# TRIPURA BOARD OF JOINT ENTRANCE EXAMINATION

Syllabi of
*Tripura Joint Entrance Examination*

For admission to
**Engineering, Medical, Technological**
**&**
**other professional degree courses**

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Tripura Board of Joint Entrance Examination

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**TRIPURA BOARD OF JOINT ENTRANCE EXAMINATION**
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# FOREWORD

This booklet contains the updated syllabi of Tripura Joint Entrance Examination for 2008 onwards, to be conducted by the Tripura Board of Joint Entrance Examination for admission to Engineering, Medical and other Professional Degree courses in Institutions both inside and outside the state of Tripura. This has been done in consultation with experienced teachers of schools, colleges and University of the state.

While undertaking this task, the experts considered the prescribed syllabi of different national level examinations as well as the curriculum of different Boards, maintaining the basic framework of syllabus adopted by Tripura Board of Secondary Education.

The syllabi have been validated in a workshop participated by subject teachers of different schools under State Board.

The Government of Tripura vide notification No.F.2(358)-DHE/GTCA/ 01(L) dt 19.09.07 has approved the new syllabi and also approved the new Pattern of Question paper vide Notification No.F.2(362)-DHE/GTCA/2011(L-2)/3381(12) dated, Agartala, the 5th January, 2012 etc. for the subjects Physics, Chemistry, Mathematics and Biology of the Tripura Joint Entrance Examination which has been followed by the Board for conducting examination.

Date: 8th January, 2013

Dr. R. Debnath
(Chairman)
TBJEE

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# TRIPURA BOARD OF JOINT ENTRANCE EXAMINATION
## SYLLABUS FOR PHYSICS
### Full Marks - 100
### Each Module Carries 10 marks

## MODULE - 1

Unit of measurement, System of units, S.I. units, Fundamental and derived units, Dimensional Analysis.

Composition and resolution of vectors, Rectangular components in two & three dimensions, Unit vector, Representation of vectors in term of co-ordinates, Addition & Subtraction of vectors, Multiplication of vectors - scalar product & vector product.

Uniformaly accelerated motion, Velocity - time graph Position-time graph, Kinematical equations in one dimension.

Centre of mass, Centre of gravity, Conditions of equilibrium of a system of forces, Moment of a force about a point and an axis, couple, torque.

Newton's laws of motion, Inertial fraame, Impulse & impulsive forces. Conservation of linear momentum, Static and kinetic friction, Projectile motion.

Rotational motion of a particle, Angular momentum and conservation of angular momentum, Moment of inertia, Relation between Torque, Angular momentum, Moment of inertia & Angular acceleration, Rotational kinetic energy, Centripetal force & centrifugal force.

Work, energy & power ; Conservative and non-conservative force ; Elastic collision in one dimension.

## MODULE - 2

Laws of gravitation, Gravitational field & potential ; Acceleration due to gravity and its variation with altitude, depth & rotation of earth ; Escape velocity, Kepler's laws of planetary motion (rigorous proof is not required), Geostationary satellite.

Elasticity, Elastic behaviour, Hooke's Law of elasticity, Elastic module, Poisson's ratio, Elastic Energy.

Pascal's law, Principle of multiplication of thrust & its application, Hydraulic press. Archimedes' principle and its application, Atmospheric pressure, Torricelli's Expt., Fortin's Barometer.

Surface energy and surface tension, Capillarity, Streamline and turbulent motion, Newton's law of viscous force, Coefficient of viscosity, Stoke's law, Terminal velocity, Bernoulli's Principle (statement only) and its simple application.

## MODULE - 3

Simple Harmonic Motion, Differential equation of S.H.M. & its solution, Energy in S.H.M.,Time period of simple pendulum, Superposition of two S.H.M.,'s (analytical treatment), Free, forced & damped vibrations (qualitative idea only), Resonance.
Elastic waves - longitudinal and transverse waves, Progressive waves.

Superposition of waves : beats ; stationary waves - vibration of strings & air columns.

Doppler effect in sound propagation (effect of medium excluded), Sound wave as longitudinal elastic wave, Velocity of sound wave, Newton's formula and Laplace's correction, Dependence of velocity of sound in a medium on temperature, pressure, density and humidity.

## MODULE - 4

Thermal expansion of solids, Relation among coefficients of linear, superficial and cubical expansion of solids, Applications of expansion of solids, Thermal expansion of liquids, Relation between expansion coefficients.

Colorimetry, Change of state, Latent heat.

Conduction, convection and radiation, Thermal conductivity, Thermometric conductivity, Black body ratiation, Stefan's law, Newton's law of cooling (statement and qualitative explanation only.)

Mean free path, Mean, rms speed and most probable speed, Pressure of an ideal gas ; Charle's law, Boyle's law, Avogadro's law & pressure law from Kinetic theory of gases, Kinetic energy of molecules, Kinetic interpretation of temperature.

