14. **परीक्षा शुल्क भुगतान करने की प्रक्रियाः–**

परीक्षा शुल्क जमा करने के लिए Submit To Proceed Payment Click करें। एक नया पेज खुल जायेगा जिसमें Term & Condition को टिक (√) कर Proceed बटन दबाकर आगे बढ़ें। इसके बाद Select Payment category के सामने JLACE-2022 Select करें तथा अपना Registration Number डालकर अपना परीक्षा शुल्क का भुगतान करें।

15. **पदों का विकल्प** :–

अभ्यर्थी अपनी शैक्षणिक अहर्त्ता के आधार पर इच्छानुसार किसी एक पद के लिए आवेदन समर्पित कर सकेंगे।

16. **परीक्षा का स्वरूप** :–आयोग द्वारा कम्प्यूटर आधारित परीक्षा **(CBT)** ली जायेगी। परीक्षा यदि विभिन्न समूहो में लिया जाता है तो अभ्यर्थियों के प्राप्तांक का Normalisation किया जायेगा। Normalisation का सूत्र अलग से आयोग के वेबसाईट पर प्रकाशित है। अभ्यर्थियों की मेधा सूची उनके प्राप्तांक के Normalised अंक के आधार पर तैयार किया जायेगा तथा परीक्षाफल प्रकाशन के पश्चात उन्हें Normalised अंक ही दिया जायेगा।

परीक्षा का स्वरूप निम्न प्रकार होगा :–

परीक्षा का स्वरूप एवं पाठ्यक्रम :– परीक्षा एक चरण (मुख्य परीक्षा) में ली जायेगी।

परीक्षा में सभी प्रश्न वस्तुनिष्ठ एवं बहुविकल्पीय उत्तर युक्त होंगे। सभी विषयों के प्रश्न हिन्दी एवं अंग्रेजी भाषा में होंगे।

17. **मुख्य परीक्षा** :–

मुख्य परीक्षा के लिए दो पत्र होंगे। यह परीक्षा दो पालियों में ली जायेगी। प्रत्येक पत्र के परीक्षा की अवधि 3 घंटा की होगी।

प्रश्न पत्र –1 सामान्य ज्ञान एवं हिन्दी भाषा की परीक्षा – 100 अंक

प्रश्न पत्र –2 जिस विषय में नियुक्ति होनी है उस विषय की परीक्षा – 300 अंक

(i) प्रश्न पत्र–1 में कुल 100 प्रश्न होंगे। 50 प्रश्न सामान्य ज्ञान तथा 50 प्रश्न हिन्दी भाषा से होंगे प्रत्येक प्रश्न के सही उत्तर के लिए 1 अंक दिये जायेंगे। प्रश्न पत्र–2 में कुल 150 प्रश्न होंगे। प्रत्येक प्रश्न के सही उत्तर के लिए 2 अंक दिये जायेंगे।

(ii) प्रश्न पत्र–1 अर्हक (Qualifying) प्रश्न पत्र होगा, अर्थात इसमें मात्र न्यूनतम 33 प्रतिशत अंक प्राप्त करना अनिवार्य होगा। परन्तु जिन अभ्यर्थियों द्वारा 33 प्रतिशत अंक प्राप्त नहीं किया जाता है, उनके प्रश्न पत्र–2 की उत्तर पुस्तिकाओं का मूल्यांकन नहीं किया जायेगा। प्रश्न पत्र–1 में स्नातक स्तर के प्रश्न पूछे जायेंगे। **प्रश्न पत्र–1 एवं प्रश्न पत्र–2 में गलत उत्तर के लिए अंको की कटौती नहीं की जायेगी।**

(iii) प्रश्न पत्र–2 अन्तर्गत न्यूनतम अंक 50 प्रतिशत लाना अनिवार्य होगा। अनुसूचित जाति/ अनुसूचित जनजाति के उम्मीदवार को 45 प्रतिशत अंक लाना अनिवार्य होगा।

अनिवार्य अंक अथवा इससे अधिक अंक प्राप्त करने वाले अभ्यर्थियों की एक मेधा सूची तैयार की जायेगी। यह मेधा सूची प्रयोगशाला सहायक पद पर नियुक्ति का आधार होगी। प्रश्न पत्र–2 में भी स्नातक स्तर के प्रश्न पूछे जायेंगे।

(iv) भौतिकी विषय के प्रयोगशाला सहायक के लिए प्रश्न पत्र–2 में 150 प्रश्न भौतिकी विषय से होंगे।

(v) रसायन शास्त्र विषय के प्रयोगशाला सहायक के लिए प्रश्न पत्र–2 में 150 प्रश्न रसायन शास्त्र विषय से होंगे।

