Hour (), Left (), Len (), Minute (), Month (), Monthname (), Now ();

Arrays: Declaration and use of 1 dimensional and 2 dimensional arrays;

Controls: OF..THEN, IF..THEN..ELSE..END IF, IF..THEN..ELSEIF..THEN..END IF, SELECT..CASE..END SELECT,   FOR ..NEXT, FOR EACH..NEXT, DO WHILE..LOOP, DO..LOOP WHILE, DO UNTIL.LOOP;

Procedures and Functions, Passing parameters/ arguments;

Concept of object model structure (client to server and server to client);

Objects: Properties, Methods, Events, Setting Object properties, Retrieving Object properties, calling objects/ methods;

Types of Objects: Response, Request, Application, Session, Server, ASP Error;

Response Object: Write Method, Addheader, Append To Log, Binary Write, Using Shortcuts

<%=value/ expr%>, Controlling information: Buffer, Flush Clear, End;

Request Object: Request Object Collection: Querystring, Form, ServerVariables, Cookies, ClientCertificate;

Application: Contents, Lock, Unlock, Remove, Remove ALL;

Asp components: AD Rotator, Content Rotator, Counter, Page Counter, Permission Checker;

Text Files: Open and Read content from a text file;

Elementary Database Concepts: Concept of Table/ Relation, Relationship, Candidate Key, Primary Key, Alternate Key, Foreign KEY

Connecting with Databases: Creation of DSN, using OLEDB.

Working on Databases: Inserting, Retrieving, Modifying/ Updation of records from Tables in Databases using server objects (ADODB. Connection, DODB. Recordset);

Server Variables: HTTP_User_Agent, REMOTE_ADDER, REMOTE_HOST, SERVER_NAME;

WEB SCRIPTING

1. VB Script

Introduction, Adding VBScript code to HEML page, VBScript Data type-Variant Subtypes, VBScript Variables: (Declaring variable, Naming restrictions, Assigning value to variables, Scalar variables and Arrays), VBScript Constants, VBScript Operators, and Operator precedence;

MsgBox: functions of message box (Prompt, Buttons, Title, Helpline, Context), Return values of MsgBox function, button argument setting.

Conditional statement: If..Then..Else, Select case;

Loops: Do loops, While..Wend, For..Next, For..Each..Next;

VBScript variables: Sub procedures, Function procedures;

Using VBScript with HTML form controls, Data handling functions, String functions, Date and Times function;

2. Java Script

Introduction, History of Java Script, Using Java Script in an HTML Page, Objectives, Properties Methods and Events;

Event handling, Adding Java Script in an HTML Page (Using SRC attribute within script with examples), Variable and data types- Data types and type casting, String processing, Arrays, Operators, Control flow with looping- for loop, while loop, using continue and break statement, Adding comments to scripts, The Window object, The Document Object, The Location Object, The Form Object, Working with control Objects (Button, reset and submit objects, Checkbox objects and Radio objects, Select object, Password, text and text area object, The Data object, Performing calculation.

MULTIMEDIA AND AUTHORING TOOLS

1.Graphics Devices: Monitor display configuration, Basics of Graphics Accelerator Card and its importance;

Basic concepts of Images: Digital Images

Digital Image Representation

Image Formats

TIFF, BMP, JPG/ JPEG, GIF, IC, PDF, PSD:

Graphic Formats

Theory of design, form, line, space, texture, color, typography, layout, color harmony, unity, balance, proportion, rhythm, repetition, variety, economy, still life, light and shade, Poster Design:

Still life, colored layout, Poster Design, Designing of Books, magazines brochures, children's literature, narrative text handling, scripts in Indian Languages, picture books, comics, illustrations with photographs, scientific illustrations, conceptual illustrations, handling of assignment for the market;

Image Scanning with the help of scanner: Setting up Resolution, Size, File formats of images; image preview, Bitonal, Grey Scale and color options;

Significance of PDF-creation, modification;

Animation, Morphing and Applications

Graphic Tools: Image Editing Software (Photoshop/ CorelDraw)

Basic Concepts: An Introduction, creating, Opening and saving files, Menus, Toolbox, Color control icons, Mode control icons, Window controls icons; creating new images, Image capture (TWAIN) from scanner other files;

Image Handling: Cropping an image, adjusting image size, increasing the size of the work canvas, saving an image;

Layers: Adding layers, dragging and pasting selections on to layers, dragging layers between files, viewing and hiding layers, Editing layers, rotating selections, scaling an object, preserving layers transparency, moving and copying layers, duplicating layers, deleting layers, merging layers, using adjustment layers;

Channels and Masks: Channel palette, showing and hiding channels, splitting channels in to separate image, merging channels, creating a quick mask, editing masks using quick mask mode;

Painting and Editing: Brushes palette, brush shape, creating and deleting brushes, creating custom brushes, setting brush options, saving, loading and appending brushes, Options palette;

Opacity, pressure, or exposure, paint fade-out rate, making selections, using selection tools, adjusting selections, softening the edges of a selection, hiding a selection border,

moving and copying selections, extending and reducing selections, pasting and deleting selections, Image tracing (CorelDraw).