First law of Thermodynamics, Thermodynamic variables, Isothermal and Adiabatic expansions of gases, reversible and irreversible processes, Specific heats of gases at constant pressure and at constant volume and relation between them.

# MODULE - 5

Reflection of light,Spherical mirrors, Mirror formula,linear magnification (formula).

Refraction at plane surface, Total internal reflection,Critical angle, Relation between refractive index and critical angle, optical fibre, Total reflecting prism, Refraction and dispersion of light through prism.

Thin lenses - concave and convex, lens formula, power of a lens, lens maker's formula (deduction is not required), two thin lenses in contact.

Simple and compound microscope, Astronomical telescope (simple construction as a combination of coaxial lenses and ray diagram showing final image formation) Magnifying power. Human eye - defects of vision and corrections.

Wave front and Huygen's principle, Reflection and Refraction of a plane wave front at a plane surface on the basis of Huygen's Principle, Interference of light. Young's double slit experiment and expression for fringe width, coherent sources.

# MODULE - 6

Coulomb's law in electrostatics, Electric field intensity and potential and their relation, Electric dipole, Electric field due to a dipole, Dipole moment, Electric flux, Gauss' theorem in electrostatics (statement only) and its application to find electric field intensity due to uniformly charged infinitely long thin straight wire and uniformly charged thin spherical shell (field inside & outside).

Capacitance, Principle of capacitor, Capacitance of parallel plate capacitor, series & parallel combination of capacitors, energy stored in capacitor, sharing of charges & loss of energy.

Coulomb's law in magnetism, Magnetic field intensity due to a magnetic dipole (short bar magnet) at a point on its axis and on the perpendicular bisector of the axis ; Torque on a magnetic dipole in a uniform magnetic field, Current loop as a magnetic dipole and magnetic dipole moment.

Properties of magnetic material, permeability & susceptibility, dia, para & ferromagnetic materials & their uses. Magnetic field of earth, Elements of the earth's magnetic field.

# MODULE - 7

Drift velocity and mobility of charge carrier throughmetallic conductor and their relation with electric current, Ohm's law, Resistance of conductor, Factors influencing resistance, Temperature coefficient of resistance, Resistivity, Combination of resistors, Internal resistance of a cell and circuit equation, Combinations of cells.

Kirchhoff's law and simple applications, Wheatstone bridge principle, Meter bridge (with application for the determination of unknown resistance), Principle and applications of potentiometer.

Joule's law on heating effect of current, Electrical method of determination of 'J', electric power, B.O.T. unit of electrical energy.

Thermocouple, Thermo-emf, E-T graph, Neutral temp.,Temp. of inversion, Seebeck effect, Peltier effect.

# MODULE - 8

Magnetic effect of current, Biot - Savart law and its application to current carrying circular loop, Ampere's circuital law and its application to infinitely long straight wire, Straight and toroidal solenoids, Force on a moving charge in uniform electric field and magnetic field, Lorentz force.

Force between two straight parallel current carrying conductors -

definition of ampere, Fleming's left hand rule, Torque experienced by a current carrying loop in a   uniform magnetic field, Moving coil galvanometer,Conversion of a galvanometer into ammeter and voltmeter.

Faraday's laws of electromagnetic induction, Lenz's law, Self and mutual induction, Fleming's right hand rule,  Alternating current (basic concept), Peak and rms value of alternating current/voltage.

Qualitative idea of electromagnetic waves and its spectrum.

# MODULE - 9

Bohr's theory of hydrogen like atom, Hydrogen spectrum, Photo electric effect, Einstein's photo electric equation, Explanation of laws of Photo electric  emission, Photo electric cell, Wave - particle duality, deBroglie's hypothesis.

Radioactivity ; alpha, beta & gamma rays and their properties, Radioactive decay law, Decay constant, half life & mean life, Radioisotope and their uses.

# MODULE - 10

Distinction between metals (conductors), semiconductors & insulators in terms of energy bands in slids, Intrinsic and Extrinsic semiconductors, p-n Junction diode,semiconductor diode rectifiers, p-n-p and n-p-n  Transistors, Common Emitter Transistor  Characteristics.

Logic Gates - OR gate, AND gate & NOT gate.

Constituents of atomic nucleus, Mass defect, Binding energy, Mass energy equivalence, Nuclear fission, Chain reaction, Nuclear reactor - Principle of operation, Nuclear fusion, Thermo nuclear fusion as the source of energy in Sun and Stars.