(vi) जीव विज्ञान विषय के प्रयोगशाला सहायक के लिए प्रश्न पत्र–2 में 75 प्रश्न वनस्पति शास्त्र तथा 75 प्रश्न जन्तु शास्त्र विषय से होंगे।

मुख्य परीक्षा का पाठ्यक्रम

पत्र – 1 (सामान्य ज्ञान एवं हिन्दी भाषा की परीक्षा)

(क) हिन्दी भाषा ज्ञान :–

(i) हिन्दी अनुच्छेद पर आधारित प्रश्न – 25 प्रश्न

(ii) हिन्दी व्याकरण पर आधारित प्रश्न – 25 प्रश्न

इस भाग में हिन्दी अपठित अनुच्छेद (Unseen Passage) तथा हिन्दी व्याकरण पर आधारित प्रश्न रहेंगे।

(ख) सामान्य ज्ञान पर आधारित प्रश्न – 50 प्रश्न

(i) सामान्य अध्ययन :–

इस भाग में प्रश्नों का उद्देश्य अभ्यर्थी की सामान्य जानकारी तथा समाज में उनके अनुप्रयोग के सम्बन्ध में उसकी योग्यता की जाँच करना होगा। वर्तमान घटनाओं और दिन–प्रतिदिन की घटनाओं के सूक्ष्म अवलोकन तथा उनके प्रति वैज्ञानिक दृष्टिकोण जैसे मामलों की जानकारी जिसे कि किसी भी शिक्षित व्यक्ति से अपेक्षा की जातीी है। इसमें झारखण्ड, भारत और पड़ोसी देशों के संबंध में विशेष रूप से यथा संभव प्रश्न पूछे जा सकते हैं। सम–सामयिक विषय, वैज्ञानिक प्रगति, राष्ट्रीय/अंतर्राष्ट्रीय पुरस्कार, भारतीय भाषाएँ, पुस्तक, लिपि, राजधानी, मुद्रा, खेल–खिलाड़ी, महत्त्वपूर्ण घटनाएँ। भारत का इतिहास, संस्कृति, भूगोल, पर्यावरण, आर्थिक परिदृश्य, स्वतंत्रता आंदोलन, भारतीय कृषि तथा प्राकृतिक संसाधनों की प्रमुख विशेषताएँ एवं भारत का संविधान एवं राज्य व्यवस्था, देश की राजनीतिक प्रणाली, पंचायती राज, सामुदायिक विकास, पंचवर्षिय योजना।

झारखण्ड राज्य की भौगोलिक स्थिति एवं राजनीतिक स्थिति की सामान्य जानकारी।

(ii) सामान्य विज्ञानः–

सामान्य विज्ञान के प्रश्न में दिन–प्रतिदिन के अवलोकन एवं अनुभव पर आधारित विज्ञान की सामान्य समझ एवं परिबोध से संबंधित प्रश्न रहेंगे। जैसा कि एक

सुशिक्षित व्यक्ति से जिसने किसी विज्ञान विषय का विशेष अध्ययन नहीं किया हो, अपेक्षित है।

(iii) मानसिक क्षमता जाँचः–

इसमें शाब्दिक एवं गैर शाब्दिक दोनो प्रकार के प्रश्न रहेंगे। इस घटक में निम्न से संबंधित यथासंभव प्रश्न पूछे जा सकते हैं – सादृश्य, समानता एवं भिन्नता, स्थान कल्पना, समस्या समाधान, विश्लेषण, दृश्य स्मृति, विभेद, अवलोकन, संबंध अवधारणा, अंक गणितीय तर्कशक्ति, अंक गणितीय संख्या श्रृंखला एवं कूट लेखन तथा कूट व्याख्या इत्यादि।

(iv) झारखण्ड राज्य से संबंधित ज्ञानः–

झारखण्ड राज्य के भूगोल, इतिहास, सभ्यता, संस्कृति, भाषा–साहित्य, स्थान, खान खनिज, उद्योग, राष्ट्रीय आंदोलन में झारखण्ड का योगदान, विकास योजनाएँ, खेल–खिलाड़ी, व्यक्तित्त्व, नागरिक उपलब्धियाँ, राष्ट्रीय एवं अन्तर्राष्ट्रीय महत्त्व के विषय इत्यादि।

(v) कम्प्यूटर का मूल्यभूत ज्ञान :–

इसमें कम्प्यूटर के विभिन्न उपकरणों, एम॰एस॰ विन्डो ऑपरेटिंग सिस्टम, एम॰एस॰ ऑफिस एवं इंटरनेट संचालन की विधि की जानकारी से संबंधित प्रश्न पूछे जा सकते हैं।

प्रश्न पत्र–2 (संबंधित विषय की परीक्षा)

