

PRTs

## **Primary teacher (PRT)**

Subject paper will assess the candidates' ability in following areas:-

- (i) Core language Competency (Hindi and English)
- (ii) General Science
- (iii) General Maths
- (iv) Environmental science

### **CORE LANGUAGE COMPETENCY**

The candidate should have adequate understanding of English and Hindi language to deal with students of Elementary Classes. The ability to comprehend the texts and express them effectively in writing/orally will be measured through written test and interview.

#### **English**

Articles/Determininals, Prepositions, Verb forms, Adjectives, Tenses, Modal Auxiliaries, Active/Passive, Reported speech, Punctuations Letter Writing-formal & informal, Essay on current issues, Speech, vocabulary, idioms and phrases, Antonym & Synonyms, Methods of teaching english at elementary level.

#### **हिन्दी पाठ्यक्रम**

व्यवहारिक-व्याकरण :- भाषा, संज्ञा, सर्वनाम, विशेषण, क्रिया अव्यय, लिंग, / पुल्लिंग, स्त्रीलिंग/, उपसर्ग, प्रत्यय, वचन / एकवचन, बहुवचन / वाक्य रचना, विलोम या विपरीतार्थक शब्द, समरूपी भिन्नार्थक शब्द, मुहावरे, अंलकार, विराम चिन्ह, पदपरिचय संधि एकार्थी शब्द, अनेकार्थी शब्द, अनेक शब्दों के लिए एक शब्द, तत्सम-तद्भव शब्द, समास लोकोक्तियाँ, मुहावरे। अपठित गद्यांश भाषा शिक्षण की प्रभावी विधियाँ

### **GENERAL SCIENCE**

Living word, Human Body, Plant Life, Natural Vegetation and Wild Life, Food, The Universe:- Natural phenomenon, planets, Indian space research programme; Our country – Its surface, natural resources, food & crop.

Matter, concept of elements, molecule and atom. Basic structure of atom, Radioactivity, gases and liquids, classification of Hydrocarbons. Chemical and physical changes. Green house effect, photo synthesis

Motion: displacement, velocity; uniform and non-uniform motion along a straight line; acceleration, distance – time and velocity, idea of uniform circular motion. Force and motion, Inertia, momentum, force and acceleration action and reaction forces. Elementary idea of conservation of momentum, conservation of energy, simple machine.

## **General Maths**

Number System, estimation of numbers, Place value, use of symbols, word problems on number operations involving large numbers, conversions of units of length & mass, Multiples and factors, Even/odd and prime/composite numbers, prime factorization, HCF and LCM, Rationale numbers. Whole numbers, Seeing patterns:- identifying and formulating, rules, Integers, Properties of integers, Fractions, Ratio and Proportion, percentages, profit & loss, work & time velocity & distance simple and compound interest, binomials, polynomials, basic of algebra, linear equation, quadratic equation & word related problems

Basic geometrical ideas: Line, line segment, ray. Open and closed figures. Angle - Vertex, arm, interior and exterior, Triangle- vertices, sides, angles, interior, Quadrilateral- Sides, vertices, angles, Circle- Center, radius, diameter, arc, Concept of perimeter Data handling Pictograph- scaling in pictographs and its interpretation.

General understanding of *perimeter* using regular shapes. Shapes of different kinds with the same perimeter. Area of various regular-geometric shapes. Measuring areas of different shapes with the help of graph.

Concept of volume, measurement of volume using a basic unit, volume of a cube, cuboids and cylinder, Volume and capacity (measurement of capacity). Surface area of a cube, cuboids and cylinder.

## **Environmental Science**

Primary Institutions of democracy, Local bodies, State bodies, National bodies, citizen's rights in democracy, Role of panchayat and Nagarpalikas in education, health and other social services. Population growth in India: distribution, density & growth, sex ratio, rural urban composition, education, Human development indicators.

Common Diseases, Deficiency diseases & Communicable diseases and their prevention. First Aid and Our Health Services at village and District Level, Natural Calamities – their causes impact and steps to reduce the effect, Transport and Communication – their impact, Natural Resources- Air, Water, Soil and Land (Minerals, metals, non-metals),

Resources and Development Natural resources:- forest and minerals, Water resources, rivers, irrigation system and crop pattern.

Map of India: - Location of identification, understanding of globe with special reference to Latitude, Longitude & time, Five Years plans, National freedom movement, cultural renaissances, social reformers of India.

## Syllabus for written examination for PRT (Music)

### Science of Music and Studies of Shruties

Vibration and frequency; pitch and its relation with Vibrator, Vocal and Instrumental ranges of sound; Amplitude, Timber, Qualities and musical and unmusical overtones (Swayambhu Swar); consonance and Dissonance; Main types of chords; Absorption, Echo; Reverberation and Resonance of sound, concept of Shruti (different opinions on it). Placement of suddha and Vikrit Swars on different shruties according to Lochan, Ahobal, Pundarik, Ramamatya, Somnath etc. Comparative study of Vyankat-Mukhi's 72 melas, Bhatkhande's Ten That's and Modern thirty-two That's.

Study of Ragas and Tals

Critical, detailed and comparative study of the following Ragas:- SUDHAKALYAN, DESHKAR, KAMOD, CHHAYANAT, GOUDSARANG, JAIJAIWANTI, RAMKALI, POORIYA, MARWA, SOHANI and SHANKARA, Illustrations of Nyas, Alpatva, Bahutva, Avirbhava and Tirobhava in the above Ragas by means of notes.

Knowledge of the following Tals with different types of Layakaries and writing of the Tals in Dugun, Tigun, Chougun and Ada:- Trital, Ektal, Rupak, Teevra, Sootal, Jhoomra, Dhamar and Jat tal.

Writing the songs in notation in the above ragas with Alaps. Tans, Boltans in Khayals and Dugun, Tigun etc., in dhruvpad and Dhamar. Identification of Ragas from given notes.

### Instrumental Music

### Science of Music and Studies of Shruties

Vibration and frequency, pitch and its relation with vibrator Vocal and Instrumental ranges of sound. Amplitude, Timber, qualities of musical, unmusical overtones (Swayambhu-Swar) consonance and Dissonance. Main types of chords, Absorption, Echo, Reverberation and resonance of sound, concept of shruti (different opinions on it) placement of suddha and vikrit swara according to lochan, Ahobal, Pundarik Rammamatya, somnath etc. Comparative study of Swaras of Northern and Southern saptak, critical study of Vyankatmukhu's 72 Melas. Bhatkhande's Ten That's and Modern thirty two that's.

Study of Ragas and Tals

Critical, detailed and comparative study of the following Ragas:- SUDHAKALYAN, DESHKAR, KAMOD, CHHAYANAT, GOUDSARANG, JAIJAIWANTI, RAMKALI, POORIYA, MARWA, SOHANI and SHANKARA.

Illustrations of Nyas, Alpatva, Bahutva, Tirobhav and Avirbhava in the above Ragas by means of notes. Knowledge of the following Tals with different types of Layakaries and writing of the Tals in Dugun, Tigun, Chougun and Ada:- Trital, Jhaptal, Choutal, Keharwa, Dadra, Tilwada, Rupak, Teevra, sool - Tal, Dhamar and Jat-Tal.

Writing the Gats in notation in the above ragas with Alaps, Todas, Jhalas, Identification of Ragas from the given notes.

Candidates offering percussion Instruments must have critical detailed and comparative study of the following Tals:-

TEENTAL, JHAPTAL, RUPAK, CHOUTAL, SOOLTAL, TEEVRA, TILWADA, DADRA, KAHARWA, PANJABI, JATTAL.

They should also know the different types of Laykaries, Tukaras, paranas, Peshkara, Quada, Avartan, Bant, Kisim, Palta, Rela, Laggi, Ladi, etc. where applicable in the abovementioned talas, writing in notation of all the matter in above talas and identified - for given Bols.

### Vocal Music

### Notation system, scales and study of Bio-graphics of Musicians.

Notation system of Bhatkhande and vishnudigambar and western Music, writing of simple songs in these notations. Western Note, various types of intervals of notes. Time signature, different Musical scales, Dia-tonic scale, comparative study of scales of Bhatkhande and western Music. Harmony and Melody, placement of notes on veena according to Pt. Srinivas, comparative study of Northern and Southern Tal paddhaties, contribution of various scholars and musicians to the Indian Music.

Biographies of Bhatkhande, Vishnudigambar, Tansen, Ameer Khusroo, Faiyyaz Khan, Pt. Ravi Shankar, Pt. Ram Sahay, Ahmadjan Thirakwas, Kudau Singh, Nana Sahib panse.

Study of Musical Styles and Ragas

Geet, Gandharva, Gan, Deshi Sangeet, Sthaya, Mukhachalan, akshiptika, Nibadha and Anibadh Gan, Raglakshan, Ragalap, Alapti swasthan Niyam, prachalit Alap, Tan; Meend.

Critical detail and comparative study of the following Ragas with illustration of Nyas, Alapatva, Bahutva, Tirobhav and Avirbhav in them.

Lalit, Darbari, Adana, Mia-Malhar, Goudmalhar, Bahar, Todi, Multani, Deshi, Jogiya and Vibhas.

Knowledge of the following Tals with different types of Layakaries and writing of the Talas in Dugun, Tigun, Chougun and Ada:

Trital, Ektal, Jhaptal, Choutal, Kaharwa, Dadra, Tilwada, Rupak, Teevra, Sootal, Jhoomra, Dhamar and Jattal and pancham Sawari.

Comparative and detail study with the descriptions of different styles of Indian Music viz. Dhrupad, Dhamar, Khayal, Thumri, Tappa, Chaturang, Taranas, Trivat, etc. and their evolution, writing of notation of songs in the above Ragas with alaps, Tans Boltans etc. and with different Layakaries in Dhrupad and Dhamar, Identification of Ragas from given notes. A short essay on any musical subject.

#### Instrumental Music

Notation system of Bhatkhande, Vishnudidgamber and western Music. Writing of simple gats in these notations. Western notes. Various types of intervals of notes. Time signature, different Musical scales Dia-tonic scale, pythagorain scale, Tempered scale, Major scale, Minor scale etc. Comparative study of scales of Bhatkhande and Western Music. Harmony and Melody, placement of notes on Veena according to Pt. Srinivas.

Comparative study of Northern and southern Tal paddhaties contribution of various scholars and Musicians to the Indian Music.