# MODULE - 1

## A. Atomic structure :
Concept of nuclear atom : Electron, Proton and Neutron, atomic number ; Rutherford's model and its  limitations. Extra nuclear structure, line spectrum of  hydrogen atom ; quantization of energy (Planck's equation = $h_v$), Bohr model of atom and its limitations, Sommerfeld's modification (elementary idea), the four quantum numbers, ground state electronic configurations of many electron atoms and mono atomic ions, the Aufbau principle, Pauli's exclusion principle and Hund's Rule, Dual nature of electron, the concept of atomic orbitals, shapes of S, P and d-orbitals (Pictorial Approach)

## B. Radioactivity and Nuclear Chemistry :
Natural Radioactivity alpha, beta, gamma - rays and their properties, rate of radioactive decay, decay constant and half-line period of radio elements, Numerical Problems, Artificial radioactivity, Nuclear reactions, stability of atomic nucleus, effect of neutron - proton (n/p) ratio on the modes of decay, group displacement law, radio isotopes and their uses ( $_6C^{14}$, $_{15}P^{32}$ and $_{53}I^{137}$ as examples ), isobars and isotones, Nuclear fission and fusion reactions.

## C. The Periodic table and Chemical families :
Morn periodic law, Modern periodic table based onelectronic configurations, groups and periods, types of elements : Representative (s and p-block) elements, transition (d-block) elements and inner transition (f-block) elements (lanthanides and actinides) and their general characteristics, periodic trends in physical and chemical properties - atomic radii, Valency, ionization energy, electron affinity, metallic character, acidic and basic   characters of oxides and hydrides of the representative elements (upto $Z = 36$), position of hydrogen and noble gases in the periodic table, Diagonal relationships.

# MODULE - 2

## A. Chemical Bonding and Molecular Structure :

Valence electrons, the octet rule, Electrovalent, convalent and coordinate convalent bonds with examples, properties of electrovalent, covalent and co-ordinate covalent compounds, limitations of octet rule (examples), Fajan's rule.

Directionality of covalent bonds, shapes of polyatomic molecules (examples). Concept of hybridization of atomic orbitals involving s.p and d orbitals.

Molecular Orbital energy diagrams for homonuclear diatomic species - bond order and magnetic properties, Valence shell electron pair Repulsion (VSEPR) concept, (elementary idea) - shapes of molecules, concept of resonance (elementary idea), resonance structure (examples), Elementary idea about electronegativity, bond polarity and dipolemoment, Hydrogen bonding and its effect on physical properties (M.P., B.P. and Solubility).

Double and complex salts, Werner's Co-ordination compounds (examples only), co-ordination number and geometry (example with CN 4 and 6 only), IUPAC nomenclaature of mono nuclear co-ordination complexes (examples).

## B. Chemical Energetics and Chemical Dynamics :

**Some basic concepts of Thermodynamics :** System, Sorroundings, Types of system, types of processes, intensive and extensive properties, state functions, irreversible process, internal energy, enthalpy, work, heat capacity specific heat capacity, molar heat capacity, enthalpy changes during phase transitions, Enthalpy change in chemical reactions, standard enthalpy of formation, Hess's law and its applications, bond enthalpy, measurement of enthalpy of reactions, energy of combustion reactions, conservation of energy and the first law of thermodynamics, Mathematical form of First law of thermodynamics, Numerical problems.

Spontaneity of a process, entropy, the second law of thermodynamics, elementary idea about entropy change ($\Delta S$) and free energy change ($\Delta G$), significance of the relation ; $\Delta G = \Delta H - T\Delta S$ (without derivation), example with gaseous reaction, Numerical problems.

## Chemical Dynamics :

Dependence of reaction rates with concentration, pressure, temperature, catalyst, size of particles etc.concept of energy barrier and activation energy.

Order and molecularity of reactions (determination excluded), First order reaction, specific rate constant, half life period, numerical problems, examples of first order, pseudo first order and second order reactions.

# MODULE - 3

## A. Gaseous State :

Measurable properties of gases, Boyle's Law and Charle's Law, absolute scale of temperature, ideal gas equation, PV = nRT, Dalton's Law of partial pressure, Graham's Law of diffusion, Derivation from ideal behaviour, Liquifaction of gases, real gases, Vander waal's equation, Numerical problems.

## B. Chemical Equilibria, Ionic Equilibria and Redox Equilibria :

**Chemical Equilibria :** The law of mass action, dynamaic nature of chemical equilibrium, equilibrium constant (K), Le Chatelier's principle, Equilibrium constants of Gaseous reactions (Kp and Kc) and relation between them (examples).

**Ionic Equilibria :** Ionization of weak electrolytes, Ostwald's dilution law, Ionization constants of weak acids and bases, ionic product of water, the PH - scale, PH of aqueous solutions of acids and bases, Buffer solutions, buffer action and Henderson equation, acid - base titrations, acid - base indicators (structures non evaluative), solubility and solubility product, common ion effect (examples), Numerical problems.

**Redox Equilibria :** Oxidation - Reduction reactions as electron transfer processes, oxidation numbers, balancing of chemical equations of redox reactions by oxidation number and ion - electron methods.