Concept of Multimedia: Picture/ Graphics, Audio, Video;

Sound: Recording Sound using Sound Recorder (Capture), Sound capture through sound editing software (ex: Sound forge), Sound editing, Noise correction, Effect enhancement;

Voice Recognition Software Philips/ Dragon, MIDI Player, Sound Recorder, MONO & Stereo.

Sound File Format: AIFF (Audio Input File Format from Apple Mac), MIDI, WAV, MP3, ASF (Streaming format from Microsoft). Importing audio and saving audio from Audio CD.

Sound Quality: CD Quality, Radio Quality, Telephone

Quality; Picture/ Graphics/ Image files;

2. Movie File Formats: AVI, MPEG, SWF, MOV, DAT;

Movie Frames: Concept of Frame, Frame Buffer, and Frame Rate; Authoring Tools; Making Animation, Embedding Audio/Video, and Embedding on the web page;

3. Multimedia Authoring Using Macromedia Flash

Making of Simple Flash Movie, Setting Properties, Frame Rate, Dimensions, and Background Color;

Scene: Concept of Scene, Duplicate Scene, Add Scene, Delete Scene, and Navigating between Scenes;

Layers: Concept of Layer, Layer Properties, Layer Name, Show/ Hide/ Lock layers, Type of Layer- Normal/Guide/ Mask, Outline Color, Viewing Layer as outline, Layer Height, Adding/ deleting a layer;

Frame: Concept of Frame;

Creating a Key Frame, Inserting Text Into the Frame, Inserting Graphical Elements into the frame, Converting Text/ Graphics to symbol, Inserting Symbol into the Frame, Setting Symbol Property (Graphics/ Button/ Movie), Inserting Blank Frame, Inserting Blank Key Frame, Inserting Key Frame into the Blank frame, Selecting all/ Specific frames of a Layer, Copying/ Pasting selected Frames,

Special Effects: Motion Tweening, Shape Tweening, Color effect, Inserting Sound Layer; Testing a Scene and Movie;

Import/ Export (Movie/ Sound and other multimedia objects)

Publishing: Publishing A Flash Movie; Changing publish Settings; Producing SWF (Flash Movie), HTML page, GIF image, JPEG Image (*. Jpg), PNG Image, Windows Projector (*. Exe), Macintosh Projector (*. Hqx), Quick Time (*. Mov), Real Player (*.smil);

Testing with Publish Preview.

COMMUNICATION AND NETWORK CONCEPTS

Evolution of Networking: ARPANET, Internet, Interspace;

Different ways of sending data across the network with reference to switching techniques ;

Data Communication terminologies: Concept of Channel, Baud, Bandwidth (Hz, KHz, MHz) and Data transfer rate (bps, kbps, Mbps, Gbps, Tbps);

Transmission media: Twisted pair cable, coaxial cable, optical fiber, infrared, radio link, microwave link and satellite link.

Network devices: Modem, RJ45 connector, Ethernet Card, Hub, Switch, Router,

Gateway; Different Topologies- Bus, Star, Tree; Concepts of LAN, WAN, MAN;

Protocol: TCP/IP, File Transfer Protocol (FTP), PPP, Level-Remote Login (telnet), Internet, Wireless/ Mobile Communication, GSM, CDMA, WLL, 3G, SMS, Voice mail, Electronic Mail, Chat, Video Conferencing;

Network Security Concepts: Cyber Law, Firewall, Cookies, Hackers and Crackers;

WebPages; Hyper TEXT markup Language (HTML), extensible Markup Language (EML); Hyper Text Transfer Protocol (HTTP); Domain Names; URL; Protocol Address; Website, Web Browser, Web Servers; Web Hosting.

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PART – A

INTRODUCTORY MICRO ECONOMICS AND MACRO ECONOMICS

1. **Introduction:** Central problems of an economy, production possibility curve and opportunity cost.

2. **Consumer Behaviour and Demand:** Consumer's Equilibrium - meaning and attainment of equilibrium through Utility Approach and Indifference Approach, Demand, market demand, determinants of demand, demand curve, movement along and shifts in demand curve. Law of demand and its exceptions. Price elasticity of demand, measurement of price elasticity of demand - percentage, total expenditure and geometric method.

3. **Producer Behaviour & Supply:** Agents of production. Production function. Cost and Revenue- meaning and various types of costs and revenue. Isoquants. Returns to a factor and returns to scale. Supply, market supply, determinants of supply, supply curve, movement along and shifts in supply curve, price elasticity of supply and its measurement. Components and theories of distribution. Welfare economics: Pareto-optimality, private and social products. Consumer surplus.