पाठ्यक्रम यथा परिशिष्ट–XI में संलग्न है।

18. मुख्य परीक्षा के आधार पर मेधा सूची का निर्माण :

(i) आयोग द्वारा आयोजित मुख्य परीक्षा के उपरांत विवरणिका की कंडिका–17 के अधीन प्रश्न पत्र 2 के विषय के प्राप्तांक के आधार पर सामान्य मेधा–सूची (Common Merit List) तैयार की जायेगी, जिसके आधार पर कोटिवार रिक्त पदों की संख्या के अनुसार अभ्यर्थियों का चयन किया जायेगा।

(ii) मेधा–सूची में एक से अधिक उम्मीदवारों के प्राप्तांक समान (Equal Marks) रहने पर मेधा का निर्धारण उम्मीदवारों की जन्म तिथि के आधार पर किया जायेगा तथा अभ्यर्थी, जिनकी उम्र ज्यादा होगी, उन्हे अपेक्षाकृत ऊपर स्थान मिलेगा। यदि एक से अधिक उम्मीदवारों के प्राप्तांक और जन्म तिथि समान पायी जाती है, तो ऐसी स्थिति में उनके स्नातक योग्यता में प्राप्त अकों के प्रतिशत के आधार पर वरीयता का निर्धारण किया जायेगा, अर्थात् स्नातक योग्यता परीक्षा में अधिक प्रतिशत अंक प्राप्त करने वाले अभ्यर्थी को मेधाक्रम में ऊपर रखा जायेगा।

(iii) मेधा के आधार पर अनारक्षित पद के लिये तैयार मेधा सूची में समान मापदंड पर आरक्षित वर्ग के अभ्यर्थी के आने की स्थिति में उक्त अभ्यर्थी की गणना अनारक्षित वर्ग के अनुमान्य पदों के विरूद्ध की जायेगी और उनके नाम के सामने उनका

आरक्षण वर्ग भी वही होगा। इस सम्बन्ध में राज्य सरकार से प्राप्त अद्यतन निर्देशों का पालन कियाजायेगा।

(iv) परीक्षा में निम्न न्यूनतम अर्हतांक से कम अंक पाने वाले अभ्यर्थियों को मेधा–सूची में शामिल नहीं किया जायेगाः–

(i)	**अनारक्षित**	**– 50 (पचास) प्रतिशत**
(ii)	**अनुसूचित जाति/अनुसूचित जनजाति**	**– 45 (पैतालीस) प्रतिशत**
(iii)	**अत्यन्त पिछड़ा वर्ग –(अनुसूची–1)**	**– 50 (पचास) प्रतिशत**
(iv)	**पिछड़ा वर्ग अनुसूची–2**	**– 50 (पचास) प्रतिशत**
(v)	**आदिम जनजाति**	**– 45 (पैंतालीस) प्रतिशत**
(vi)	**आर्थिक रूप से कमजोर वर्ग (EWS)**	**– 50 (पचास) प्रतिशत**

(v) उपर्युक्त उप कंडिकाओं के आधार पर सामान्य मेधा–सूची तैयार की जायेगी और तदुपरान्त रिक्तियों के सापेक्ष आरक्षण कोटिवार चयन सूची गठित होगी।

19. अभ्यर्थियों के प्रमाण पत्रों का सत्यापन

विवरणिका की कंडिका–18 के आधार पर मेधा–सूची प्रारूप गठित करने के पश्चात् आयोग के द्वारा अंतिम रूप से सफल अभ्यर्थियों की पात्रता/अहर्त्ता से सम्बन्धित प्रमाण पत्रों की जाँच की जायेगी।

प्रमाण पत्रों की जांच के क्रम में यदि किसी कोटि के उम्मीदवार के आवेदन पत्र में अंकित दावों का सत्यापन नहीं हो पाता है और उनकी उम्मीदवारी उक्त कोटि की रिक्ति के लिए स्थापित नहीं होती है तो ऐसी स्थिति में सम्बन्धित कोटि में रिक्त पदों के विरूद्ध मेधासूची में उपलब्धता के आलोक में निचले क्रम के उम्मीदवारों को आयोग द्वारा प्रमाण–पत्रों की जाँच के लिए आमंत्रित किया जायेगा।

20. नियुक्तिः–

(i) परीक्षा में सफलता सेवा पदों पर नियुक्ति के लिये कोई अधिकार प्रदत्त नहीं करेगा, जब तक झारखण्ड सरकार का, ऐसी जांच के पश्चात्, जो आवश्यक समझी जाय, समाधान नहीं हो जाता है कि अभ्यर्थी लोक सेवा में नियुक्ति के लिये अपने चरित्र और पूर्व वृत्त के सम्बन्ध में सभी प्रकार से उपयुक्त है।