Standard Electrode potentials ($E^0$), Nernst equation and its applications, Electrochemical series, feasibility of a redox reacction, significance of Gibb's equation $\Delta G^0 = nF \Delta E^0$ (without derivation), e.m.f.

of galvanic cells (examples), stoichiometry of redox reactions, redox titration's (examples), Numerical problems.

# MODULE - 4

## A. Atoms, molecules and Chemical Arithmetic :

Definition of atomic weight on hydrogen scale, oxygen scale and carbon scale, physical and chemical atomic weight, Avogadro's hypothesis and its application for deduction of $M = 2D$ and molar volume of ideal gases at STP, Mole concept, weight - weight - volume calculations, Eudiometry, Percentage Composition, empirical formula and molecular formula, Equivalent weight of elements, radicals and compounds (No experimental determination required), E V A relations, Law of reciprocal proportion and Law of equivalent weight, Numerical Problems.

## B. Chmistry of Solutions :

**Non-electrolytic solutions -** Types of solution, strength of solution in terms of normality, molarity, molality, Mole fraction and formality, vapour pressure of solutions, Raoults Law, colligative properties - Relative lowering of vapour pressure, elevation of boiling point, depression of freezing point, Osmotic pressure and their relationship with molecular mass (without derivation), Numerical Problems.

**Colloidal Solution :**
Differences from true solutions, Hydrophobic and Hydrophilic colloids (examples, Preparation, properties and uses), coagulation and peptization of colloids, dialysis and its applications, Brownian motion, Tyndall effect and its applications, electrical properties, Protection of colloids and protective colloids, gold number, Elementary idea of emulsion, surfactant and micelle.

**Electrolytic Solutions :**
Electrolysis and electrolytic cell, factors influencing electrolysis, examples of electrolysis of few aqueous solutions of different strength (NaCl, $H_2SO_4$, $CuSO_4$ and $AgNO_3$ ) by using different suitable electrodes, Faraday's laws of electrolysis, relationship between electrochemical equivalent and chemical equivalent, Definition of Faraday's from Faraday's first and second laws, Relationship between e, F and

N. Determination of charge of electron from Faraday's law, Electrolytic conduction, Conductance, Specific condutance, equivalent conductance and ionic conductance, Molar conductance, Kohlrausch's law and its application, Numerical Problems.

# MODULE - 5

## A. Chemistry of Non-Metallic Elements and their compounds :

i) **Carabon :** Allotropes of Carb on-Diamond, graphite, Fullerene. Preparation, properties and uses of CO and $CO_2$, carbonate-bicarbonate fuffer systems.

ii) **Nitrogen and Phosphorus :** Occurance, isotopes, iisolation from natural source and purification, reactivity of the free element, Preparation, properties andm reaction of $PH_3$, $N_2O$, NO, $NO_2$, $HNO_2$, $HNO_3$, $P_4O_6$, $P_4O_{10}$, $H_3PO_3$, and $H_3PO_4$, $NH_3$.

iii) **Sulphur and Oxygen :** Occurance, isotopes, allotropic forms and isolation from natural sources and purification, properties and reactions of free element, $H_2O$ : unusal properties of water, heavy water (Production and uses) $H_2O_2$ and $O_3$ - their preparation, purification, Properties, reactions and uses. $SO_2$ and $H_2SO_4$: Preparation, Properties reactions and uses.

$H_2S$ : reaactions with oxidising agents, use of $H_2S$ as reagent in qualitative inorganic analysis.

iv) **Halogen Family :** Occurance, Principle of preparation, physical states and Chemical reactivity of the free elements, peculiarities of fluorine and iodine, hydracids of halogen (preparation, properties, reactions and uses), interhalogen compounds (examples).

## B. Chemistry in Industry :

Large scale production (including physico-chemical principles where applicable omitting technical details and uses of individual items).

i) **Heavy Chemicals :** Sulphuric acid (contact process), Ammonia (Haber's process), Nitric acid (ostwald's process), Sodium bicarbonate and sodium Carbon ate (Solvay process).

ii) **Electro chemicals :** Sodium hydroxide and Chlorine.

iii) **Fuel Gases :** Coal Gas, Water Gas, LPG, LNG and CNG.

iv) **Firtilizer :** Urea, Nitrolim, Ammonium sulphate, Super phosphate of lime.

# MODULE - 6

## A. Chemistry of Metallic elements and their compounds :

**General principles of metallurgy :** Occurance,concentration of ores, extraaction and purification of metals, minerals wealth of India.

**Typical Members :** Na, Ca, Al, Fe, Cu, Zn - occurance, extraction, purification (where applicable), properties and reactions. Manufacture of steels and alloy steel (Bessemer, open - Hearth and L D process). Principles of chemistry involved in electroplating, anodizing and galvanizing.