Biographies of Bhatkhande, Vishnudidgamber, Tansen, Ameer Khusro Faiyyaz Khan, Onkarnath Thakur, Allaaddin Khan, Pt. Ravishankar, Pt. Ram Sahai, Ahmad Jan Thirakwa, Kudau Singh, Nana Saheb Panse.

#### Study of Styles, Baj, Ragas and Tals

Geet, Gandharv, Gan, Deshi Sangeet, Sthaya Mukhchalan, Akshiptika Nibadha and Anibadh gan, Raglakshan, Raga-Alap, Rupakalap, Alpati Swasthan-Niyam, Prachalit Alap and Tan, Zamzama, Meend, Sootghaseet, Jor Alap, Toda.

Critical detailed and comparative study of the following Ragas with illustrations of nyas, Alpatva, Bahutva, Tirobhava and Avirbhav in them.

Vibhas, Lalit, Darbari Kanhda, Adana, Miyan Malhar, Goud Malhar, Bahar, Todi, Multani, Deshi and Jogiya.

Identification of Raga from given notes. Knowledge of following tals: Ada chartal, Ektal, Deepchandi, Dhamar, Farodast, Pancham Sawari, Kumbh, Sikhar.

Candidates offering percussion instruments must have critical detailed and comparative study of the following tals:

Adachartal, Ektal, Pancham Sawari, Farodast, Dhamar, Kumbh, Shikhar, Matt Tal, Dhumali, Deepchandi, Addha tal.

They must also know, Tukras, parans, Tihai, Kayadas, Palas, Relas, Peshkaras, Mukharas, Tipallis, chaupalli, Chakkardar bols, Farmaishi, Paranas, Lom - Bilom, Charbagh, Stuti ke bol, Jhulna ke bol. Dhamar and Bedamdar tihais in the above mentioned tals.

Ability to recognize tals by given bols, writing of all the matters in notations.

A short essay on any Musical subject. Knowledge of Baithaks, styles of playing and Gharanas. Ability to writ tals in different layakaries knowledge of different types of Musical instruments and their system of classification.

#### Vocal Music

#### History of Music and Classification of Rags and Tals

Short history of Music of Ancient periods up to 13th century A.D. with classification of Rags and Tals. Evolution of jatis Ragas, short history of Music of Medieval and Modern periods, prabandh. Revival of Indian Classical Music, comparison of the Hindustani and Karnataka Music systems. Impact of Modern Science in the development and propagation of Music. Essay on any general topic of Music.

### Study of Musical Styles and Ragas

Critical, detailed and comparative study of the following Ragas with illustrations of Nyas, Alpatva, Bahutva, Avirbhava and Tirobhav.

Shree, Pooria-Dhanashree, Basant, Paraj, Hindol, Chandrakans, Suddhasarang, Madhuwanti, Bageswari, Jaunpuri, Malgunji.

Critical study of different styles of Music of North and South, various Gharanas of Music, Gram, Moorchana, various kinds of Gamak, writing of notation of songs. Ability to compose any song in any Raga.

Knowledge of the following Tals with different types of Layakaries Ada - Choutal, Brahma, Lakshmi, Rudra, Shikhar, Pancham Sawari.

### Practical (Stage Demonstration)

One Drut Khayal in each raga and at least five Vilambit Khayals in the following Ragas: Shree, Basant, Paraj, Puriya-Dhanashree, Hindol, Chandra Kans, Suddhasarang, Madhuwanti, Bageswari, Jaunpuri, Malgunji.

The candidates will have to give stage performance of his or her own choice of Raga of the Courses for half an hour. They will have to sing a Thumri composition too.

### Instrumental Music

### History of Music and Classification of Ragas and Tals

Short history of Music of ancient period up to 13th century A.D. with particular reference to Natyashastra, Brihaddesi, Sangeet Ratnakar. Classification of Ragas and Tals. Evolution of Jatis, Ragas. Short History of Music in Medieval period. Revival of Indian classical Music. Comparison of the Hindustani and Karnataka Music system. Impact of Modern science in the development and propagation of Music. Essay on any general topic of Music.

Critical, comparative and detailed study of Musical styles and the following Ragas with illustration of Nyas, Alpatva, Bahutva, Avirbhav and Tirobhav:

Shree, Pooria - dhanashree, Basant, Paraj, Hindol, Chandrakans, Suddh Sarang, Madhuwanti, Bageshree, Jaunpuri, Malgunji.

Critical study of the different styles of Music of North and South. Various Gharanas of Music, Gram, Moorchana, various kinds of Gamaks, Writing of Notation of gats. Ability to compose any gat in any Ragas.

Knowledge of the following Tals with different types of layakaries and writing of Tals in Dugun, Tigun, Chougun, Ada. and Kuad, and Biyad.

Basant, Rudra, Laxmi, Gajjhampa, Pashto, Brahma. Candidates offering percussion instruments should also know the various kinds of Baj and styles of Table and Pakhawaj and should also know Peskhkaras, Paran, Tihais, Tukaras, Kishime, Kyadas, Paltas, Relas, Mukhras, Tripalli, Choupallies, Chakkardar, Bols, Farmaishi paran, Kamali paran, Lom-Bilom, Charbagh, Stuti ke bole, Jhulan ke bole, Jababi Paran, Nayakka, Damdar and Bedam ki tihai where applicable in the following Talas, along with their critical, detailed and comparative study:

Rudra, Badi swari, Jattal, Basant, Laxmi, Gaj Jhampa, Brahma tal, Asth Mangal, Ganesh Tal, Mani Tal, Pashto.

Various kinds of chands in the Tals where applicable and writing of different layakaries, Dugun, Tigun, Chougun, Ada, Kuad and Biyad.

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**TGT(Misc)**

**Syllabus for written examination of TGT (Work Experience)**  
**(Electrical Gadget and Electronics)**

**Unit: I**

|           |                                       |
|-----------|---------------------------------------|
| <b>a.</b> | <b>CIRCUIT FUNDAMENTALS</b>           |
| <b>b.</b> | <b>RESISTIVE CIRCUITS</b>             |
| <b>c.</b> | <b>KIRCHHOFF'S LAW</b>                |
| <b>d.</b> | <b>NETWORK THEOREMS</b>               |
| <b>e.</b> | <b>PASSIVE CIRCUITS ELEMENTS</b>      |
| <b>f.</b> | <b>ENERGY SOURCES</b>                 |
| <b>g.</b> | <b>MAGNETISM AND ELECTROMAGNETISM</b> |

**(a) Circuit Fundamentals**

Zero Reference Level - Chassis Ground - Ohm's Law - Formula Variations of Ohm's Law - Graphical Representation of Ohm's Law - Linear Resistor - Non-linear Resistor - Cells in Series and Parallel - Conventional Problems

**(b) Resistive Circuits**

Series Circuit - Characteristics of a Series Circuit - The Case of Zero IR Drop - Polarity of IR Drops - Total Power - Series Aiding and Series Opposing Voltages - Proportional Voltage Formula in a Series Circuit Series Voltage Dividers - 'Opens' in a Series Circuit - 'Shorts' in a Series Circuit - Parallel Circuits - Laws of Parallel Circuits - Special Case of Equal Resistances in all Branches - Special Case of Only Two Branches Any Branch Resistance -Proportional Current Formula - 'Opens' in a Parallel Circuit - 'Shorts' in a Parallel Circuit - Series-Parallel Circuits Analysing Series Parallel Circuits - 'Opens' in Series-Parallel Circuits 'Shorts' in Series-Parallel Circuits - Voltage Division in a Complex Series-Parallel Circuit - Conventional Problems

**(c) Kirchhoff's Laws**

General - Kirchhoff's Current Law - Kirchhoff's Voltage Law - Determination of Algebraic Sign - Assumed Direction of Current Flow - Conventional Problems.

**(d) Network Theorems**

General - Superposition Theorem - Ideal Constant-Voltage Source - Ideal Constant-current Source - Thevenin's Theorem - How to Thevenize a Circuit? - Norton's Theorem - How to Nortonise a Given Circuit - Maximum Power Transfer Theorem - Conventional Problems

**(e) Passive Circuit Elements**

General - Resistors - Resistor Types - Wire-wound Resistors - Carbon Composition Resistors - Carbon Film Resistors - Cermet Film Resistors .Metal Film Resistors - Power Rating - Value Tolerance - Variable Resistors - Potentiometers and Rheostats - Fusible Resistors - Resistor Colour Code - Resistance Colour Bands - Resistors under Ten Ohm - Resistor Troubles - Checking Resistors with an Ohmmeter - Inductor - Comparison of Different Cores - Inductance of an Inductor - Another Definition of Inductance - Mutual Inductance - Coefficient of Coupling - Variable Inductors - Inductors in Series or Parallel without M - Series Combination with M - Stray Inductance - Energy Inductance - Energy Stored in a Magnetic Field - DC Resistance of a Coil - Troubles in Coils - Reactance Offered by a Coil - Impedance Offered by a Coil - Q-Factor of a Coil - Capacitors - Capacitor Connected to a Battery - Capacitance -Factors Controlling Capacitance - Types of Capacitors - Fixed Capacitors - Variable Capacitors - Voltage Rating of Capacitors - Stray Circuit Capacitance Leakage Resistance - Capacitors in Series - Two Capacitors in Series Capacitors in Parallel - Two Capacitors in Parallel - Energy stored in a Capacitor - Troubles in Capacitors - Checking Capacitors with Ohmmeter - Charging of a Capacitor - Capacitor Connected Across an AC Source Capacitive Reactance

**(f) Energy Sources**

Primary and Secondary Cells - Cell and Battery - Voltage and Current of a Cells - Cell life - Different Types of Dry Cells - Carbon Zinc Cell Alkaline Cell - Manganese Alkaline Cell - Nickel Cadmium Cell - Mercury Cell - Silver Oxide Cell - Lead Cells - Battery Rating - Testing Dry Cells - Photoelectric Devices - Photovoltaic Cell - Solar Cell Conventional Problems

**(g) Magnetism and Electromagnetism**

Magnetic Materials- Ferrites - Types of Magnets - Demagnetising or Degaussing -Magnetic Shielding - Magnetic Terms and Units - Ohm's Law for Magnetic Circuit - Transformer - Transformer Working - Transformer Impedance - Can a Transformer Operate on DC ? - RF Shielding - Autotransformer - Impedance Matching - Conventional Problems.