(ii) सेवा में नियुक्तियाँ समय–समय पर कार्मिक, प्रशासनिक सुधार तथा राजभाषा विभाग, झारखण्ड सरकार द्वारा अनुसूचित जाति, अनुसूचित जनजाति, अत्यन्त पिछड़ा वर्ग (अनुसूची–1), पिछड़ा वर्ग (अनुसूची–2) तथा आर्थिक रूप से कमजोर नागरिकों के वर्ग के लिये सेवा में विशेष प्रतिनिधित्व के सम्बन्ध में आदेशों के अध्यधीन होगी।

Science (Physics) (विज्ञान भौतिकी)

Mechanics, Thermal Physics and Waves and Oscillation

Mechanics: Conservation Laws, Collisions, impact parameter, scattering cross-section, centre of mass and lab systems with transformation of physical quantities, Rutherford Scattering. Motion of a rocket under constant force field. Rotating frames of reference, Coriolis force, Motion of rigid bodies. Angular momentum, Torque and procession of a top, Gyroscope, Central forces, Motion under inverse square law. Kepler's Laws, Motion of Satellites (including geostationary). Galilean Relativity, Special Theory of Relativity, Michelson-Morley Experiment, Lorentz Transformations-addition theorem of velocities, Variation of mass with velocity, Mass-Energy equivalence. Fluid dynamics, streamlines, turbulence, Bernoullis Equation with simple applications.

Thermal Physics: Laws of thermodynamics, Entropy, Carnot's cycle, Isothermal and Adiabatic Changes, Thermodynamic Potentials Maxwell's relations. The Clausius-Clapeyren equation reversible cell, Joule-Kelvin effect etc. Fan Boltazmann Law, Kinetic Theory of Gases, Maxwell's Distribution Law of velocities, Equipartition of energy, Specific heats of gases. Mean Free path, Brownian Motion. Black Body radiation, specific heat of solid-Einstean & Dbye theories, Wein's Law, Planck's Law, Solar Constant. Thermalionization and Stellar spectra-production of law temperatures using adiabatic demagnetization and dilution refrigeration, Concept of negative temperature.

Waves and Oscillations: Oscillations, Simple harmonic motion, stationary and travelling waves, Damped harmonic motion, Forced oscillation & Resonance. Wave equation, Harmonic Solutions, Plane and Spherical waves, Superposition of waves, Phase and Group velocities, Beats. Huygen's principle, Interference.

Differaction-Fresnee and Fraunhofer. Diffraction by straight edge, Single and multiple slits. Resolving power of grating and Optical Istiments. Ravleigh Criterion. Polarization; Production and Detection of polarized light (linera, circular and elliptical). Laser sources (Helium-Neon, Ruby and semiconductor diode). Concept of

spatial and temporal coherence. Diffraction as a Fourier transformation. Fresnel and Fraunhofer diffraction by rectangular and circular apertures, Holography; theory and applications.

Electricity & Magnetism, Modern Physics and Electronics Electricity & Magnetism: Coulmb's Law, Electric field, Gauss's law, Electric potential, Possion and Laplace equations for a homogeneous dielectric, uncharged conducting Plane. Magnetic Shell Magnetic induction and field strength. Blot Savart law and applications. Electro-magnetic induction, Faraday's Lenz's laws, Self and mutual inductances. Alternating currents, L.C.R. circuits series and parallel resonance circuits, quality factor. Kirchoff's laws with application. Maxwell's equations and electromagnetic waves, Transverse nature of electromagnetic waves, Poynting vector, magnetic fields in matter- dia, para, ferro antiferro and ferri magnetism (qualitative approach only).

Modern Physics: Bohr's theory of hydrogen atom. Electron spin, Optical and X ray Spectra. Stern-Gerlach experiment and spatial quantization. Vector model of the atom, spectral terms, fine structure of spectral lines. J-J and L-S coupling, Zeeman effect, Paull's exclusion principle, spectral terms of two equivalent and non-equivalent electrons, Gross and fine structure of electronic band Spectra. Raman effect Photoelectric effect. Compton effect, debroglie waves. Wave particle duality and uncertainty principle. Schrodinger wave equation with application to (i) particle in a box, (ii) motion across a step potential, One dimensional harmonic oscillator eigen values and eigen functions. Uncertainty Principle Radio activity, Alpha, Beta and Gamma radiations. Elementary theory of the alpha decay. Nuclear binding energy. Mass Spectroscopy, Semi empirical mass formula. Nuclear fission and fusion. Elementary Reactor physics. Elementary particles and their classification. Strong and Weak Electromagnetic interactions. Particle accelerators:

Cyclotron. Leniar accelerations, Elementary ideas of Superconductivity.