**Metals of Life :** Biological roles of $Na^+$, $K^+$, $Mg^{2+}$, $Ca^{2+}$ $Fe^{2+}$, $Fe^{3+}$, $Cu^{2+}$, and $Zn^{2+}$ (elementary idea), mioglobin haemocyanin, chlorophyll (metal ion present and biofunction to be mentioned, structure - non evaluative).

**Compounds of metals :** Principles of preparation, properties and uses of Bleaching powder, Plaster of paris, Epsom salt, Copper sulphate, Aluminium Chloride, Comon alum.

**B. Cement :** Composition and setting of portland cement.

# MODULE - 7

## A. Chemistry of Organaic Compound :

Unique nature of carbon atom - catenation, tetravalency of carbon, Hybridization of orbitals, Modern concept of sigma and Pi-bond, classification of organaic compounds, Nomenclatuare of organic compounds (IUPAC name and trivial name), Homologous series, isomerism (structural), steric hindrance, inductive effect, resonance hyperconjugation.

**Organaic reaactions :** Addition, substitution, elemination, rearrangement, Fission of a covalent bond, free radicals, electrophiles, nucleophiles, carbocations, carbanions.

## B. Hydrocarbons :

**Classification of hydrocarbons** : Alkane-general methods of preparation and general properties with reactions.

**Methane and ethane :** Principle of preparation, properties and uses.

**Alkene and Alkynes :** General method of preparation, general properties with reactions. Saytzeff rule.

**Ethylene :** Principle of preparation, properties, Marcownikoffs rule, Peroxide effect, ozonolysis, test of unsaturation and uses.

**Actylene :** Principle of preparation, properties, Acidic character, test and uses.

## C. Aromatic hydrocarbon :

o, m, p isomers, Nucleus and side chain, Aromaticity. Benzene and its homologoues : Coal tar distillation and isolation of benzene, substitution reaction (chlorination, nitration,sulfonation and Friedalcraft's reaction), ozonolysis, Dirtive influence of substituents (examples).

Toluene and its o, m, p, substituted derivaties, chlorination (hydrolysis of chlorinated products indluded), side chain oxidations.

## D. Organic Compounds Containing halogens (Haloalkanes and Haloarenes) :

General method of preparation, properties and reactions, haloform reaction, chloroform and Iodoform, carbylamine reaction, Chlorobenzene, (preparation, properties and uses).

Preparation of Grignard reagents and their synthetic applications.

# MODULE - 8

## Organic compounds containing Oxygen :

General methods of preparation, Large scale production, Properties, reactions, uses of individual compounds included in the syllabus and problem based on stoichiometry, structure, physical and chemical properties, reactions of functional groups.

**Alcohols :** Methanol and ethanol (from fermentation). Ether : Diethlyether. Aldehydes and ketones : Formaldehyde, acetaldehyde and acetone.

**Carboxylic acids and their derivatives :** Formic acids, acetic acid and oxalic acid, acetyl chloride, acetic anhydride, acetamide, Ethyl acetate.

Phenol, Benzaldehyde, benzoic acid, salicylic acid, anthranilic acid, Acidity of carbozylic acid and phenol, effect of substitutents on the acidity of carboxylic acid.

# MODULE - 9

## A. Organic compounds containing nitrogen :

Cyanides and Isocyanides - General methods of preparation, chemical properties, comparison.

**Nitrobenzene :** Preparation from benzene, diazonium salts, aniline properties reaction, halogenation, nitration, sulphonation.

**Amines :** Classification, isomerism, general methods of preparation, properties with reactions, distinction and basicity of amines.

Methyl amine, Ethyl amine, Aniline - preparations, properties, reactions and uses. Diazonium chloride - preparation, reaction and synthetic application.

**B. Polymer :** Classification of polymers, natural and synthetic polymers (with stress on their general methods of preparation) and important uses of the following.

Polythene, Nylon-66, Teflon, PVC, Rubber from natural sources including Vulcanization.

## C. Introduction of Biomolecules :

**Carbohydrates :** Pentoses and Hexoses ; Distinctive chemical reaction of glucose, Amino acids : glycine, alanine, aspartic acid, cysteine (structure), Zwitterion structures of amino acids, Peptide bond, ADP and ATP - structure and role in bioenergeties. Nucleic acids - DNA and RNA.

# MODULE - 10

## A. Environmental Chemistry :

Chemical nature of air, water and soil and their role in environment, common modes of pollution of air, water and soil, importance of ozone layer, reactions causing ozone layer depletion, Green house effect, smog, pollution of water by domestic and industrial effluents, pollutants - pesticides, fertilizers and plastic.

## B. Application Oriented Chemistry :

Main ingredients, their chemical natures (structures not required) and their side effects, if any, of common antiseptics, analgesics, antacids, pain killers, Vitamin C.

Technical/Domestic/Medicinal uses of Chemicals :

Baking powder, Calcium lactate, Boric acid, Borax, Zinc sulphate, oil of wintergreen, Carbolic acid.