## Unit - II:

|    |                             |
|----|-----------------------------|
| a) | A.C. FUNDAMENTALS           |
| b) | SERIES A.C. CIRCUITS        |
| c) | TIME CONSTANTS              |
| d) | TUNING CIRCUITS AND FILTERS |
| e) | SOLID STATE PHYSICS         |
| f) | THE P-N JUNCTION            |
| g) | P-N JUNCTION DIODE          |

### (a) A.C. Fundamentals

Introduction - Types of Alternating Waveforms - The Basic AC Generator - Some Definitions - Characteristics of a Sine Wave - Audio and Radio Frequencies - Different Values of Sinusoidal Voltage and Current - Phase of an AC - Phase Difference - Vector Representation of an Alternating Quantity - AC Through Pure Resistance Only - AC Through Pure Inductance Only - AC Through Pure Capacitance Only - Non-sinusoidal Waveforms - Harmonics - Conventional Problems

### (b) Series A.C. Circuits

R-L Circuit - Q Factor of a Coil - Skin Effect - R-C Circuit - Coupling Capacitor - R-L-C Circuit - Resonance in an R-L-C Circuit - Resonance Curve - Main Characteristics of Series Resonance - Bandwidth of a Tuned Circuit - Sharpness of Resonance - Tuning - Tuning Ratio - Radio Tuning Dial - Parallel Resonance - Conventional Problem

### (c) Time Constant

Rise and Fall of Current in Pure Resistance - Time Constant of an R-L Circuit - Circuit Conditions - Inductive Kick - Time Constant of an RC Circuit - Charging and Discharging of a Capacitor - Decreasing Time Constant - Flasher - Pulse Response of an RC Circuit - Effect of Long and Short Time Constants - Square Voltage Wave Applied to Short A RC Circuit - Square Voltage Wave Applied to Long A, E.C Circuit - Conventional Problems

### (d) Tuning Circuits and Filters

What is a Tuning Circuit? - Tuned Circuit - Operating Characteristics of a Tuning Circuit - Resonance - Actual Series Resonance - Is it Series or Parallel Resonance? - Tuned Transformers - Double Tuned Transformers - Parallel Circuit - Coupled Circuits - Simple Coupled Circuits - Coefficient of Coupling - Filters - Filter Definitions - Types of Filter Circuits - Low-pass Filter - Highpass Filter - Bandpass Filter - Bandstop Filter - Multisection Filter Circuits - Uses of Filters - Conventional Problems

### (e) Solid State Physics

Definition of Matter - Crystalline Solids - Unit Cell - Forms of Matter - Atom and Molecule - Atomic Structure - Atomic Number (Z) - Atomic Mass Number (A) - Electron Orbits or Shells - Electron Distribution of Different Atoms - Electron Sub orbits or Subshells - Valence Electrons Orbital Energy - Normal, Excited and Ionised Atom - Orbital Energies in Hydrogen Atom - Energy Levels in an Isolated Atom - Energy Bands in Solids - Bonds in Solids - Valence and Conduction Bands - Conduction in Solids - Hole Formation and its Movement - Conductors, Semiconductors and Insulators - Types of Semiconductors - Intrinsic Semiconductors Extrinsic Semiconductors - Majority and Minority Charge Carriers - Mobile Charge Carriers and Immobile Ions - Drift Current in Good Conductors Drift Current in Intrinsic Semiconductors - Intrinsic Conduction - Conventional Problems

### (f) The P-N Junction

The P-N Junction - Formation of Depletion Layer - Junction or Barrier Voltage (V<sub>B</sub>) - Effect of Temperature on Barrier Voltage - Forward Biased P-N Junction - Forward V/I Characteristics - Reverse Biased P-N Junction - Reverse Saturation Current (I<sub>s</sub> or I<sub>0</sub>) - Reverse V/ I Characteristic Combined Forward and Reverse V/I Characteristics - Junction Breakdown - Junction Capacitance

### (g) P-N Junction Diode

P-N Junction Diode - Diode Ratings or Specifications - Diode Testing The Ideal Diode - The Real Diode - Diode Circuits with DC and AC Voltage Sources - Diode Fabrication - Grown Junction - Alloy Junction - Diffused Junction - Epitaxial Junction - Point Contact Junction - Clippers and Clampers - Clippers - Some Clipping Circuits - Clampers - Summary of Clamping Circuits - Conventional Problems, Questions.

**Unit – III**

|    |                                                     |
|----|-----------------------------------------------------|
| a) | <b>SPECIAL DIODE</b>                                |
| b) | <b>OPTOELECTRONIC DEVICES</b>                       |
| c) | <b>D.C POWER SUPPLIES</b>                           |
| d) | <b>THE BASIC TRANSISTOR</b>                         |
| e) | <b>TRANSISTOR CHARACTERISTICS AND APPROXIMATION</b> |
| f) | <b>LOAD LINES AND DC BIAS CIRCUITS</b>              |
| g) | <b>TRANSISTOR EQUIVALENT CIRCUITS AND MODELS</b>    |

**(a) Special Diodes**

Zener Diode - Voltage Regulation - Zener Diode as Peak Clipper - Meter Protection - Tunneling Effect - Tunnel Diode - Tunnel Diode Oscillator - Varactor - PIN Diode - Schottky Diode - Step Recovery Diode Thermistors - Conventional Problems

**(b) Optoelectronic Devices**

Introduction - Spectral Response of Human Eye - Light Emitting Diode (LED) - Photoemissive Devices - Photomultiplier Tube - Photovoltaic Devices - Bulk Type Photoconductive Cells - Photodiodes - P-N Junction Photodiode - PIN Photodiode - Avalanche Photodiode -

**(c) DC Power Supplies**

Introduction - Unregulated Power Supply - Regulated Power Supply Steady and Pulsating DC Voltages - Rectifiers - Half-wave Rectifier Full-wave Rectifier - Full-wave Bridge Rectifier - Filters - Series Inductor Filter - Shunt Capacitor Filter - Effect of Increasing Filter Capacitance - LC Filter - The CLC or Pi Filter - Bleeder Resistor - Voltage Regulation Zener Diode Shunt Regulator - Transistor Series Voltage Regulator - Controlled Transistor Series Regulator - Transistor Shunt Voltage Regulator Transistor Current Regulator - Voltage Dividers - Complete Power Supply - Voltage Multipliers - Half-wave Voltage Doubler - Full-wave Voltage Doubler - Voltage Tripler and Quadrupler Circuits - Troubleshooting Power Supplies - Controlled Rectification - Output Waveforms for Different Firing Angles - Output Voltage and Current Values in Controlled Rectifiers Average Values for FW Controlled Rectifier - Silicon Controlled Rectifier (SCR) - Pulse Control of SCR - 90° Phase Control of SCR - 180° Phase Control of SCR - SCR Controlled Circuit - UJT Controlled Circuit Conventional Problems

**(d) The Basic Transistor**

The Bipolar Junction Transistor - Transistor Biasing - Important Biasing Rule - Transistor Currents - Summing Up - Transistor Circuit Configurations - CB Configuration - CE Configuration - Relations between  $\alpha$  and  $\beta$  - CC Configuration - Relations between Transistor Currents - Leakage Currents in a Transistor - Thermal Runaway - Conventional Problems

**(e) Transistor Characteristics and Approximations**

Transistor Static Characteristics - Common Base Test Circuit - Common Base Static Characteristics - Common Emitter Test Circuit - Common Emitter Static Characteristics - Common Collector Static Characteristics - Different Ways of Drawing Transistor Circuits - Common Base Formulas Common Emitter Formulas - Common Collector Formulas - The Beta Rule - Importance of  $V_{CE}$  - Cut-off and Saturation Points - Normal DC Voltage Transistor Indications - Transistor Fault Location - Solving Universal Stabilization Circuit - Notation for Voltages and Currents - Increase / Decrease Notation - Applying AC to a DC Biased Transistor - Transistor AC/DC Analysis - Conventional problems

**(f) Load Lines and DC Bias Circuits**

DC Load Line - Q-point and Maximum Undistorted Output - Need for Biasing a Transistor - Factors Affecting Bias Variations - Stability Factor - Beta Sensitivity - Stability Factor for CB and CE Circuits - Different Methods for Transistor Biasing - Base Bias - Base Bias with Emitter Feedback - Base Bias with Collector Feedback - Base Bias with Collector and Emitter Feedbacks - Voltage Divider Bias - Load Line and Output

### (g) Transistor Equivalent Circuits and Mode

General - DC Equivalent Circuit - AC Equivalent Circuit - Equivalent Circuit of a CB Amplifier - Effect of Source Resistance  $R_S$  on Voltage Gain - Equivalent Circuit of a CE Amplifier - Effect of Source Resistance  $R_S$  - Equivalent Circuit of a CC Amplifier - Small-Signal Low-frequency Model or Representation - General - T-Model - Formulas for T-Equivalent of a CB Circuit - T-Equivalent of a CE Circuit - T-Equivalent of a CC Circuit - What are h-parameters? - The h-parameter Formulas for Notation for Transistors - The h-parameters of an Ideal Transistor -, The h-parameters of an Ideal CB Transistor - The h-parameters of an Ideal CE Transistor - Approximate Hybrid Equivalent Circuits - Typical Values of Transistor h-parameters - Hybrid Formulas for Transistor Amplifier - Approximate Hybrid Formulas - Conventional Problems

### Unit - IV

|    |                                   |
|----|-----------------------------------|
| a) | SINGLE STAGE TRANSISTOR AMPLIFIER |
| b) | MULTISTAGE AMPLIFIER              |
| c) | DECIBELS AND FREQUENCY RESPONSE   |
| d) | FEEDBACK AMPLIFIERS               |
| e) | FIELD EFFECT TRANSISTORS          |
| f) | BREAKDOWN DEVICES                 |
| g) | SINUSOIDAL OSCILLATORS            |
| h) | NON SINUSOIDAL OSCILLATORS        |

### (a) Single-Stage Transistor Amplifiers

Classification of Amplifiers - Common Base (CB) Amplifier - Various Gains of a CB Amplifier - Characteristics of a CB Amplifier - Common Emitter (CE) Amplifier - Various Gains of a CE Amplifier - Characteristics of a CE Amplifier - Common Collector (CC) Amplifier - Various Gains of a CC Amplifier - Characteristics of a CC Amplifier - Uses - Comparison of Amplifier Configurations - Amplifier Classification Based on Biasing Condition - Graphic Representation - Class-A Amplifiers - Power Distribution in a Class-A Amplifier - Power Rectangle - Power Efficiency Maximum AC Power in Load - Transformer-coupled Class-A Amplifier Class-B Amplifier - Power Relations for Class-B Operation - Maximum Values - Class-B Push-Pull Amplifier - Crossover Distortion - Power Efficiency of Push-Pull Amplifiers - Complementary Symmetry Push-Pull Class-B Amplifier - Class-C Amplifier - Tuned Amplifier - Distortion in Amplifier - Non-linear Distortion - Intermodulation Distortion - Frequency Distortion - Phase or Delay Distortion - Noise