4. **Forms of Market and Price Determination:** Forms of market – meaning and features. Price determination under perfect competition, monopoly and imperfect competitions, effects of shifts in demand and supply.

5. **National Income and related aggregates:** Macroeconomics: Meaning. Circular flow of income, concepts of GDP, GNP, NDP, NNP (at market price and factor cost), National Disposable Income, Private Income, Personal Income and Personal Disposable Income. Measurement of National Income.

6. **Determination of Income and Employment:** Aggregate demand, Aggregate supply and their components. Propensity to consume and propensity to save. Involuntary unemployment and full employment. Determination of income and employment. Concept of investment multiplier and its working. Problems of excess and deficient demands Measures to correct excess and deficient demands - availability of credit, change in Government spending. Inflation: meaning, causes and remedies

7. **Money and Banking:** Money - meaning, evolution and functions. Central bank - meaning and functions. Commercial banks - meaning and functions. Recent significant reforms and issues in Indian Banking System-privatisation and modernisation

8. **Government Budget and the Economy:** Government budget - meaning and its components. Objectives of government budget. Classification of receipts; classification of expenditure. Types of budget. Revenue deficit, fiscal deficit and

primary deficit: meaning and implications; measures to contain different deficits. Downsizing the role of government.

9. **Balance of Payments:** Foreign exchange rate- meaning (Fixed and Flexible), merits and demerits; Determination through demand and supply. Balance of payments accounts - meaning and components

10. **International Economics:** Theories of international trade, free trade and protection, IMF – The World Bank and its associates. WTO.

11. **Concepts of shares, debentures, SEBI, NSEW, BSE and various indices.**

PART-B

STATISTICS AND INDIAN ECONOMIC DEVELOPMENT

1. **Introduction and collection, organization of data:** Meaning, scope and importance of statistics in Economics. Collection and organisation of data. Census of
India and National Sample Survey Organisation. **Statistical Tools and Interpretation:** Measures of Central Tendency. Geometric mean and harmonic mean. Measures of Dispersion. Lorenz Curve: Meaning and its application. Correlation – meaning. Measures of correlation - Karl Pearson's method, Spearman's rank correlation. Time series analysis. Introduction to Index Numbers - meaning, types - wholesale price index, consumer price index and index of industrial production, uses of index numbers; Inflation and index numbers.

2. **Development Policies and Experience:** A brief introduction of the state of Indian economy on the eve of independence. Common goals of Five Year Plans, major controversies on planning in India. Main features, problems and policies of agriculture, industry and foreign trade.

3. **Economic Reforms since 1991:** Need & main features - liberalisation, globalisation and privatisation; an appraisal of LPG policies

4. **Current challenges facing Indian Economy:** Poverty and programmes for poverty alleviation. Rural development: Key issues - credit and marketing - role of cooperatives; agricultural diversification; alternative farming - organic farming.

Human Capital Formation. Growth of Education Sector in India. Employment: opportunities and other related issues. Infrastructural Problems and policies. Sustainable Economic Development: Meaning; Effects of Economic Development on Resources and Environment.

5. **Development Experience of India: A comparison with neighbours** India and Pakistan, India and China, Issues: growth, population, sectoral development and other developmental indicators.

SYLLABUS FOR WRITTEN EXAMINATION FOR PGT (ENGLISH)

Section A

READING COMPREHENSION

Ability to comprehend, analyze and interpret unseen texts.
Three/four unseen reading passages may be set.

Section B

WRITING ABILITY

Ability to express views/opinions in a coherent & logical manner.
B1. One out of two tasks such as factual description of any event or incident, a report or a process.
B2. Writing one formal letter. Letter types include
a) Business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies)
b) Letter to the editors(giving facts/figures suggestions / opinions on an issue of public interest) on contemporary / current issues.
c) Application for a job with cv.
B3. Writing personal opinion /views/stand in an article/debate/speech etc on a given socio
– cultural issue –in a style/register suitable to the task set. Issues could relate to
> (a) environment
> (b)   education
> (c) gender discrimination
> (d) economic disparity etc..

Section C

GRAMMAR AND USAGE

Ability to apply the knowledge of syntax and grammatical items & use them accurately in the context provided .
The following grammatical structures will be tested through error correction / editing/ gap filling / sentence completion / multiple choice questions :
1. Determiners
2. Tenses
3. Clauses
4. Modals
5. Voice

Section D

LITERATURE

   ▢   Shakespeare's works.

- Romantic period (e.g. Shelley, Wordsworth, Keats, Coleridge etc)
- 19th and 20th Century American and English Literature (e.g. Robert Frost, Hemmingway, Whitman, Hawthorne, Emily Dickinson , Bernard Shaw, Arthur Miller etc.)
- Modern Indian Writing in English (e.g. Anita Desai, Vikram Seth, Nissin Ezekiel, K N Daruwala, Ruskin Bond, R K Narayan, Mulk Raj Anand, Khushwant Singh etc)
- Modern writing in English from other parts of the world e.g. Latin America / Africa / Australia / South Asia.