## C. Principles of qualitative analysis :

Detection of water soluble non-interferring acid and basic radicals by dry and wet tests from among :

a)    Acid Radicals : $Cl^-$, $S^{2-}$, $SO_4^{2-}$, $NO_3^-$, $Co_3^{2-}$

b)    Basic Radicals : $Cu^{2+}$, $Al^{3+}$, $Fe^{2+}$, $Fe^{3+}$, $Zn^{2+}$, $Mg^{2+}$, $Na^+$, $NH_4^+$

Detection of special elements (N, Cl, Br, I and S) in organic compounds by chemical tests, Identification of functional groups in : phenol, aromatic amines, aldehydes, ketones and carboxylic acids.

# MODULE - 1

**Principle of Mathematical Induction (PMI) :**

Statement of the principle of divisibility, summation and inequality by using P M I, Simple applications.

**Arithmetic, geometric and harmonic progressions :**

Arithmetic, geometric and harmonic means and relation among them, sum to first n terms of an arithmetic, geometric and arithmetic-geometric series, simple applications.

**Theory of quadratic equations :**

Its rational, irrational and complex roots, relation between roots and coefficients of a quadratic equation, nature of roots, formation of quadratic equation, symmetric functions of the roots, quadratic expression, its maximum and minimum values. Simple applications.

**Complex numbers :**

Its real and imaginary parts, polar form and conjugate of a complex number, Argand diagram, cube roots of unity, triangle inequality, simple problems.

**Permutation and combination :**

Fundamental theorem of counting, permutation as arrangement and combination as selection. Permutation and combination of like and unlike things. Circular permutation is to be excluded. Simple applications

# MODULE - 2

**Binomial Theorem :**

Binomial theorem for a positive integral index, general term, middle term (terms), equidistant terms, simple applications.

**Infinite series :**

Infinite geometric series, Binomial theorem for fractional and negative index, exponential series, logarithmic series, simple applications

**Matrices and deterinants :**

Matrices upto third order, addition, subtraction, scalar multiplication and multiplication of matrices.

Determinants upto third order, Properties of deterinants, Minors and confactors, application of determinants for evaluation of area of a triangle and solution of a system of linear equations by using Cramer's rule.

Inverse of a 2 X 2 matrix, simple applications.

**Probability Theory :**

Random experiment and their outcomes, events, sample space, equally likely, mutually exclusive and exhaustive cases, classical definition of probability, addition and multiplication theorems. Simple applications.

# MODULE - 3

Trigonometric ratios of associated angles, compound angles, multiple and submultiple angles, conditional identities, general solution of trigonometric equations, inverse circular functions. Simple applications.

# MODULE - 4

**Properties of triangles :**

Sine, Cosine, Tangent rules, formulae for semi angels, expression for area of a triangle, circum radius.

**Co-ordinate geometry :**

Cartesian & Polar co-ordinates, relation between them, distance between two points, section ratio, co-ordinates of centroid and incentre of a triangle, area of the triangle, idea of loci, equations of straight

line in different forms, angle between two straight lines, condition of perpendicularity & parallelism, position of a point with respect to a straight line, distance of a point from a straight line. Simple applications.

# MODULE - 5

**Circle :**

Equation of a circle, its centre and ratius, equation of circle in general form, equation of a circle interms of end points of a diameter, length of intercept on a circle by a straight line.

**Conics :**

Idea of a conic, equation of parabola, ellipse, hyperbola in standard form, focus, directrix, chord, elementary properties, Parametric representation of conics. Simple applications.

# MODULE - 6

**Differential calculus :**

Concept of a function, different kinds of functions, domain and range of a function, geometrical representation of a function.

Concept of limit of a function at a point, right and left hand limits. Evaluation of limits using standard limits and not by using L-Hospital's Theorem.

Concept of continuity of a function (i) at a point, (ii) in an interval, Idea of discontinuity, removable discontinuity, height of the jump. Determination of continuity of a function graphically and analytically. Concept of derivative of a function at a point, derivative from first principle, first and second order derivative of a function. Simple applications.

# MODULE - 7

**Integral calculus :**

Integration as an inverse of differentiation, integration by substitution and by parts, integration by partial fraaction, simple integrals of

the type :

$$\int \frac{dx}{a^2 \pm x^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{ax^2 + bx + c},$$

$$\int \frac{dx}{\sqrt{ax^2 + bx + c}}, \int (px + q)\sqrt{ax^2 + bx + c}\, dx, \int \frac{(px + q)dx}{\sqrt{ax^2 + bx + c}}$$

$$\int \frac{dx}{(ax + b)\sqrt{1x + m}}, \int \frac{dx}{(ax + b)\sqrt{1x^2 + mn + n}}, \int \sqrt{\frac{ax + b}{cx + d}}\, dx$$

$$\int \frac{dx}{(ax^2 + bx + c)\sqrt{1x^2 + mx + n}}, \int \frac{dx}{(ax^2 + b)\sqrt{1x^2 + m}}$$

# MODULE - 8

**Definite integral :**

Definite integral as the limit of a sum, geometrical meaning of a definite integral, properties of definite integral, fundamental theorem of integral calculus. Evalution of definite integrals.