### (b) Multistage Amplifiers

General - Amplifier Coupling - RC-coupled Two-stage Amplifier - Advantages of RC Coupling - Impedance-coupled Two-stage Amplifier - Advantages of Impedance Coupling - Transformer-coupled Two Stage Amplifier - Advantages of Transformer Coupling - Frequency Response - Applications - Direct-coupled Two-stage Amplifier Using Similar Transistors - Direct-coupled Amplifier Using Complementary Symmetry of Two Transistors - Darlington Pair - Advantages of Darlington Pair - Comparison between Darlington Pair and Emitter Follower - Special Features of a Differential Amplifier - Common Mode Input - Differential Amplifier - Conventional Problems

### (c) Decibels and Frequency Response

The Decibel System - Other Expressions for Power Gain - Voltage and Current Levels - Characteristics of the Decibel System - Value of 1 dB Zero Decibel Reference Level - Variations in Amplifier Gain with Frequency - Changes in Voltage and Power Levels - Causes of Gain Variations Miller Effect - Cut-off Frequencies of Cascaded Amplifiers - Transistor Cut-off Frequencies - Alpha Cut-off Frequency - Beta Cut-off Frequency - The  $f_t$  of a Transistor - Relation Between  $f_{\alpha, \beta}$  and  $f_t$  - Gain-Bandwidth Product - Conventional Problems

### (d) Feedback Amplifier

Feedback Amplifiers - Principle of Feedback Amplifiers - Advantages of Negative Feedback - Gain Stability - Decreased Distortion - Increased Bandwidth - Forms of Negative Feedback - Shunt-derived Series-fed Voltage Feedback - Current-series Feedback Amplifier - Voltage-shunt Negative Feedback Amplifier - Current-shunt Negative Feedback Amplifier - Conventional Problems

### (e) Field Effect Transistor

What is a FET? - Junction FET (JFET) - Static Characteristics of a JFET - JFET Drain Characteristic with  $V_{GS} = 0$  - JFET Characteristic with External Bias - Transfer Characteristic - Small Signal JFET Parameters DC Biasing of a JFET - DC Load Line - Common Source JFET

Amplifier - JEFT on an IC Chip - Advantages of FETs - MOSFET or IGFET DE MOSFET - Schematic Symbols for a DE MOSFET - Static Characteristics of a DE MOSFET - Enhancement-only N-channel MOSFET Transfer Characteristic - FETs as Switches - FET Applications - MOS-FET Handling

#### (f) Breakdown Devices

What are Breakdown Devices ? - Unijunction Transistor - UJT Relaxation Oscillator - Silicon Controlled Rectifier - 90° Phase Control - Theft Alarm - Triac - Diac - Silicon Controlled Switch (SCS) -

#### (g) Sinusoidal Oscillators

What is an Oscillator? - Comparison between an Amplifier and an Oscillator - Classification of Oscillators - Damped and Undamped Oscillations - The Oscillatory Circuit - Frequency of Oscillatory Current - Frequency Stability of an Oscillator - Essentials of a Feedback LC Oscillator - Tuned Base Oscillator - Tuned Collector Oscillator - Tuned Drain Oscillator (FET) - Hartley Oscillator - FET Hartley Oscillator - Colpitts Oscillator - Clapp Oscillator - FETColpitts Oscillator - Crystals - Crystal Controlled Oscillator - Transistor Pierce Crystal Oscillator - FET Pierce Oscillator - Phase Shift Principle - Phase Shift Oscillator - Wien Bridge Oscillator

#### (h) Noninusoidal Oscillators

Nonsinusoidal Waveforms - Classification of Nonsinusoidal Oscillators Pulse Definitions - Basic Requirements of a Sawtooth Generator - UJT Sawtooth Generator - Multivibrators (MV) - Uses of Multivibrators - Astable Multivibrator - Monostable Multivibrator (MMV) - Bistable Multivibrator (BMV) - Schmitt Trigger - Transistor Blocking Oscillator

### Unit - V

|    |                             |
|----|-----------------------------|
| a) | MODULATION AND DEMODULATION |
| b) | INTEGRATED CIRCUITS         |
| c) | NUMBER SYSTEMS              |
| d) | LOGIC GATES                 |
| e) | BOOLEAN ALGEBRA             |
| f) | LOGIC FAMILIES              |
| g) | TRANSDUCERS                 |
| h) | ELECTRONIC INSTRUMENTS      |

#### (a) Modulation and Demodulation

Introduction - What is a Carrier Wave? - Radio Frequency Spectrum Sound - Need for Modulation - Radio Broadcasting - Modulation Methods of Modulation - Amplitude Modulation - Per cent Modulation Upper and Lower Side Frequencies - Upper and Lower Sidebands - Mathematical Analysis of a Modulated Carrier Wave - Power Relations in an AM Wave - Forms of Amplitude Modulation - Generation of SSB - Methods of Amplitude Modulation - Block Diagram of an AM Transmitter - Modulating Amplifier Circuit - Frequency Modulation - Frequency Deviation and Carrier Swing - Modulation Index - Deviation Ratio - Per cent Modulation - FM Sidebands - Modulation Index and Number of Sidebands - Mathematical Expression for FM Wave - Demodulation or Detection - Essentials of AM Detection - Diode Detector for AM Signals - Transistor Detectors for AM Signals - FM Detection - Quadrature Detector - Frequency Conversion - Superheterodyne AM Receiver - FM Receiver - Comparison between AM and FM - The Four Fields of FM - Conventional Problems

#### (b) Integrated Circuits

Introduction - What is an Integrated Circuit? - Advantages of ICs - Drawbacks of ICs - Scale of Integration - Classification of ICs by Structure Comparison between Different ICs - Classification of ICs by Function Linear Integrated Circuits (UCs) - Digital Integrated Circuits - IC Terminology - How Monolithic ICs are Made? - IC Symbols - Fabrication of IC Components - Complete Monolithic Integrated Circuits - Popular Applications of ICs - MOS Integrated Circuits - What is an OP-AMP? OP-AMP Symbol - Polarity Conventions - Ideal Operational Amplifier - Virtual Ground and Summing Point - Why  $V_i$  is Reduced to almost Zero? - OP-AMP Applications - Linear Amplifier - Unity Follower - Adder or Summer - Subtractor - Integrator - Differentiator - Comparator

#### (c) Number Systems

Number of Systems - The Decimal Number System - Binary System Binary to Decimal Conversion - Binary Fractions - Double-Dadd Method - Decimal to Binary Conversion - Shifting the Place Point - Binary Operations - Binary Addition - Binary Subtraction - Complement of a Number - 1's Complemental Subtraction - 2's Complemental Subtraction - Binary Multiplication - Binary Division - Shifting a Number to Left or Right - Representation of Binary Numbers as Electrical Signals - Octal Number System - Octal to Decimal Conversion -

Decimal to Octal Conversion - Binary to Octal Conversion - Octal to Binary Conversion - Advantages of Octal Number System - Hexadecimal Number System - How to Count beyond F in Hex Number System? ---, Binary to Hexadecimal Conversion - Hexadecimal to Binary Conversion - Conventional Problems

#### **(d) Logic Gates**

Definition - Positive and Negative Logic - The OR Gate - Equivalent Relay Circuit of an OR Gate - Diode OR Gate - Transistor OR Gate OR Gate Symbolizes Logic Addition - Three Input OR Gate - Exclusive OR Gate - The AND Gate - Equivalent Relay Circuit of an AND Gate. Diode AND Gate ~ Transistor AND Circuit - AND Gate Symbolizes Logic Multiplication - The NOT Gate - Equivalent Circuits for a NOT Gate The NOT Operation + Bubbled Gates -. The NOR Gate - NOR Gate is a Universal Gate - The NAND Gate - NAND Gate is a Universal Gate The XNOR Gate - Logic Gates at a Glance - Adders and Subtractors Half Adder - Full Adder - Parallel Binary Adder - Half Subtractor - Full Subtractor - Conventional Problems

#### **(e) Boolean Algebra**

Introduction - Unique Feature of Boolean Algebra - Laws of Boolean Algebra - Equivalent Switching Circuits - De Morgan's Theorems - Duals - Conventional Problems

#### **(f) Logic Families**

Main Logic Families - Saturated and Non-saturated Logic Circuits - Characteristics of Logic Families - RTL Circuit - DTL Circuit --- TTL Circuits - TTL Subfamilies - ECL Circuit - I<sup>2</sup>L Circuit - MOS Family - PMOS Circuit - NMOS Circuit - CMOS Circuit

#### **(g) Transducer**

What is a Transducer? - Classification of Transducers - Classification based on Electrical Principle Involved - Resistive Position Transducer - Resistive Pressure Transducer --- Inductive Pressure Transducer - Capacitive Pressure Transducer - Self-generating Inductive Transducers - Linear Variable Differential Transformer (LVDT) - Piezoelectric Transducer - Strain Gauge Temperature Transducers - Resistance Temperature Detectors - Thermistor - Thermocouples - Ultrasonic Temperature Transducers - Photoelectric Transducers - Various Types of Microphones - Carbon Microphone Ribbon Microphone - Moving-Coil (Me) Microphone - Crystal Microphone - Ceramic Microphone - Capacitor Microphone - The Electret Microphone - The Loudspeaker

#### **(h) Electronic Instruments**

Introduction - Analog and Digital Instruments - Functions of Instruments - Electronic versus Electrical Instruments - Essentials of an Electronic Instrument - Measurement Standards - The Basic Meter Movement - Characteristics of Moving Coil Meter Movement - Variations of Basic Meter Movement - Converting Basic Meter to DC Ammeter - Multirange Meter - Measurement of Current - Converting Basic Meter to DC Voltmeter Multirange DC Voltmeter - Loading Effect of a Voltmeter - Ohmmeter The Multimeter - Rectifier Type AC Meter - Electronic Voltmeters - The Direct Current VTVM - Comparison of VOM and VTVM - Direct Current FET VM - Electronic Voltmeter for Alternating Currents - The Digital Voltmeter (DVM) - Cathode Ray Oscilloscope (CRO) - Cathode Ray Tube (CRT) - Deflection Sensitivity of a CRT - Normal Operation of a CRO Triggered and Non-triggered Scopes - Dual Trace CRO - Dual Beam CRO - Storage Oscilloscope - Sampling CRO - Digital Readout CRO - Lissajous Figures - Frequency Determination with Lissajous Figures - Applications of a CRO