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Syllabus for Written Examination for PGT (Geography)

Topic I: Geography as a discipline-

Geographical ideas in ancient, medieval & modern periods: the contributions of Varenius, Kant, Reine, Humboldt and Ritter. Influence of Richthofen and Darwin. Videl-da-la Blache, F. Ratzel etc.

Contemporary geography: Post Second World War, Environmentalism, Areal Differentiation, spatial organization, Behavioural and perceptual Geography. Positivism in Geography. Humanistic Geography. Marxist Geography and critical social theory. Development in Indian Geography.

Topic-2 Origin and Evolution of the Earth-

Introduction to the solar system,
Motions of Earth: Rotation, Revolution, Occurrence of Day and Night; change of seasons; Latitudes and Longitudes; Finding time.
Earth's Interior: Origin of contents and ocean basis Wagener's Continental drift theory, Theory of Plate Tectonics Earthquakes and Volcanoes, Folding and faulting
Origin of the Earth: Nebular hypothesis (old Theory) and Big-Bang Theory. Evolution of continents, atmosphere and oceans.

Topic-3 Interior of the Earth and Distribution of oceans and continents-

Constitution of Earth's interior (based on Seismic Evidences), origin of the continents and ocean basins. Wegner's theory of Continental drift and Plate Tectonics. Plate movements and interactions-Volcanism and seismicity.

Topic-4 Landforms-

Mineral and rocks- classification of rocks, rock cycle. Important minerals geomorphic process of denudation Endogenic and Exogenic processes. Mass Wasting, Landslide, Work of River, Glacier Wind, Sea Waves etc, processes of soil formation.

Topic-5 Climate:

Atmosphere: Composition and structure. Insolation and temperature, Atmospheric pressure and winds, Atmospheric moisture, cyclones, classification of climate (Koeppen and Thornthwaite Schemes classification). Global climatic changes: Causes and effects.

Topic-6 Water (Ocean)

Geomorphology of the ocean floor, submarine relief features of Atlantic, Pacific and Indian Ocean. Movement of ocean water: Currents, tides and waves. Marine deposits and coral reefs.

Topic -7 Life on the Earth

Approaches in environmental Geography, landscape, ecosystem and perception approaches, Man and the Biosphere: Interactive and dynamic relationship. Human impact on biogeochemical cycles.

Topic-8 India:

Geographical basis of Indian State-territory; location, extent, shape and size.

Topic-9 Physiography:

Structure, Physiographic divisions, Drainage system and its

evolution. Topic-10 Climate, Vegetation and Soil-Climate: factors

controlling climate of India

Origin and mechanism of Indian monsoon; Seasons of India, Classification of climate of India (Koeppen's, Thornthwaite, Triwartha).
Soils: Type and distribution (I.C.A.R.), Soil problems, conservation of soil
Vegetation- Types & Distribution; conservation
Wild Life- its conservation.

Topic-11 Natural Hazards and disasters-

Causes, Consequences and management in India Environmental Hazards: Floods, droughts, cyclones, earthquakes and landslides; human adjustment to hazards; hazards perception and mitigation; environmental institutions and legislation in India.

Topic-12 Human Geography: Nature and Scope.

Nature and scope of Human Geography, Approaches to the Human Geography, Determinism, Environmental Determinism, Possibilism, Neo-determinism, ecological and Behaviouralism.

Topic -13 People (World and India)

Trends and patterns of population growth: determinants and patterns of population distribution; theories, demographic transition; Human migration, Patterns of human development.

Topic-14 Human Activities: (World and India)

Primary: -Hunting, gathering, Herding (Nomadic & Commercial) Lumbering fishing, mining and agriculture; Agricultural practices; some major crops.
Secondary: - Industries: Classification, Theories of localization, major Industries, recent trends in industries, world comparisons.
Tertiary:-(Services)
Quaternary-Quinary activities
Planning in India: target area planning, idea of sustainable development

Topic-15 Transport, Communication and Trade(World and India)

Transport and communication Roads, railways, waterways and airways; oil and gas pipelines, national electric grids. Communication networking-radio, television, satellite and Internet. International Trade-Basis and components, trade balance, major trading organizations, changing pattern of India's foreign trade, sea-routes, inland water-ways, sea ports and their hinter-land.

Topic-16 Human settlements (World and India)

Unstable and stable settlements, rural settlements: origin, types and patterns; Urban settlements: Origin and growth of towns; functional classification of towns. Problems of urbanization in the world; urbanization in India; Urban slums and squatters. Morphology of cities; distribution of Mega-cities, problems of human settlements in Developing countries.