**Differential Equation :**

Genesis of differential equation, meaning of solution of differential equation, solution of differential equation of 1st order by variable seperable method, homogeneous differential equation of 1st order, solution of equation of the type

$$\frac{d^2 y}{dx^2} = f(x).$$ Simple applications.

# MODULE - 9

**Significanace of** $\dfrac{dy}{dx}$ :

**Derivative as a rate measure.**
**Calculation of approximate value and error.**

**Increasing and decreasing functions.**
**Tangents and normals.**

**Maxima and minima :**

Determination of maxima and minima of a function by using (i) first order derivative only, (ii) first and second order derivatives.

**Determination of area :**

Calculation of area of a closed region. Simple applications.

# MODULE - 10

**Relations & Mapping :**

Ordered pair, Cartesian product of sets, relation - different types of relations, different types of mappings.

**Vectors :**

Idea of vectors - addition and subtraction of vectors, scalar multiplication of a vector, triangle law, Position vector of a point dividing a line segment in a given ratio, dot and cross product of vectors, projection of a vector on another vector, application of vectors in geometry.Simple application.

**TRIPURA BOARD OF JOINT ENTRANCE EXAMINATION**
**SYLLABUS FOR BIOLOGY**
**Full Marks - 100**
**Each Module Carries 10 marks**

## MODULE - 1

a) Tools (Compound microscope & Electron microscope - Magnification & Resolving power) - Brief idea Technique (cell fractionation & Tracer Techniques) - brief idea. Principle & use of $^{32}P$, $^{14}C$.

b) Definition of Prokaryotic & Eukaryotic cells with example and comparison between them.

c) Structural organization of eukaryotic cells with special reference to i) Nucleus ii) Mitochondria iii) Chloroplast iv) Ribosome v) Lysosome vi) Endoplasmic reticulum vii) Golgi complex viii) Centrosome ix) Cell wall & plasma membrance (Fluid Mosaic Model) & x) Ergastic substances.

d) Cell function :

i) Physico-Chemical Diffusion, Osmosis, Plasmolysis, water & ion-absorption. ii) Cell reproduction - Cell cycle with a brief idea of its control & regulation. Cell division - Mitosis & Meiosis (with special reference to prophase - I).

## MODULE - 2

a) Photosynthesis (Major photosynthetic pigments, Dark and light reactions, basic idea of bacterial photosynthesis $C_3$, $C_4$ & CAM pathways).

b) Basic mode of plant nutrition (only types). Basic constituents of food and their nutritional significances Vitamins - (chemical names, dietary sources and dificiency symptoms), Provitamins, Pseudovitamins and Antivitamins.

Carbohydrates, Proteins and fats (classification with example)

c) Enzymes - its characteristics, classification with example, Mechanism of action, Allosterism and Regulation.

d) Basal metabolism and BMR, Elementary idea about metabolic pathways (glycogenesis, glycogenolysis, gluconeogenesis, glycolysis and Kreb's cycle. Beta oxidation of fatty acid, ketone body formation & its significance, deamination and transamination with their significances). Ornithin cycle (Flow sheet only).

## MODULE - 3

a) Toxonomy & classification - Definition and importance of taxonomy, Basic concept of classification, Binomial nomenclature, species concept & role of reproductive isolation in speciation.

b) Concepts of Biodiversity - Definition, Species and Ecosystem biodiversity (Elementary idea), Five kingdoms classification (only distinctive characters). Salient features of major animal phyla with common examples. Classification of

Chordata (upto class) with distinctive characters only. Important Botanical gardens, Zoological parks & Museum of India.

c) Population Biology - Concept of population growth (logistic and exponential) and population control.

d) Spcial physiology - Mental health, Tobacco smoking and chewing, Alcoholism, Drug addiction & Global immunization.

## MODULE - 4

a) Viruses and Becteria - Definition, Characterization, Classification, Size and shape, General organization & Reproduction. Structure of bacteriophage, TMV, Influenza virus & E. coli (Typical bacterium). Staining of bacteria. Impotance of both virus & bacteria. Biotechnological Application of microbes (Agricultural-Nitrogen fixing bacteria, Bio-fertilizer and Bio-pesticide, Industrial - Curd, Tanning, Brewery, Antibiotics & Vitamin - C).

b) Plant breeding - Definition, Hybridization technique Emasculation. Importance of plant breeding.

c) Immunology - A brief idea of Antigen and Antibody, elementary idea of inherited, acquired, humoral cell medicated immunity. Active and passive immunity.