Electronics: Band theory of Solids- conductors, insulators and semiconductors, Intrinsic and extrinsic semiconductors. P-N junction, Thermist Zenner diodes and transistors for rectification, amplification, oscillation modulation and detection of r.f. waves. Transistor receiver. Televtion Logic Gates.

रसायन शास्त्र (Chemistry)

1. **Atomic structure, Periodic properties and chemical bonding —** Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of Ψ and Ψ^2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of S, p, and d orbitals, Aufbau and Pauli's exclusion principles, Hund's rule, electronic configuration classification of elements as s, p, d and f-blocks.

   Periodic tables and periodic properties (atomic and ionic radii, ionization energy, electron affinity, electro-negativity) and their trends in periodic table, Their applications in chemical bonding.

   Covalen bonding. V.B. Theory, VSEPR Theory, M O. Theory, homonuclear and heteronuclear diatomic molecules, bond order and magnetic properties.

   Resonance, hydrogen bonds and vimder Waals forces. Ionic solids - Born-Haber cycle, Fajaris rule.

2. **Gaseous states —** Postulates of kinetic theory of gases, deviation from ideal behavior of van der Waal's equation of state. Critical temperature, pressure and volume. Liquification of gases, Critical constants and vander Waals constants, the law of corresponding states, reduced equation of state Molecular velocities — r:m.s. velocity, average velocity, most probable velocity. Maxwell's distribution of molecular velocities.

3. **Solid State —** Space lattice, Unit cell. Laws of crystallography. X-ray diffraction by crystals. Bragg's equation coordination number radius ratio rule, detects in crystals and their magnetic and electric behavior semi-conductors and super conductors

4. **Thermodynamics —** Law of thermodynamics, work, heat, energy. State functions — E, H, S and G and their significance criteria for chemical equilibrium and spontaneity of reactions. Variations of free energy with T, P and V Gibbs Helmhotts equation. Entropy changes in gases for reversible and irreversible processes. Hess law Bond energy.

5. **Chemical kinetics and catalysis —** Order and molecularity, chemical kinetics and its scope, rate of a reaction, factors influencing rate of reaction. Rate equations of zero, first and second order reactions. Pseudo order, half life and mean life. Determination of order of reactions. Theories of chemical kinetics — collision theory, transition state theory, Arrhenius equation, concept of activation energy, effect of temperature on rate constant.

   Catalysis, characteristics of catalysed reactions, theories of catalysis, examples.

6. **Electrochemistry —** Electronic conduction in electrolytic solutions, specific, equivalents and molar conductance, effect of dilution on them, cell constant, experimental method of determining conductance.

   Migration of ions and Kohlrausch, law. Arrhenius theory of electorlytic dissociation and its limitations, weak and strong electrolytes Ostwald's dilution law, its uses and limitations Debye - Huckel Onsager's equation (elementary treatment) Transport number - definition, determination by Hittor method.

   Galvanic cells, electrodes and electrode reactions, Nernst equation, E.M.F. of cells, Hydrogen electrode, electrochemical series, concentration cell and their applications p^H. Buffer solutions theory of buffer action,

7. **Transition and inner transition metals and complexes —** General characteristics of d-block elements, co-ordination components - nomenclature, isomerism and bonding in complexes V.B. theory and crystal field theory. Werners theory, eAN metal carbonyls, cyclopentadienys, olefin and acetylene complexes.

   Compounds with metal-metal bonds and metal atom clusters.

   General chemistry of f-block elements Lanthanides and actinides - ionic radic, separation, oxidation states, magnetic and spectral properties.

8. **Non-aqueous solvents —** Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liqued NH3 and liquid SO_2.

9. **Photochemistry —** Interaction of radiation with matter, difference between thermal and photochemical processes. Lawa of photochemistry — Grothus-Drapper law, stark-Einstein law, Jablonski diagram. Fluerescence. phosphorescence, Quantum yield Photoelectric cells.

10. **Hard and soft arids and bases —** Classification of acids and bases as hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness, symbiosis, theoretical basis of hardness and softness, symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

11. **Structure and Binding —** Hybridization, bond lengths and bind angles bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperunjugation, aromaticity, inductive and field effects, hydrogen bonding.

12. **Mechanism of organic reactions —** Homolytic and heterolytic bond breaking, types of reagents - carbocations. and nucleophiles, types of organic reactions, Reactive intermediates - Carbocations, carbanions, free radicals, carhbenes,

arynes and nitrenes (with examples) Different types of addition, substitution and elimination reactions - SN^1, SN^2, SN^i, E_1, E_2, E_{1cb} etc.