Topic -17 Geographical perspective on selected issues and problems

Environmental pollution-Land, Water, Air, Noise, Global Warning, Poverty, Food Security; Sustainable Development.

Topic -18 General Cartography (Practicals)

Elements and classification of maps, scales, map-projections, finding directions, latitudes, longitudes and calculation of local & standard time, Identification & Analysis

of relief forms: Topographical Maps and interpretation. Weather-instruments and interpretation of weather maps. Digital mapping, Remote sensing, Visual interpretation. Processing of Data, Thematic mapping, representing statistical data by various diagrams-Bar, Histogram, Pie etc.

Spatial Information technology: GIS, GPS, Computers-Software and Hardware components, Data format, Raster and Vector, editing and topology etc.

Spatial Analysis; Overlay, Buffer and Proximity analysis.

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SYLLABUS FOR WRITTEN EXAMINATION FOR PGT HISTORY

INDIAN HISTORY
Harappan Civilization –a. Town Planning
b. Religion
c. Economic & Social
Life d. Script Writing

1) **Rise of Magadh in relation to 16 Mahajanpadas**
   Rise of Heterodox sects with special reference
2) to   Buddhism, Jainism –
   a. Rise
   b. Teaching
   c. Comparison
   d. Effect on society, trade &commerce
3) The Mauryas –
   a. Causes for its rise
   b. Chandragupta Maurya Administration
   c. Contribution of Ashoka the Great (all
      aspects)
   d. Decline and fall of Mauryan Empire
4) The Guptas –
   a. Golden Period
   b. Samudra Gupta
   c. Chandragupta Vikramaditya etc
   d. Administration, Religion, Trade & Commerce
5) Society & Economy – From Vedic till 7th century
   Sultanate Era – The Defeat of Hindu kingdom   establishment of Delhi
6) and   Sultanate

7) Mughal Period – 1526 to 1707(all aspects)
   a. Polity
   b. Administration
   c. Society
   d. Economy

8) Medieval Period – Society and Culture with special Reference to Bhakti
   Movement and Sufism
9) Medieval Architecture – Delhi Sultanate 'n Mughal Period
10) The Advent of Europeans and the establishment of   5 British rule
11) British rule and its impact on Indian economy
12) Revolt 1857 –   a. Nature
   b. Causes
   c. Leadership
   d. Events
   e. Consequences
   f. Causes of defeat
   g. Impact

13) The socio – religious reform movements and the rise of nationalism
14) The Indian freedom movement - 1885 to 1947
15) Constitution –   a. Framing
   b. Features
   c. Working of the
   Constitution d. Adoption of
   the Constitution

HISTORY OF THE WORLD

1) **Rise of Ancient Civilizations with special reference to**

    b. Script
    c. Trade
    d. Calendar

2) **Roman and Greek civilization**
  a. Rise of the empire
      b. Administration
    c. Society

3) **Rise of Islam –** a. Teachings
      b. Culture
      c. Crusades

4) **Nomadic people of Central Asia**
5) **The Dark age - Feudalism in Europe**
      a. Manor State
      b. Decline

6) **Renaissance 'n Reformation period in Europe**

7) Capitalism and Mercantilism

                a. Industrial Revolution
                b. Imperialism and colonialism

8) **China Since 1840 to 1949**

    9)   **Japan 1840 to 1949**

Sets :
Sets and their representations. Empty set. Finite & Infinite sets. Equal sets. Subsets. Subsets of the set of real numbers. Power set. Universal set. Venn diagrams. Union and Intersection of sets. Difference of sets. Complement of a set.

Relations & Functions:
Ordered pairs, Cartesian product of sets. Number of elements in the cartesian product of two finite sets. Cartesian product of the reals with itself (upto R x R x R). Definition of relation, pictorial diagrams, domain. co-domain and range of a relation. Function as a special kind of relation from one set to another. Pictorial representation a function, domain, co-domain & range of a function. Real valued function of the real variable, domain and range of these functions, constant, identity, polynomial, rational, modulus, signum and greatest integer functions with their graphs. Sum, difference, product and quotients of functions. Sets and their Representations. Union, intersection and complements of sets, and their algebraic properties, Relations, equivalence relations, mappings, one-one, into and onto mappings, composition of mappings.

Principle of Mathematical Induction:
Processes of the proof by induction. The principle of mathematical induction.

Permutations & Combinations:
Fundamental principle of counting. Factorial *n.* Permutations and combinations, derivation of formulae and their connections, simple applications.

Complex Numbers:
Complex numbers, 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. Modulus and Argument of a complex number, square root of a complex number. Cube roots of unity, triangle inequality.

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. Absolute value, Inequality of means, Cauchy-Schwarz Inequality, Tchebychef's Inequality.

Binomial Theorem:
Statement and proof of the binomial theorem for positive integral indices. Pascal's triangle, general and middle term in binomial expansion, simple applications. Binomial Theorem for any index. Properties of Binomial Co-efficients. Simple applications for approximations.