## **Syllabus for written examination for TGT (Physical & Health Education)**

### **Physical Education Theory**

#### **Part – A**

1. **Concept of Physical Education**

(Meaning and definition of Physical Education-its aim and objectives, Modern concept and scope of Physical Education, Need and importance of Physical Education, Place of Physical Education in the total education process)

2. **Physiological Aspects of Physical Education**

Effect of exercise on :

**Muscular System, Circulatory System, Respiratory System, Digestive System**

3. **Psychological Aspects of Physical Education**

Definition of Psychology and Sports Psychology, Achievement and Motivation in Sports, Sportsmanship and Sports Ethics

4. **Physical Fitness and Wellness**

Meaning and Importance of Physical Fitness and Wellness, Components of Physical Fitness and Wellness, Factors affecting Physical Fitness and Wellness, Principles of Physical Fitness development, Means of fitness development, Aerobic Activities- Jogging, Cycling Calisthenics and Rhythmic exercises, Participation in Games and Sports, Circuit Training

5. **Training Methods**

Meaning and Concept of Training, warming up, Limbering down and their importance, Methods of Training, Methods of Strength Development-Isometric, and Isokinetic Exercises, Methods of Endurance Development-Continuous Method, Interval Training and Fartlek, Methods of Speed Development-Acceleration Runs and Pace Races.

6. **Sociological Aspects of Physical Education**

Meaning of Sociology and its importance in Physical Education and Sports. Games and Sports as man IS Cultural Heritage. Development of leadership qualities and group dynamics.

#### **Part – B**

History of the game/sport (Anyone game/ sport of student's choice), Latest general rules of the game/ sport (Anyone game/ sport of student's choice), Measurement of play fields and specifications of sports equipment, Fundamental skills of the game/ sport, Related sports terminologies, Important tournaments and venues, Sports personalities, Sports Awards.

#### **Part – C**

1. **Health Education**

Concept and objectives of Health Education, Importance of Health Education, Principles of Health Education, Importance of community participation for health promotion and welfare of individual, family and community

2. **Communicable Diseases**

Meaning of Communicable Diseases, Essential conditions for Communicable Diseases to occur and disease process, Common alert signals indicating on set of Communicable Diseases, Mode of transmission, common symptoms and prevention of spread (transmission) of AIDS, Hepatitis B and Hepatitis C

3. **Contemporary Health Problems**

Abuse of alcohol, tobacco and drugs and the effect of abuse on individual, family and community, Effect of alcohol, tobacco and drugs on sportsperson., Eating habits that cause obesity and its effect on health of individual

4. **Healthful living**

Concept of environment, Scope of environment – living environment, work place environment and environment for leisure activities, Essential elements of healthful environment – safe water, low levels of noise, clean air, sanitary surrounding, low levels of radio active radiations and absence of hazards responsible for accidents in (i) home and neighborhood in rural and urban areas (ii) school and work place (iii) during leisure time activities recreation and sports, Role of individual in improvement of environment for health promotion and prevention of accidents related to transportation swimming and water sports, Disaster preparedness and health care during disasters.

### 5. Family Health Education

Meaning and functions of family and its importance as a social institution, Needs and problems of adolescents and their management, Human reproduction – menstruation, conceptional and prenatal care, Problems associated with pre-marital sex and teenage pregnancies, Preparation of marriage, Role of parents in child care.

### 6. Prevention and first aid for common sports injuries

Soft Tissue injuries – sprain and strain, Bone Injuries, Joint Injuries

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## Syllabus for written examination for TGT (Art Education)

### DRAWING AND PAINTING

#### HISTORY OF INDIAN ART

##### UNIT 1: Art of Indus Valley

(Harappan and Mohenjo-daro)  
(2500 B.C. to 1500 B.C.)

###### (1) Introduction

- (i) Period and Location.
- (ii) Extension: In about 1500 miles
  - (a) Harappa & Mohenjo-daro (Now in Pakistan)
  - (b) Ropar, Lothal, Rangpur, Alamgirpur, Kali Bangan, Banawali and Dhaula Veera (in India)

###### (2) Study of following

###### Sculptures and Terracottas:

- (i) Dancing girl (Mohenjo-daro)  
Bronze, 10.5 x 5 x 2.5 cm.  
Circa 2500 B.C.  
(Collection : National Museum, New Delhi).
- (ii) Male Torso (Harappa)  
Stone, 9.2 x 5.8 x 3 cms.  
Circa 2500 B. C.  
(Collection : National Museum, New Delhi).
- (iii) Mother Goddess (Mohenjo-daro) terracotta, 22 x 8 x 5 cm.  
Circa 2500 B.C.  
(Collection : National Museum, New Delhi).

###### (3) Study of following

###### Seal:

- (i) Bull (Mohenjo-daro)  
Stone, 2.5 x 2.5 x 1.4 cm.  
Circa 2500 B.C.  
(Collection : National Museum, New Delhi).

###### (4) Study of following

###### Decoration on earthen wares:

- (i) Painted earthen-ware (Jar) Mohenjo-daro  
(Collection : National Museum, New Delhi).

##### UNIT 2 : Buddhist, Jain and Hindu Art.

(3<sup>rd</sup> century B.C. to 8<sup>th</sup> century A.D.)

###### (1) General Introduction to Art, during Mauryan, Shunga, Kushana & Gupta Period:

###### (2) Study of following

###### Sculptures:

- (i) Lion Capital from Sarnath (Mauryan period)  
Polished sand stone,  
Circa 3<sup>rd</sup> Century B.C.  
(Collection: Sarnath Museum, U.P.)
- (ii) Chauri Bearer from Didar Ganj (Mauryan period)  
Polished sand - stone  
Circa 3<sup>rd</sup> Century B.C.  
(Collection: Patna Museum, Bihar)
- (iii) Bodhisattva head from Taxila (Gandhara Period)  
Stone, 27.5 x 20 x 15 c.m.  
Circa 2<sup>nd</sup> Century A.D.  
(Collection: National Museum, New Delhi)
- (iv) Seated Buddha from Katra Tila  
Mathura - (Kushan Period)  
(Collection: Mathura Museum)
- (v) Seated Buddha from Sarnath (Gupta Period)  
Stone  
Circa 5<sup>th</sup> Century AD  
(Collection: Sarnath Museum, U.P.)
- (vi) Jain Tirathankara (Gupta period)  
Stone  
Circa 5<sup>th</sup> Century AD  
(Collection at State Museum, Lucknow U.P.)

- (3) Introduction to Ajanta  
Location, period, No. of caves, Chaitya and Vihara, Paintings and Sculptures subject matters and techniques etc.
- (4) Study of following  
Painting & Sculpture:
  - (i) Padmapani Bodhisattva (Ajanta Cave No. I)  
Mural Painting  
Circa 5<sup>th</sup> Century A.D.
  - (ii) Mara Vijay (Ajanta Cave No. 26)  
Sculpture in stone  
Circa 5<sup>th</sup> Century A.D.

### Unit 3: Temples Sculpture, Bronzes and Indo-Islamic Architecture

Artistic aspects of Indian Temples  
(6<sup>th</sup> Century A.D. to 13<sup>th</sup> Century A.D.)

- (1) Introduction to Temple Sculpture  
(6<sup>th</sup> Century A.D. to 13<sup>th</sup> Century A.D.)
- (2) Study of following Temple-Sculptures;
  - (i) Descent of Ganga (Pallava period, Mahabalipuram Tamilnadu), Stone Circa 7<sup>th</sup> Century A.D.
  - (ii) Ravana Shaking Mount Kailash (Rashtrakuta period, Ellora,
  - (iii) Trimurti (Elephanta, Maharashtra)  
Stone  
Circa 9<sup>th</sup> Century A.D.
  - (iv) Lakshmi Narayana (Kandariya Mahadev Temple) (Chandela; Period, Khajuraho, M.P.)  
Circa 10<sup>th</sup> Century A.D.
  - (v) Cymbal Player Sun Temple (Ganga Dynasty, Konark, Orissa)  
Circa 13<sup>th</sup> Century A.D.
  - (vi) Mother & Child (Vimla-Shah Temple, Solanki Dynasty, Dilwara, Mount Abu, Rajasthan) White marble.  
Circa 13<sup>th</sup> Century A.D.
- (3) Bronzes
  - (i) Introduction to Indian Bronzes
  - (ii) Method of casting (solid and hollow)
- (4) Study of following south Indian Bronzes:
  - (i) Nataraj (Thanjavur Distt., Tamilnadu)  
Chola period (12<sup>th</sup> Century A.D.)  
(Collection: National Museum, New Delhi)
  - (ii) Devi (Uma)  
Chola Period (12<sup>th</sup> Century A.D.)  
(Collection: National Museum, New Delhi)
- (5) Artistic Aspects of the Indo-Islamic Architecture
  - (i) Introduction
- (6) Study of following architectures:
  - (i) Qutab Minar, Delhi
  - (ii) Taj Mahal, Agra
  - (iii) Gol Gumbaz of Bijapur

### Unit 4: The Rajasthani and Pahari Schools of Miniature painting (16<sup>th</sup> Century A.D to 19<sup>th</sup> Century A.D.)

Introduction to Indian Miniature Schools: Western-Indian, Pala, Rajasthani, Mughal, Central India, Deccan and Pahari.