13. **Stereochemistry of Organic Compounds —** Isomerism, Optical isomerism - elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity properties of enantiomers, chiral and achiral moleculers with tar stereogenic centres, diastereomers. threo and erythro diastereomers, meso compounds, resolution of enantiomers. inversion, retention and racemizarion.

    Relative and absolute configuration requence rule, D & L and R & S nomenclature.

    Geometric isomerism: Determination of configuration of geometric isomers - E & Z nomenclature, geometric isomerism ot oximes and alecyclic compounds. Configuration and confurmation, conformations of ethane, butane and cyclohexane.

14. **Organometallic Compounds —** Organometallic compounds of Mg. Li & Zn their formation, preparation, structure and systhetic applications.

15. **Organic Synthesis via enolates —** Acidity of **α**-llydrogens, preparation, properties and synthetic applications of diethyl malonate and eithyl acctoacetate, keto-enol tautomeins.

16. **Carbohydrates —** Classification and nomenclature Monosacharides, mechanism of asazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses and ketoses, Anomers and epimers Formation of glycosides, ethers and esters Ring structure of glucose and fructose mechanism of mutarotation.

17. **Polymers —** Addition or chain growth polymerization. Free radical vingt polymerization, ionic vingl polymerizations, Ziegler - Natta polymerization and vinigl polymers. Condensation or step-growth polymerization, Polyesters, polyamider, phenol-formaldelyde resins, urea-formaldelyde resins, epoxy.resins and polyurethanes.

    Natural and synthetic rubbers. Inorganic polymeric systems - silicones and phosphazenes, nature of bonding in triphosphazenes

18. **Study of following types of organic compounds:**

a. Alkanes and cycloalkanes — Preparation of alkanes - wartz reactions Kolbe reaction, Corey - House reaction etc physical and chemical properties, free-radical halogenation of alkanes - reactivity and selectivity.

    Cycloalkanes : Nomenclature, formation, properties - Baeger's strain theory

b. Alkenes, cyclocalkenes, Diencs & Alkynes — Mechanism of dehydration of alcohols, and delydrogenation of alkyl halides, regioselectivity in alcohol dehydration. The saytzeff rule, Hofmanu elimination Mechanisn involved in hydrogenation, electrophilic and free radical additions, markownikoffs rule, kharasch effect, hydroboration - oxidation, oxymercuration - reduction, Epoxidation, Ozonolysis, hydration, hydroxyltion and oxidation with KMnOu. Polymenization.

Substitution at the allylic and vinylic positions of alkenes. Uses Dienes: Classificatin, preparation, properties Alkyness : Preparation, properties, acidic reactions of alkynes, mechanism of electrophilic and nucleophilic addition reactions, hydroboration - oxidation, metal-ammonia reductins, oxidation and polymerization.

c. Arenes and Aromaticity — Aromaticity : The Huckel rule, arematic ions, M.O. diagram, anti-aromatic, Aromatic electrophilic substitution — Mechanism, role of **σ** and **π** complexes. Mechanism of nitration, halogenters sulphonation, mercuration and Friedel Crafts reaction. Energy profile diagram, activating and deactivating substituents, orientation, ortho-para ratio. Side-chain reactions of benzene derivatives. Birch reduction.

19. Study of some reactions — Pinacol - pinacotone rearrangement, aldol reaction, perkin reaction. Cannizzaro's reaction, Mannich reaction, Clemmensen reduction, claisen rearrangement, Peimer Tiemann reaction, Friedel crafts reaction, Fries rearrangement. Reformatsky reaction.

20. Spectroscopy — Basic principles of the following type of spectroscopy and their applications in determining structures.

a. UV - Visible spectroscopy
b. IR - "
c. NMR - "
d. Mass - "
e. ESR - "(cemplexes)

SUBJECT : ZOOLOGY

A general survey, Classification and relationship of the various phyla.

Protozoa: Study of the structure, bionomica and life history of paramaecium, Monocyotis, malarial parasite, Trypanosoma and Leishmania.

Locomotion, nutrition and reproduction in protozoa.

Porifera : Canal system, skeleton and reproduction.

Coelenterata: Structure and life history of Obelia and Aurelia, polymorphism in hydrozoa, coral formation, metagenesis, phylogenetic relationship fo Cinidaria & Acnidaria.

Helminths: Structure and life history of planaria, Fasciola, Taenia & Ascaris. Parastic adaptation, Helminths in relation to man.

Anneliada : Nereis, earthworm and leech: coelom & metamerism: modes of life in polychactes.

Arthopoda: Palemon Scorpion, Cockroach, larval forms and parasitism in Crustacea, mouth part vision and respiration in arthropods, social life and metamorphosis in insects. Importance of peripatus.