Sequence and Series:
Sequence and Series. Arithmetic, Geometric and Harmonic progressions (G.P.), General terms and sum to *n* terms of A.P., G.P. and H.P. Arithmetic Mean (A.M.), Geometric Mean (G.M.), and Harmonic Mean (H.M.), Relation between A.M., G.M. and H.M. Insertion of Arithmetic, Geometric and Harmonic means between two given numbers. Special series, Sum to *n* terms of the special series. . Arithmetico-Geometric Series, Exponential and Logarithmic series.

Elementary Number Theory:
Peano's Axioms, Principle of Induction; First Principle, Second Principle, Third Principle, Basis Representation Theorem, Greatest Integer Function Test of Divisibility, Euclid's algorithm, The Unique Factorisation Theorem, Congruence, Sum of divisors of a number . Euler's totient function, Theorems of Fermat and Wilson.

Quadratic Equations:
Quadratic equations in real and complex number system and their solutions. Relation between roots and co-efficients, nature of roots, formation of quadratic equations with given roots; Symmetric functions of roots, equations reducible to quadratic equations – application to practical problems.

Polynomial functions, Remainder & Factor Theorems and their converse, Relation between roots and coefficients, Symmetric functions of the roots of an equation. Common roots.

Matrices and Determinants:
Determinants and matrices of order two and three, properties of determinants, Evaluation of determinants. Area of triangles using determinants, Addition and multiplication of matrices, adjoint and inverse of matrix. Test of consistency and solution of simultaneous linear equations using determinants and matrices.

Two dimensional Geometry:
Cartesian system of rectangular co-ordinates in a plane, distance formula, section formula, area of a triangle, condition for the collinearity of three points, centroid and in-centre of a triangle, locus and its equation, translation of axes, slope of a line, parallel and perpendicular lines, intercepts of a line on the coordinate axes.

Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrence of three lines, distance of a point from a line, Equations of internal and external bisectors of angles between two lines, coordinates of centroid, orthocentre and circumcentre of a triangle, equation of family of lines passing through the point of intersection

of two lines, homogeneous equation of second degree in x and y, angle between pair of lines through the origin, combined equation of the bisectors of the angles between a pair of lines, condition for the general second degree equation to represent a pair of lines, point of intersection and angle between two lines.

Standard form of equation of a circle, general form of the equation of a circle, its radius and centre, equation of a circle in the parametric form, equation of a circle when the end points of a diameter are given, points of intersection of a line and a circle with the centre at the origin and condition for a line to be tangent to the circle, length of the tangent, equation of the tangent, equation of a family of circles through the intersection of two circles, condition for two intersecting circles to be orthogonal.

Sections of cones, equations of conic sections (parabola, ellipse and hyperbola) in standard forms, condition for y = mx + c to be a tangent and point(s) of tangency.

Trigonometric Functions:
Positive and negative angles. Measuring angles in radians & in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Graphs of trigonometric functions. Expressing sin (*x+y*) and cos (*x+y*) in terms of sin*x*, sin*y*, cos*x* & cos*y*. Identities related to sin2x, cos2x, tan 2x, sin3x, cos3x and tan3x. Solution of trigonometric equations, Proofs and simple applications of sine and cosine formulae. Solution of triangles. Heights and Distances.

Inverse Trigonometric Functions:
Definition, range, domain, principal value branches. Graphs of inverse trigonometric functions.
Elementary properties of inverse trigonometric functions.

Differential Calculus:
Polynomials, rational, trigonometric, logarithmic and exponential functions, Inverse functions. Graphs of simple functions. Limits, Continuity and differentiability; Derivative, Geometrical interpretation of the derivative, Derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions, Derivative of composite functions; chain rule, derivatives of inverse trigonometric functions, derivative of implicit function. Exponential and logarithmic functions and their derivatives. Logarithmic differentiation. Derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems and their geometric interpretations.

Applications of Derivatives:
Applications of derivatives: rate of change, increasing / decreasing functions, tangents & normals, approximation, maxima and minima.

Integral Calculus:
Integral as an anti-derivative. Fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions. Integration by substitution, by parts and by partial fractions. Integration using trigonometric identities. Definite integrals as a limit of a sum, Fundamental Theorem of Calculus. Basic Properties of definite integrals and evaluation of definite integrals; Applications of definite integrals in finding the area under simple curves, especially lines, areas of circles / Parabolas / ellipses, area between the two curves.

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.

Vectors:
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.

Three dimensional Geometry:
Coordinates of a point in space, distance between two points; Section formula,
Direction cosines / ratios of a line joining two points. Cartesian and vector equationof 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. Scalar and vector triple product. Application of vectors to plane geometry. Equation of a sphere, its centre and radius. Diameter form of the equation of a sphere.