- (A) The Rajasthan Schools
  - (1) Original and Development
  - (2) Schools-Mewar, Bundi, Jodhpur, Bikaner, Kishangarh and Jaipur
  - (3) Main features of the Rajasthani Schools
  - (4) Study of the following Rajasthani Paintings:

| Title                          | Painter     | School     |
|--------------------------------|-------------|------------|
| Maru-Ragini                    | Sahibdin    | Mewar      |
| Raja Ajniruddha Singh Heera    | Utkal Ram   | Bundi      |
| Chaugan Players                | Dana        | Jodhpur    |
| Krishna on swing               | Nuruddin    | Bikaner    |
| Radha (Bani - Thani)           | Nihal Chand | Kishangarh |
| Bharat meets Rama at Chitrakut | Guman       | Jaipur     |

- (B) The Pahari Schools:
- (1) Origin and development
  - (2) Schools-Basohli and Kangra
  - (3) Main features of the Pahari School
  - (4) Study of the following pahari Paintings

| Title               | Painter | School  |
|---------------------|---------|---------|
| Krishna with Gopies |         | Basohli |
| Raga Megha          |         | Kangra  |

Unit 5 The Mughal and Deccan Schools of Miniature Painting (16<sup>th</sup> Century AD to 19<sup>th</sup> Century A.D.)

- (A) The Mughal School
- (1) Origin and development
  - (2) Main features of the Mughal School
  - (3) Study of the following Mughal paintings

| Title                                  | Painter                | School                   |
|----------------------------------------|------------------------|--------------------------|
| Krishna lifting mount                  | Goverdhan              | Miskin Akbar             |
| Babur Crossing the river sone          | Jaganath               | Akbar                    |
| Jahangir holding the picture of Madona | Abul Hassan            | Jahangir                 |
| Falcon on a bird rest                  | Ustad Mansoor          | Jahangir                 |
| Kabir and Raidas                       | Ustad Faquirullah Khan | Shahjahan                |
| Marriage procession of Dara Shikoh     | Haji Madni             | Provincial Mughal (Oudh) |

- (B) The Deccan School
- (1) Origin and development
  - (2) Main features of the Deccan School
  - (3) Study of the following Deccan paintings

| Title                             | Painter | School     |
|-----------------------------------|---------|------------|
| Raga Hindola                      |         | Ahmednagar |
| Chand Bibi Playing Polo (Chaugan) |         | Gol Konda  |

Unit 6 : The Bengal school and the Modern trends in Indian Art

- (A) (1) A. New Era in Indian Art- an introduction  
B. Study of the following painting  
(i) Rama Vanquishing the pride of the ocean-Raja Ravi Verma
- (2) Evolution of the Indian national Flag (First – 1906, Middle – 1921 and Final 1947 stages): Study of the form and the colour scheme
- (B) (1) Introduction to the Bengal School of painting  
(i) Origin and development of the Bengal School  
(ii) Main Features of the Bengal school
- (2) Contribution of Indian artists in the struggle for National Freedom Movement
- (3) Study of the following paintings of the Bengal School  
(i) Journey's End – Rabindranath Tagore  
(ii) Parthasarathi – nandlal Bose  
(iii) Radhika – M.a.R. Chughtal
- (C) The Modern Trends in Indian Art  
Introduction
- (1) Study of the following Paintings:  
(i) Magician-Gaganendranath Tagore  
(ii) Mother and child-Jamini Roy  
(iii) Woman face-Rabindranath Tagore  
(iv) Tree Girls-Amrita Sher gill
- (2) Study of the following pieces of Sculpture:  
(i) Triumph of labour- D.P. Roychowdhury  
(ii) Santhal Family-Ramkinker Vajj
- (3) Study of the following work of contemporary Indian Art'  
A Paintings  
(i) Mother Teresa-M.F. Hussain.  
(ii) Birth of Poetry- K.K. Hebbar  
(iii) Gossip-N.S. Bendre  
(iv) Untitled G.R. Santosh  
(v) Diagonal – Tyeb Mehta

- (4) Graphic Prints
  - (i) Whirl Pool-Krishna Reddy
  - (ii) Children-Somnath Hore
  - (iii) Devi-Jyoti Bhatt
  - (iv) Of Walls-Anupam Sud
  - (v) Man, Woman and Tree K. Laxman Goud
- (5) Sculptures
  - (i) Standing Woman-Dhanraj Bhagat
  - (ii) Cries Un-heard-Amar nath Sehgal
  - (iii) Ganesha-P.V. Jankiram
  - (iv) Figure- sankho-Chaudhuri
  - (v) Chattrumukhi - Aekka Yada Giri Rao

Note: The names of artists and their art work as listed above are only suggestive and in no way exhaustive.

Practical

Unit 1: Nature and Object Study

Study of two or three natural and geometric forms in pencil with light and shade from a fixed point of view. Natural forms like plants, Vegetables, fruits and flowers etc., are to be used. Geometrical forms of objects based on geometrical forms like cubes, cones, prisms, cylinders and sphere should be used.

Unit 2: Painting composition

- (i) Simple exercises of basic design in variation of linear geometric and Rhythmic shapes in primary and secondary colours to understand designs as organized visual arrangements.
- (ii) Sketches from Life and nature  
Imaginative painting based on subject from Life and or Nature in water and poster colours with colour values.
- (iii) Imaginative painting based on subject from Life and or Nature in water and poster colours with colour values.

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PGTs

## 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, pteridophytes, 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 : Meristematic 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, Skeletal 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 & Pluripotency ; 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 ; biopiracy.

#### **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 quantitative 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 uncertainty and types of error statistical analysis presentation of experimental data, data analysis, trends, testing mathematical models, goodness of 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, entropy Building 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 amino acids, fragmentation of polypeptide chain, 3D structure of proteins, secondary, tertiary and quaternary 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- Nucleotides, 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 fixation, 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, electrophoresis, isoelectric focusing, hydrophobic 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 precipitation, 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 organelles – Golgi bodies, Endoplasmic reticulum, lysosomes, peroxisomes, ribosomes, internalisation 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, apoptosis, 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, hydrophobic 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 comparative genomics, functional genomics-micro array techniques, fluorescence, in situ hybridization, comparative DNA hybridisation, history of bioinformatics, sequences and nomenclature, DNA and protein sequences, information sources-major databases, blast family search tools, resources for gene level sequences, analysis using bioinformatics 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, applications of animal cell culture-Tissue plasminogen activator, factor VIII, erythropoietin, hybridoma technology, monoclonal 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, immunoglobulins, MHCs, cytokines, T cell receptor, generation of antibodies and T cell receptor diversity, complement system, humoral and cell mediated immunity, immune regulation, vaccines, hybridoma, immunodeficiencies, AIDS, transplantation immunity and cancer.

### Applied Biotechnology

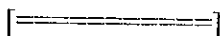
Biotechnology industry, Bioinformatics, molecular technology for diagnosis of genetic disorders, onco viruses and immunity, lymphocyte, homeostasis, viral induced modulation of host immune response, HLA polymorphism, induction and maturation of B cells, safe limits for radiation determined, radiation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

**Syllabus for written examination for PGT(CHEMISTRY)**

| S.No. | Topic (Details of the syllabus)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.    | <b>Some Basic concepts of Chemistry:</b> 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     | <b>States of Matter:</b> Gases, liquids and solids, three states of matter, types of intermolecular forces.<br>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.<br><i>Liquid and their properties.</i><br><i>Solids:</i> 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     | <b>Structure of Atom:</b> 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 principle, 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     | <b>Equilibrium:</b> 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.    | <b>Surface Chemistry:</b> 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     | <b>Chemical Kinetics:</b> 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     | <b>Redox Reaction and Electrochemistry:</b> 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     | <b>Solutions:</b> 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     | <b>Chemical bonding and Molecular Structure:</b> 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.   | <b>Thermodynamics:</b> 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.   | <b>Classification of elements and periodicity in properties:</b> 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.   | <b>Hydrogen:</b> 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.   | <b>General principles and processes of isolation of elements and s - block elements:</b> Principles and methods of extraction, oxidation and reduction as applied to the extraction procedures of Al, Cu, Zn and Fe.<br>s - block elements, general introduction - Electronic configuration, occurrence, Anomalous properties of the first element of each group, diagonal relationship,                                                                                                                                                                                                                                                                                                                                                                                              |

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|     | 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. | <b>p - Block Elements:</b> 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. | <b>The d - and f- Block Elements:</b> 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 $\text{KMnO}_4$ and $\text{K}_2\text{Cr}_2\text{O}_7$ , lanthanoids and actinoids.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 16. | <b>Co-ordination Compounds and organometallics:</b> 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. | <b>Organic Chemistry : Some Basic Principles and Techniques:</b> 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.<br><b>Isomerism :</b> Structural and Stereo Isomerism <b>Fundamental Concepts in Reaction Mechanism:</b> Cleavage of covalent bond, Types of attacking species, electron movement in organic reactions, electronic displacement in a covalent bond and types of organic reactions.<br><b>Methods of purification of organic compounds:</b> Qualitative analysis, Quantitative analysis, estimation of the elements and determination of empirical and molecular formula.                                                                                                                                           |
| 18. | <b>Hydrocarbons:</b> Classification of hydrocarbons.<br><b>Alkanes:</b> Conformations (Newmann and Sawhorse formulae), Physical properties, Chemical reactions<br><b>Cycloalkanes:</b> Preparation, physical and chemical properties, stability of cycloalkanes(Bayer strain theory), chair and boat forms of cyclohexane.<br><b>Alkenes:</b> , structure of double bond, geometrical isomerism, physical properties, methods of preparation, chemical reactions.<br><b>Alkadienes:</b> Classification of dienes, Preparation of conjugated dienes, Chemical properties(1,2 and 1,4- addition to conjugated dienes).<br><b>Alkynes:</b> , structure of triple bond, physical properties, methods of preparation Chemical properties, Acidic nature of alkynes<br><b>Aromatic Hydrocarbons:</b> , Structure of benzene, resonance, aromaticity (Huckel's rule) Chemical properties, mechanism of electrophilic substitution direct influence of substituents in monosubstituted benzene.       |
| 19. | <b>Environmental Chemistry:</b> 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. | <b>Haloalkanes and Haloarenes:</b> Classification, methods of preparation of haloalkanes and haloarenes, their physical properties, tests to distinguish between alkyl and aryl halides, <b>mechanism of <math>\text{SN}^1</math> and <math>\text{SN}^2</math> reactions</b> , elimination reactions ( <b>Saytzeff Rule</b> , <b><math>\text{E}_1</math> &amp; <math>\text{E}_2</math> mechanism</b> ). <b>Poly halogen compounds:</b> Preparation and properties.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 21. | <b>Alcohols, Phenols and Ethers:</b> 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. | <b>Aldehydes, Ketones and Carboxylic Acids:</b> 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