Mollusea, unio Pila, Oyster culture and pearl formation, cephalopods, Torsion and Detorsion in Gastropada.

Echinodermata: General organization, larval forms and affinities of Echinodermata.

General organization and characters, outline classification and inter-relationship of protochordata, pisces, Amphibia, Reptillia, Aves and mammalia.

Neoteny and retrogressive metamorphosis.

A general study of comparative account of the various systems of vertebrates.

Pisces : Locomotion, migration and respiration in fishes: structure and affinities Dipnoi

Ambhibia: Origin o Amphibia; distribution, anatomical peculiarities and affinities of urodela and Apoda parental Care.

Reptiles: Origin of Reptiles; adaptise radiation in reptiles. Fossil reptiles; poisonous & non poisonous snakes of India; poison apparatus of snake.

Aves: Origin of birds; flightless birds; aerial adaptation and migration of birds.

Origin of mammals; homologies of ear ossicles in mammals; dentition and phylogenetic relations of protothria and Mehtatheria. Endicrine glands (Pituitary, thyroid, Parathyroid, Adrenal, Pancresa, Gonads).

Comparative anatomy of various system of vertebrates (Integument, Heart, Aortic, Arches, Kidney, Brain)

Environment : Abiotic factors and their role; Biotic factors – Intra and inter-specific relations. Biogeochemical Cycles, green house effect, ozone depletion, Eco logical succession, Biomes ecotones.

Animal : Organisation at population and community levels, ecological successions.

Ecosystem: Concept, components, fundamental operation, energy flow, biogeo-chemical cycles food chain and tophic levels.

Adaptation in fresh water, marine and terrestrial habitats.

Pollution in air, water and land.

Wild life in India and its conservation.

Sustainable production in agriculture, Integrated Pest manager.

Ehology-

General survey of various types of animal behaviour.

Role of harmones and pheromones in behavior.

Biological clock, seasonal rhythms, tidal, seasonal and circadian rhythm.

Neuro-endocrine control of behaviour.

Methods of studying animals behaviour.

Biostatistics-

Methods of sampling, frequency distribution and measures of central tendency. Standard deviation, standard error and standard deviance, correction and regression and chi-square and f-test, student t-test.

Economics Zoology-

Parasitism, commensalism & host parasite relationship.

Parasitic protozoans, helminthis and insects of man and domestic animals.

Insect pests of crops and stored products.

Benefical insects.

Pisciculture and induced breeding, Apiculture, sericulture, Lac culture, pearl culture, prawn culture.

Cell Biology Genetics, Evolution & Systematics.

Cell Biology- Structure and function of cell and cytoplasmic constituents; structure of nucleus, Plasma membrane, mitochondria golgibodies, endo-plasmic reticulum and ribosomes, cell division; mitotic spindle and chromosome movements and meiosis.

Genetics- Gene structure and function; Watson- Crick model of DNA, replication of DNA Genetic code; protein synthesis cell differentiation; sexchomosomes and sex determination.

Mendelian laws of inheritance recombinations, linkage and linkage maps, multiple, allels; mutation (natural and induced), mutation and evolution, meiosis, chromosome number and from, structural rearrangements; polyploidy; cytoplasmic inheritance, regulation of gene expression in Prokaryotes and eukaryotes; biochemical genetics, elements of human genetics; normal and abnormal karyotypes; genes and diseases. Eugenics, DNA- finger printing.

Evolution and Systematic- Origin of life, history of evolutionary thought Lamarck and his works. Darwin and his works, sources and nature of organic variation, Natural selection, hardy-weinberg law, cryptic and warning colouration mimicry; Isolation mechanisms and their role. Insular fauna. Concept of species and sub- species, principles of classification, phylogeny of horse, elephant, camel, origin and evolution of man, principles and theories of continental distribution of animals, zoogeographical realms of the world.

Bio-Chemistry, Physiology and Embryology- Biochemistry: Structure of carbohydrates, lipids, aminoacids, proteins, and nueleic acids, glycolysis and krebs cycle, oxidation and reduction, oxidative phosphorylation, energy conservation and release, ATP, cyclic AMP, saturated and unsaturated fatty acids, cholesterol, streroid, hormones; Types of enzymes, mechanism of enzyme action, immunoglobulius and immunity, vitamins and coenzymes; Hormone, their classification, biosynthesis & functions.