Statistics:
Calculation of Mean, median and mode of grouped and ungrouped data. Measures 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. Events: occurrence of events, exhaustive events, mutually exclusive events, Probability of an event, probability of 'not', 'and' & 'or' events., Multiplication theorem on probability. Conditional probability, independent events,,

Baye's theorem, Random variable and its probability distribution, Binomial and Poisson distributions and their properties.

Linear Algebra

Examples of vector spaces, vector spaces and subspace, independence in vector spaces, existence of a Basis, the row and column spaces of a matrix, sum and intersection of subspaces. Linear Transformations and Matrices, Kernel, Image, and Isomorphism, change of bases, Similarity, Rank and Nullity. Inner Product spaces, orthonormal sets and the Gram-Schmidt Process, the Method of Least Squares. Basic theory of Eigenvectors and Eigenvalues, algebraic and geometric multiplicity of eigen value, diagonalization of matrices, application to system of linear differential equations. Generalized Inverses of matrices, Moore-Penrose generalized inverse.

Real quadratic forms, reduction and classification of quadratic forms, index and signature, triangular reduction of a pair of forms, singular value decomposition, extrema of quadratic forms. Jordan canonical form, vector and matrix decomposition.

Analysis

Monotone functions and functions of bounded variation. Real valued functions, continuous functions, Absolute continuity of functions, standard properties. Uniform continuity, sequence of functions, uniform convergence, power series and radius of convergence. Riemann-Stieltjes integration, standard properties, multiple integrals and their evaluation by repeated integration, change of variable in multiple integration. Uniform convergence in improper integrals, differentiation under the sign of integral - Leibnitz rule.

Dirichlet integral, Liouville's extension. Introduction to n-dimensional Euclidean space, open and closed intervals (rectangles), compact sets, Bolzano-Weierstrass theorem, Heine-Borel theorem. Maxima-minima of functions of several variables, constrained maxima-minima of functions. Analytic function, Cauchy-Riemann equations, singularities, Statement of Cauchy theorem and of Cauchy integral formula with applications, Residue and contour integration. Fourier and Laplace transforms, Mellin's inversion theorem.

Syllabus for written examination for PGT (Phy)

Unit I: Physical World and Measurement
Need for measurement: Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments; errors in measurement; significant figures. dimensional analysis and its applications.

Unit II: Kinematics
Frame of reference. Motion in a one ,two and three dimension: Position-time graph, speed and velocity.
Uniform and non-uniform motion, average speed and instantaneous velocity. Uniformly accelerated motion, velocity-time, position-time graphs, relations for uniformly accelerated motion .Vectors :Position and displacement vectors .addition and subtraction of vectors. Relative velocity.scalar product of vectors,Vector product of vectors.
Unit vector; Resolution of a vector in a plane - rectangular components.
Motion in a plane. Cases of uniform velocity and uniform acceleration- projectile motion.

Unit III: Laws of Motion
Intuitive concept of force. Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion. Law of conservation of linear momentum and its applications.
Equilibrium of concurrent forces. Types of friction, laws of friction, .Dynamics of uniform circular motion .

Unit IV: Work, Energy and Power
Work done by a constant force and a variable force;
kinetic energy, work-energy theorem, power.
Notion of potential energy, potential energy of a spring, conservative forces: conservation of mechanical energy (kinetic and potential energies); non-conservative forces: elastic and inelastic collisions in one and two dimensions.

Unit V: Motion of System of Particles and Rigid Body
Centre of mass of a two-particle system, momentum conversation and centre of mass motion. Centre of mass of a rigid body; centre of mass of uniform rod.
; moment of a force, torque, angular momentum,
conservation of angular momentum with some examples.
Dynamics of rigid bodies, comparison of linear and rotational motions; moment of inertia, radius of gyration.
Values of moments of inertia for geometrical objects. Parallel and perpendicular axis theorems and their applications.

Unit VI: Gravitation
Keplar's laws of planetary motion. The universal law of gravitation. Variation of Acceleration due to gravity and with altitude,latitude and depth. Gravitational potential energy; gravitational potential. Escape velocity. Orbital velocity of a satellite. Geo-stationary satellites.

Unit VII: Properties of Bulk Matter
Elastic behaviour, Stress-strain relationship, Hooke's law,modulus of elasticity .
Pressure due to a fluid column; Pascal's law and its applications
Viscosity, Stokes' law, terminal velocity, Reynold's number, streamline and turbulent flow. Bernoulli's theorem and its applications.
Surface energy and surface tension, application of surface tension ideas to drops, bubbles and capillary rise.
Heat, temperature, thermal expansion; specific heat - calorimetry; change of state - latent heat.
Heat transfer-conduction, convection and radiation, thermal conductivity, Newton's law of cooling.