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| 23. | <b>Amines (Organic compounds containing nitrogen ):</b> Classification, Structure of amino group, preparation, Physical, Chemical properties, tests to distinguish between primary, secondary and tertiary amines                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 24. | <b>Polymers:</b> 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. | <b>Biomolecules(Biochemistry):Carbohydrates:</b> Classification of carbohydrates , Structural determination of glucose and fructose on the basis of their chemical properties, Open chain (Fischer) structure, cyclic structure(Haworth form), $\alpha$ and $\beta$ forms of glucose, <b>Mutarotation</b> , anomers and epimers, Chemical reactions of glucose, Reducing and non-reducing sugars, Configuration of glucose and fructose. Disaccharides Sucrose, <b>Haworth representation of disaccharides</b> , Polysaccharides, Starch, Cellulose, and amylopectin structures, Functions of Carbohydrates in living organisms. Carbohydrate metabolism, glycolysis, electron-transport chain,<br><b>Proteins:</b> 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.<br><b>Nucleic acids :</b> 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. | <b>Chemistry in Everyday life: Drugs and medicines -</b> 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), antifertility drugs, antihistamines, antacids. Chemicals in food, Food preservatives, artificial sweetening agents, Soaps and detergents, Preparation soaps(Saponification) and detergents, cleansing action of soaps, advantages of detergents over soaps, Deodorants, Edible colours, antioxidants.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |



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 Subtractors, 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, Label, 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 file, 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: Dereference 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 (||), 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 (EQUJ, 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, CDLOR), 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, CELSPACING, 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 AUTD 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;

Form 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, BACKGRDUND-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\_HDST, 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 (TWIN) 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 Phillips/ 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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## Syllabus for written examination for PGT(ECONOMICS)

### 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, NSE, 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)
- ✓ 19<sup>th</sup> and 20<sup>th</sup> 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 Varenus, Kant, Reine, Humboldt and Ritter. Influence of Richthofen and Darwin. Vidal-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 continents and ocean basins Wegener'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 Warming, 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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## INDIAN HISTORY SYLLABUS FOR PGT HISTORY

- Harappan Civilization –
- a. Town Planning
  - b. Religion
  - c. Economic & Social Life
  - d. Script Writing
- 1) **Rise of Magadh in relation to 16 Mahajanpadas**
  - 2) Rise of Heterodox sects with special reference 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 7<sup>th</sup> century
  - 6) Sultanate Era – The Defeat of Hindu kingdom and establishment of Delhi 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 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 Mesopotamia –**
  - a. Urbanization
  - b. Script
  - c. Trade
  - d. Calendar

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- 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**

## **Syllabus for written examination for PGT(Mathematics)**

### **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  $R \times R \times R$ ). 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, Tchebycheff'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. . Arithmetic-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  $\sin 2x$ ,  $\cos 2x$ ,  $\tan 2x$ ,  $\sin 3x$ ,  $\cos 3x$  and  $\tan 3x$ . 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 equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes. (iii) a line and a plane. Distance of a point from a plane. 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

Example 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 values 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 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 recruitment of 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 conservation 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 moment of 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.

**Unit XIV: 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 defects and its correction. Microscopes

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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, diffraction 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 scintillation 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.

**केन्द्रीय विद्यालय संगठन**  
**स्नातकोत्तर शिक्षक चयन परीक्षा हेतु पाठ्यक्रम**

**विषय — हिन्दी**

**खण्ड — क**  
**इतिहास एवं साहित्य**

हिन्दी साहित्य के इतिहास का विस्तृत अध्ययन

**(i) आदिकाल से रीतिकाल**

इसके अन्तर्गत कालगत परिस्थितियाँ एवं साहित्य पर उसका प्रभाव, प्रत्येक युग के साहित्य की प्रमुख प्रवृत्तियाँ, प्रमुख रचनाकार एवं उनकी रचनाएँ, साहित्यिक विशेषताएँ, भाषा — शैली

**(क) आदिकाल —** चंदबरदाई, अमीर खुसरो, विद्यापति

**(ख) भक्तिकाल —**

**(1) निर्गुण भक्तिधारा —** ज्ञानमार्गी शाखा, प्रेममार्गी शाखा — कबीर, दादू, रैदास, नानक, जायसी, कुतुबन। .

**(2) सगुण भक्तिधारा —** राम भक्तिशाखा, औष्ण-भक्ति शाखा — तुलसीदास, केशव, सूरदास, मीराबाई, अष्टछाप के कवि

**(ग) रीतिकाल —** रीतिबद्ध, रीतिसिद्ध, रीतिमुक्त काव्य .....  
 ..... देव, घनानंद, बिहारी, मतिराम, सेनापति, भूषण, पद्माकर

**(ii) आधुनिक काल**

युगीन परिस्थितियाँ, साहित्यिक पृष्ठभूमि, मुख्य विचारधारा, मुख्य साहित्यकार, साहित्यिक रचनाएँ, विशेषताएँ, भाषा—शैली

**(क) भारतेन्दुयुग —** भारतेन्दु हरिश्चंद्र, बालमुकुन्दगुप्त, बदरीनारायण चौधरी 'प्रेमधन'

- (ख) द्विवेदीयुग — महावीर प्रसाद द्विवेदी, श्रीधर पाठक, अयोध्यासिंह उपाध्याय 'हरिऔध', मैथिलीशरणगुप्त
- (ग) छायावाद — जयशंकर प्रसाद, महादेवी वर्मा, सुमित्रानन्दन पंत, सूर्यकान्त त्रिपाठी निराला
- (घ) प्रगतिवाद — पंत, निराला, नरेन्द्र शर्मा, केदारनाथ अग्रवाल, नागार्जुन
- (ङ) प्रयोगवाद — मुक्तिबोध, नेमिचंद्र जैन, भारतभूषण अग्रवाल, प्रभाकर माचवे, गिरिजा कुमार माथुर, रामविलास शर्मा, 'अज्ञेय'
- (च) नई कविता — भवानी प्रसाद मिश्र, नरेन्द्र शर्मा, धूमिल, धर्मवीर भारती, शंभुनाथ सिंह

### गद्य साहित्य का विस्तृत अध्ययन

गद्य एवं अन्य विधाओं का प्रारम्भ, विकास, प्रमुख प्रवृत्तियाँ, प्रमुख साहित्यकार, रचनाएँ, साहित्यिक विशेषताएँ, भाषाशैली।

निबंध, कथासाहित्य — उपन्यास और कहानी, नाटक, एकांकी, रेखाचित्र, संस्मरण, यात्रा-वृत्तांत, आत्मकथा, जीवनी, पत्र, डायरी, आलोचना, रिपोतार्ज आदि इन सभी विधाओं का विस्तृत परिचय।

### 2. हिंदी साहित्य

(काव्य साहित्य पर आधारित तीन प्रश्न)

निम्नलिखित कवियों की प्रसिद्ध काव्य-रचनाओं में से लिए गए काव्यांशों पर आधारित सप्रसंग व्याख्या, भाव-सौंदर्य, शिल्प सौंदर्य पर एक वस्तु निष्ठ प्रश्न एवं दो विषय परक प्रश्न —

- (i) सप्रसंग व्याख्या, भाव सौंदर्य — विषय परक-प्रश्न

(ii) शिल्प सौन्दर्य – वस्तुनिष्ठ प्रश्न

अमीर खुसरो, विद्यापति, सूरदास, तुलसीदास, कबीरदास, जायसी, मीराबाई, रसखान, धनानंद, बिहारीलाल, भारतेन्दु, मैथलीशरण गुप्त, दिनकर, जयशंकर प्रसाद, महादेवी वर्मा, निराला, पंत, हरिवंशराय बच्चन, मुक्तिबोध, रघुवीर सहाय, केदारनाथ सिंह, भवानीप्रसाद मिश्र, 'अज्ञेय' इत्यादि (संकेत – एम. ए. तक के पाठ्यक्रम में पढ़ी उपरोक्त कवियों की प्रसिद्ध कविताएँ)

निम्नलिखित गद्य – लेखकों की प्रसिद्ध रचनाओं में से व्याख्या से संबंधित अंश, आशय स्पष्टीकरण एवं भाषा – शैली पर आधारित प्रश्न

(i) सप्रसंग व्याख्या एवं आशय स्पष्टीकरण पर आधारित दो विषय परक प्रश्न

(ii) भाषा – शैली पर आधारित

भारतेन्दु, रामचंद्र शुक्ल, प्रेमचंद, जैनेन्द्र कुमार, हजारीप्रसाद द्विवेदी, धर्मवीर भारती, रामविलास शर्मा, निर्मल वर्मा, फणीश्वर नाथ 'रेणु', कृष्णा सोबती, भीष्म साहनी, शेखर जोशी, विष्णु खरे, ममता कालिया

3. कवियों और लेखकों के व्यक्तित्व एवं औचित्य पर आधारित एक प्रश्न जिसके पाँच भाग होंगे – यह प्रश्न हिन्दी साहित्य के प्रसिद्ध कवियों एवं लेखकों के जीवन-परिचय, साहित्यिक रचनाएँ एवं भाषा – शैली पर आधारित होंगे।

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खण्ड — ख  
व्याकरण एवं रचना

व्याकरण

(क) शब्द—विचार एवं शब्द भंडार

शब्द भेद — अर्थ, रचना, स्रोत तथा प्रयोग की दृष्टि से शब्द  
भंडार—पर्यायवाची, विपरीतार्थक, एकार्थी, अनेकार्थी

शब्द—युग्म

शब्द निर्माण — उपसर्ग, प्रत्यय, समास

(ख) पद—विचार, पदबंध, पद—परिचय

संज्ञा, सर्वनाम, विशेषण, क्रिया, क्रिया विशेषण

पदबंध—भेद, प्रयोग

पद—परिचय

(ग) वाक्य—विचार

वाक्य संरचना

वाक्य भेद — अर्थ एवं रचना की दृष्टि से

वाक्य—परिवर्तन

वाक्य—संश्लेषण, वाक्य — विश्लेषण

(घ) सन्धि

स्वर सन्धि, व्यंजन सन्धि, विसर्ग सन्धि

2. अपठित बोध —

(क) काव्यांश पर आधारित प्रश्न, भाव सौन्दर्य, शिल्प — सौन्दर्य

(ख) गद्यांश (साहित्यिक/वर्णनात्मक)