Physiology with special reference to mammals; composition of blood, blood groups in man coagulation, oxygen and carbondioxide transport, hemoglobin, breathing and its regulation; nephron and urine formation, acid-base balance and homeostasis, temperature regulation in man, mechanism of conduction along axon and across synapes, neurotransmitters, vision, hearing and other receptors; types of muscles, ultra structures and mechanism of contraction of skeltal, muscle; role of

salivary gland, liver, pancreas, and intestinal glands, indigestion, absorption of degested food, nutrition and balanced diot of man mechanism of action of steroid and peptide hormones, role of hypo-thalamus, pituitary thyroid, parathyroid, pancreas, adrenal, testis, ovary and pineal organs and their inter-relationships, physiology of reproduction in humans, hormonal control of development in man and insects, pheromones in insects.

Embryology: Gametogenesis, fertilization, types of eggs, cleavage, development upto gastrulating in branchiostoma, frog and chick; Fate maps of frog and chick; Metamorphosis in frog; Formation and fate of extra embryonic membranes in chick; Types of placenta in mammals, function of placenta in mammals; organisers. Regeneration, genetic control of development. Organogenesis of central nervous system, sense organs heart and kidney of vertebrate embryos. Aging and its implication in relation to man. Invastiveness of polacenta, in vitro fertilization, embryo transfer, cloning.

BOTANY

1. **Microbiology and Plant Pathology**: Viruses, bacteria, Plasmids: Structure and reproduction. General account of infection, phytoimmunology. Application of microbes in agriculture, industry, medicine and pollution control in air, soil and water. Important plant diseases in India with special reference to Jharkhand State caused by virus, bacteria, mycoplasma and fungi. Mode of infection and dissemination. Physiology of parasitism and methods of control. Myco-toxin.
2. **Cryptogams**: Range of structure and reproduction, and evolutionary aspects. Ecology and economic importance of algae, fungi bryophytes and pteridophytes.
3. **Phanerogams**: Anatomy: meristem and secondary growth. Embryology: Micro- and megasporogenesis, fertilization, endosperm, apomixis and polyembryony. Palynology and its application. Comparison of the system of classification of angiosperms. Modern trends in bio- systematics. Taxonomic and economic importance of cycadaceae, Pinaceae, Gnetaceae, Magnoliaceae, Ranunculaceae, Brassicaceaae, Rosaceaae, Leguminosae, Euphorbiaceae, Malvaceae, Dipterocarpaceae, Umbelliferae, Asclepiadaceae, Verbenaceae, Solanaceae, Rubiaceae, Cucurbitaceae, Asteraceae, Poaceae, Arecaceae (Palmae) Liliaceae, Musaceaae and Orchidaceae.
4. **Plant utility and Exploitation**: Origin of cultivated plants. Study of plant as a source of food, fodder, forage, fatty oils, wood and timber, fibre, paper, rubber, beverage, alcohol, drugs, narcotics, resin and gums, essential oils, dyes, mucilage, insecticides and pesticides, plant indicators, ornamentation; and energy plantation with special knowledge about the conservation of forests of Jharkhand.
5. **Morphogenesis**: Polarity, symmetry, Plant tissue culture technique, differentiation and dedifferentiation of cells and organs, totipotency. Factors of morphogenesis. Protoplast culture and somatic hybridization. Applications of protoplast cell, tissue and organ culture.

1. **Cell Biology**: General knowledge of modern tools and techniques in the study of cytology. Prokaryotic and eukaryotic cell-ultra-structure details. Function of the organelles including membranes. Detailed studies of cell division-Mitosis and Meiosis. Numerical and structural variation in chromosomes and its significance.

Study of polytene and lampbrush chromosome-structure, behaviour, cytological significance.

2. **Genetics and Evolution**: Development of genetics, gene concept. Mendelism, post- mendelian development, Structure and role of nucleic acids. Genetic code and regulation of gene expression. Mutation and evolution, Polyploidy and its role in evolution and plant breeding. Multiple factors, linkage and crossing over, Gene mapping, Sex chromosome and sex-linked inheritance. Male Sterility, its significance in plant breeding. Cytoplasmic inheritance, Elements of human genetics. Transgenesis, genetic engineering, organic evolution-evidences, mechanism and theories. Plant genetic resources and their conservation.
3. **Physiology and Biochemistry**: Detailed studies of plant, soil, and water relations. Mineral nutrition and ion transport. Mineral deficiences. Photosynthesis. mechanism and importance. Photosystem I and II, photorespiration. Respiration and fermentation. Nitrogen fixation and nitrogen metabolism. Protein synthesis. Enzymes, importance of secondary metabolites. Phytochromes. Physiology of flowering. Growth substances, their chemical nature and application in agriculture and horticulture. Agrochemicals. Stress physiology, dormancy, storage and germination of seeds.

   Ecology: Ecological factors, concepts and dynamics of community. Plant succession. Concept of biosphere, Conservation of ecosystem. Pollution and its control. Forest types of India. Afforestation, deforestation, social forestry, and endagered endemic plant with special reference to Jharkhand.