Unit VIII: Thermodynamics

Thermal equilibrium and definition of temperature (zeroth law of thermodynamics). Heat, work and internal energy. First law of thermodynamics. Second law of thermodynamics: reversible and irreversible processes. Heat engines and refrigerators.carnot cycle and carnot's theorem.
Equation of state of a perfect gas, work done on compressing a gas.
Kinetic theory of gases ,degrees of freedom, law of equipartition of energy and application to specific heats of gases; concept of mean free path, Avogadro's number.

Unit IX: Oscillations and Waves
Periodic motion - period, frequency, displacement as a function of time. Periodic functions.Simple harmonic motion (S.H.M) and its equation; phase; oscillations of a spring– restoring force and force constant; energy in S.H.M.-kinetic and potential energies; simple pendulum–derivation of expression for its time period; free, forced and damped oscillations, resonance.

Wave motion. Longitudinal and transverse waves, speed of wave motion. Displacement relation for a progressive wave. Principle of superposition of waves, reflection of waves,

standing waves in strings and organ pipes, fundamental mode and harmonics, Beats, Doppler effect.

Unit X: Electrostatics
Electric Charges; Conservation of charge, Coulomb's law and its application,force between two point charges,
forces between multiple charges; superposition principle and continuous charge distribution. Electric field, electric field due to a point charge, electric field lines; electric dipole, electric field due to a dipole; torque on a dipole in uniform electric field. Gauss's theorem and its applications
Electric potential, potential difference, electric potential due to a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field. Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarisation, capacitors and capacitance, combination of capacitors, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor. Van de Graaff generator.

Unit XI: Current Electricity
Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current; Ohm's law, electrical resistance, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity. Carbon resistors, colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance. Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel.
Kirchhoff's laws and its applications..
Potentiometer - principle and its applications
Thermal and chemical effect of current.

Unit XII: Magnetic Effects of Current and Magnetism
Biot - Savart law and its application
Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids.
Lorentz's force. Cyclotron,synchrotron.
Interaction of a current-carrying conductor with magnetic field. Force between two parallel current-carrying conductors. Torque experienced by a current loop in uniform magnetic field and its application;
Current loop as a magnetic dipole and its magnetic dipole moment. Magnetic dipole momentof a revolving electron. Magnetic field intensity due to a magnetic dipole (bar magnet)
along its axis and perpendicular to its axis. Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements. Para-, dia- and ferro - magnetic substances, with examples. Electromagnets and factors affecting their strengths. Permanent magnets.

Unit XIII: Electromagnetic Induction and Alternating Currents
Electromagnetic induction; Faraday's law, induced emf and current; Lenz's Law, Eddy currents. Self and mutual inductance.
Need for displacement current.
Alternating currents and its measurement reactance
and impedance; LC oscillations, LCR series circuit, resonance; power in AC circuits,.
generator , motors and transformer.

UnitXIV: Optics
Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications, optical fibres, refraction at spherical surfaces, lenses, thin lens formula, lens-maker's formula. Magnification, power of a lens, combination of thin lenses in contact. Refraction and dispersion of light through a prism. Scattering of light and its application.

Optical instruments: Human eye-eye defects and its correction.
Microscopes and astronomical telescopes and their magnifying
powers.
Wave optics: wave front and Huygens' principle, reflection and refraction of plane
wave at a plane surface using wave fronts. Proof of laws of reflection and refraction
using Huygens' principle. Interference, Young's double slit experiment and expression
for fringe width, coherent sources and sustained interference of light. Diffraction due
to a single slit, width of central maximum. Resolving power of microscopes and
astronomical telescopes. Polarisation, plane polarised light; Brewster's law, uses of
plane polarised light and Polaroids.

Unit XV: Modern Physics
Dual nature of radiation. Photoelectric effect, Hertz and Lenard's observations;
Einstein's photoelectric equation-particle nature of light. Compton effect, deffraction
of X- rays ,Bragg's law ,Hall effect.
Matter waves-wave nature of particles, de Broglie relation. Davisson-Germer
experiment. Alpha-particle scattering experiment; Rutherford's model of atom;
Bohr model, energy levels, hydrogen spectrum.
Composition and size of nucleus, packing fraction and magnetic moment, atomic
masses, isotopes, isobars; isotones. Radioactivity-alpha,
beta and gamma particles/rays and their properties; radioactive decay law. Mass-
energy relation, mass defect; binding energy per nucleon and its variation with mass
number; liquid drop model of nucleus, nuclear fission and fusion.,critical mass ,chain
reaction

and fission reaction, ionization chamber,Geiger counter and scinitillation counter,linear accelerator.

Unit XVI: Electronic Devices
Semiconductors; semiconductor diode – I-V characteristics in forward and reverse bias, diode as a rectifier; I-V characteristics of LED, photodiode, solar cell, and Zener diode; Zener diode as a voltage regulator. Junction transistor, transistor action,

characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator. Logic gates and its combination. Transistor as a switch.