3. (i) समसामयिक विषय  
(ii) वर्णनात्मक विषय  
(iii) सर्जनात्मक विषय  
(iv) साहित्यिक विषय
4. काव्यशास्त्रीय अध्ययन  
(i) साहित्य का अर्थ, स्वरूप, उद्देश्य  
(ii) साहित्य की विविध विधाएँ  
(iii) रस-मीमांसा — सभी रसों का ज्ञान, काव्य की आत्मा के रूप में रस मीमांसा  
(iv) शब्द शक्ति — अभिधा, लक्षणा, व्यंजना  
(v) काव्य-गुण — प्रसाद, माधुर्य, ओज  
(vi) काव्य-दोष — विस्तृत जानकारी  
(vii) छंद ज्ञान — वर्णिक, मात्रिक  
(viii) अलंकार — शब्दालंकार, अर्थालंकार, उभयालंकार एवं नए अलंकार

### खण्ड — ग लेखन कौशल और पत्रकारिता

पत्रकारिता से संबंधित विषय

- (i) प्रिंट माध्यम (समाचार और संपादकीय)
- (ii) रिपोर्ट
- (iii) आलेख
- (iv) फीचर लेखन
- (v) साक्षात्कार
- (vi) रेडियो व दूरदर्शन के लिए लेखन?
- (vii) विज्ञापन लेखन

- (viii) उद् घोषणा
- (ix) स्वागत भाषण
- (x) संगोष्ठी संचालन
- 2. व्यावहारिक लेखन पर एक विषयपरक प्रश्न
  - (i) व्यावहारिक हिन्दी का स्वरूप
  - (ii) प्रयोजनमूलक हिन्दी और उसके विविध आयाम
  - (iii) कार्यालयी हिन्दी और उसके विविध आयाम
  - (iv) प्रतिवेदन, अर्थ, प्रमुख तत्त्व, विशेषताएँ, प्रकार प्रतिवेदन लेखन
  - (v) कार्यसूची - कार्यसूची तैयार करने का नमूना
  - (vi) कार्यवृत्ता - स्वरूप, निर्माण
- 3. सर्जनात्मक लेखन एवं मौलिक अभिव्यक्ति पर एक विषयपरक प्रश्न
 

कविता, कहानी, लघुकथा, डायरी लेखन आदि के रूप में -

  - (i) दिए गए विषय पर - कविता, लघुकथा संबंधी मौलिक रचना
  - (ii) कहानी का कविता में रूपान्तरण
  - (iii) अनुभवों के आधार पर लेखन
- 4. विभिन्न दक्षताओं के विकास हेतु एक विषयपरक प्रश्न
  - (i) वार्तालाप की दक्षता के विकास हेतु संवाद लेखन।
  - (ii) कोई भी समसामयिक विषय द्वारा कहानी/कविता लेखन।

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**Librarian**

## **Syllabus for written examination for Librarian**

### **Part 1: Foundation of Library & Information Science.**

#### **Unit.1. Library as an Social Institution**

- Social & Historical foundations of Library.
  - Different types of libraries- Academic, Public, Special -their distinguishing features and functions.
  - Role of U.G.C. for development of Academic libraries.
  - Role in Library of formal and informal education.
- Shivaji University, Kolhapur

#### **Unit.2 Normative Principles of Lib. & Inf. Science**

- Five Laws of Library Science.
- Implications of five laws in Lib. & Inf. Science
- Development of Libraries with special reference to India, Baroda Public Library system
- Library Co-operation Resource Sharing and Library Networking.

#### **Unit 4. Laws relating to Libraries & Informamion.**

- Library legislation need and essential features.
- Library legislation in India.
- Maharashtra Public Library Act.
- Press and registration act & Delivery of Books act (Public Library).
- Copyright act, Intellectual Property rights.

#### **Unit.5 Library and information Profession**

- Attribution of profession.
- Librarianship as a profession.
- Professional ethics.
- Professional associations & their role.
- National & International Library Associations- FID, IFLA, LA, ILA, ALA, IASLIC etc.
- Professional education & research.

#### **Unit.6 Promoters of Library & Information services**

- National level promoters- RRRLF.
- International level promoters- UNESCO

#### **Unit 7. Public relations & Extension activities**

- Definition
- facets and programs.
- publicity & extension, Out reach activities.
- Library path finders (Guides)
- Factors affecting Library development, Literacy, publishing, Book Trade.

### **Part II : Knowledge Organization, Information Processing & Retrieval.**

#### **Unit. 1. Universe of Knowledge**

- Structure and attributes.
- Modes of formation of subjects.
- Different types of subjects.
- Universe of subjects as mapped in different schemes of classification.

#### **Unit. 2 Bibliographic description**

- Catalogue purpose, Structure and types physical forms including OPAC filing rules.
- Normative Principles of cataloguing.
- Overview of principles and practice in document description.
- Current trends in Standardization, description and exchange.
- Standard codes of cataloguing.

#### **Unit. 3. Methods of Knowledge Organization**

- General theory of Library Classification.
- Normative principles of classification and their application.
- Species of Library Classification.
- Standard Schemes of Classifications and their features, CC, DDC, UDC.
- Notation: Need, Functions, Characteristics
- Design and development of schemes of Library Classification, Standard sub-division Index.
- Trends in Library Classification.

#### **Unit.4. Subject Classification**

- Principles of Subject Classification.
- Subject: heading lists and their feature.

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### **Part III: Information Technology: Basic**

#### **Unit.1 Information Technology**

- Definition, Need, Scope and Objectives.

#### **Unit. 2 Computer Basic (Hardware)**

- Introduction to Computers
- Overview of Historical Development of Computers.
- Generations of Computers, Classification of Computers.
- Essential Components of Computer system.

#### **Unit.3 Computer Architecture-Organization of Computer**

- Input and Output devices- Keyboard, Scanner, OCR, Printers, Monitor

#### **Unit. 4. Software.**

- Operating systems: Single & Multi User Systems, Basic features of MS-DOS, MS Windows, Linux, UNIX, Windows NT etc.
- Programming Languages: Concepts and Tools
- Algorithm & Flowcharting.

#### **Unit. 5 Word Processors, Spread Sheet etc.**

#### **Unit. 6 DBMS Package**

- Familiarity with DBASE, FOXPRO, CDS/ISIS, SOUL, MS Access (Basic features)

#### **Unit 7. Computer application to library & Information work**

- House keeping operations

#### **Unit 8. Communication Technology**

- Communication Technology Basic Concepts
- Networking: Basic Concepts.
- Internet

### **Part IV: Management of Libraries & Information Centres/Institutions**

#### **Unit.1 Management**

- Concepts, definition and scope.
- Management styles and approaches.
- Management schools of thought.
- Functions and principles of Scientific Management.

#### **Unit.2 Human Resource Management**

- Organizational structure.
- Delegation, Communication and Participation.
- Job Description and Analysis, Job evaluation.
- Inter-personal relation.
- Recruitment procedures.
- Motivation, group Dynamics.
- Training and Development.
- Disciplines and Grievances.
- Performance Appraisal.

#### **Unit.3. Financial Management**

- Resources Mobilization
- Budgeting Techniques and Methods PPBS, Zero Based Budgeting etc.
- Budgetary Control.
- Cost effectiveness and Cost Benefit analysis.
- Outsourcing.

#### **Unit. 4 Reporting**

- Types of reports, Annual report-compilation, Contents and style.
- Library Statistics etc.

#### **Unit 5 System Analysis and Design**

- Library as a system
- Project Management PERT/COM
- Decision Tables.
- Performance evaluation standards, MIS.
- Performance Measurement, reengineering, Time and Motion Study
- SWOT ( Strength Weakness Opportunities Threat)
- DFD (Data Flow Diagram)

#### **Unit 6. Total Quality Management (TQM)**

- Definition, Concept, Element
- Quality Audit, LIS related standards.
- Technology Management.

#### **Unit. 7 Library House Keeping Operations.**

- Different sections of Library & Information Center and their functions.
- Collection Development and Management Policies Procedures.
- Book Ordering (Acquisition)
- Technical Processing.
- Serials Control, Circulation Control, Maintenance etc.
- Stock Verification- Policies and Procedures.
- Evaluation and Weeding.
- Archiving-conservation-Preservation.
- Restoration including Print, Non-Print and Electronic Materials.
- Unit.8 Planning
  - Concept, Definition, Need and Purpose, Types.
  - Policies and Procedures, MBO
  - Building and Space management in Libraries and Information Centers.
  - Library Building, Interior & Exterior, Furniture, Equipment's, Standards & Types.
  - Risk Management, Contingency Management.
  - Planning of related Infrastructure, Library Standards.
- Unit 9. Management of change.
  - Concept of change.
  - Changes in Procedures, Methods, Tools and Techniques.
  - Problems of Incorporating Change.
  - Techniques of Managing Change.

### **Part V: Information Sources & Services**

- Unit 1. Reference and information sources.
  - Documentary Sources of Information, Print, Non-Print including Electronic: Special features, Scope, types
  - Nature, Characteristic, Utility and evaluation of different types of Information sources: Physical formats, Authority, Content, Utility.
  - Non-Documentary Information Sources.
  - Reference Sources Categories, Primary, Secondary & Tertiary Information Sources. (Encyclopedia, Dictionary, Periodical, Thesis, Books, Year book, Patents, Trade literature, standards, Monographs, Reference Books, Year Books, Almanac, Atlas, Abstracting & Indexing periodicals, Bibliographies, Handbooks etc.)
  - Internet as a Source of Information.
- Unit.2. Reference Service.
  - Concept, Definition, Need, Scope and trends.
  - Reference Interview and Search Techniques.
- Unit 3. Information Services and Products
  - Information services and Products.
  - Information services concepts, Definition, Need and trends.
  - Need, Techniques and Evaluation of Alerting services (CAS & SDI)
  - Bibliographic, Referral, Document Delivery and Translation Services.
- Unit.4. Information System and their Services.
  - Study of National, International and Commercial Information Systems and Services- Background, their Services and Products.

### **Part VI: Library Users**

- Unit 1. Techniques of Library and Information Centres Survey.
  - Proforma method.
  - Interview method.
  - Records analysis method.
- Unit.2. Information users and their information Needs
  - Categories of Information users.
  - Information needs definition and models.
  - Information seeking behaviour.
- Unit.3 User Education
  - Goals and Objectives level, Techniques and Methods, Evaluation of Users Education Programmes.
- Unit. 4. User Studies.
  - Methods and techniques of User studies.
  - Evaluation of User studies.
- Unit 5. User Orientation Programmes:
  - Conventional and modern Techniques: Study tour, Newsletters, Handbooks, Leaflets, Powerpoint Presentation, Websites etc

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