## MODULE - 5

a) **Evolution -** Oparin and Haldane concept on origin of life, Miller's experiment,  Evidences of evolution - Morphologi-

cal, Embryological and palaentological. Modern concept of natuaral selection. Human evolution - an outline.

b) **Ecosystem -** Its components, food chain, food web, Energy flow and food pyramids, Concepts of biosphere, Autoecology & synecology. Byogeochemical cycles with reference to Carbon, Nitrogen and Oxygen.

c) **Conservation -** Its concept, Renewable & Non-renewable resources, Conservation of soil &  water, Conservation of forest & wild life. Concepts of endangered species with some examples. Red data book, Green data book.

d) **Environmental pollution  -** Air, Water, Noise and Radioactive pollution, probable control strategies, Biomagnification. Green house effect, BOD, COD, Acid rain, Ozone hole & Global warming.

## MODULE - 6

a) **Economically important plants** - (Mention uses of edible parts only). Algae - Spirulina, Fungi - Mushroom, Bryophyta - Sphagnum, Pteridophyta - Marselia, Gymnosperm - Pinus, Monocot - Bamboo, Dicot - Jute and lemon.

b) **Economic zoology** - Poultry (types of poultry birds, high yielding poultry birds). Sericulture (definition of silk, types of silk and silk moth, voltinism and diapause, silk gland, disease of silk worm), Apiculture (types of honey bee, composition and uses of honey).

c) **Medical zoology** - outline idea of disease, their causative organism, mode of infection, symptoms and preventive mea-

sures of i) Malaria ii) Filaria iii) Ascariasis iv) Taeniasis. Distinguishing features of Culex, Anopheles and Aedes. Control measures of mosquito.

d) **Pest and their management** - definitiion, types    (Major and Minor pest) Mammalian pest, Insect pest (Tryporyza, Leptocorisa and Hispa sp), pest control ; IPM, biological control of insect pest. Fishery - Major carp, Minor carp, Exotic carp (definition & example), common diseases and control measures of carp Gill rot, Fin rot & Dropsy.

## MODULE - 7

a) **Plant hormones** - Sources, chemical name and  functions of Auxins, Gibberallins, Cytokinins  and Florigen in relation to plant life.

b) **Endocrine system** - Definition of Endocrine gland and mixed gland sources and functions of some important hormones in human - STH, TSH, ACTH, GTH, Thyroxine, Adrenaline, Insulin, Oestrogen, Progesterone and Testosterone, Local hormone (Gastrin, Secretin & Cholecystokinin) and  Neurohormone (ADH & Oxytocin). Elementary idea of hormone action (protein and steroid hormones) Prostaglandin - Definition and function.

c) **Growth, Metamorphosis and Ageing** - phases and factors of growth, Difference between plant and animal growth, Grand period of growth. Metamorphosis -Definition. Types and role of hormones. Senescence  and ageing of plants and animals and its factors. Growth of seedling and the role of gibberalic acid.

d) **Reproduction and  developmental Biology** - Human Gonads - Testis and Ovary (Histology, Hormones and their functions). Spermatogenesis and oogenesis. Structure of sperm and graffian follicle. Menstrual cycle, Fertiliztion, implantation. A brief idea about cleavage, morula, blastula and gastrula formation.

## MODULE - 8

a) **Chromosome and DNA :**  Chromosome structure (both physical and chemical) euchromatin and heterochromatin. DNA structure (Watson - Crick Model) DNA functions and Central Dogma with brief account of replication, transcription and translation, RNA - general organization and types, brief idea on gene and genetic code.

b) **Mendelism :** Mendel's monohybrid and dihybrid crosses. (citing one example from plant and one from animal) Mendel's laws of heredity with an explanation of different contradictions due to Incomplete dominance, Co-dominance, Multiple alleles. Epistasis and Linkage (brief idea only).

c) **Mutation :** Gene mutation and chromosomal aberration, (ref. Albinism, Down syndrome, Turner's syndrome, Klienfelter's syndrome).

## MODULE - 9
(Life system - 1)

a) **Digestion :** Structural organization of alimentary tract, salivary gland, liver and pancreas, main digestive juices & enzymes, digestion & absorption of Carbohydrate, Protein and Lipid. Movement of small   intestine (Types only).

b) **Nervous system :** A brief outline of the organization and basic functions of nervous system (central and peripheral). Autonomic Nervous System. Functions of six major parts of brain - Cerebral - cortex, Thalamus, Hypo thalamus, Pons, Cerebellum & Medulla oblongata. Reflex action and its properties, Reflex are neuromuscular transmission. Major sense organ (Eye & Ear) and Receptors.

c) **Muscle Tissue :** Different types of muscles and their structures in brief. Properties of muscle - Excitability, Contractility. All or none law, Refractory period, Rigormortis, Important muscles of hand and leg.

# MODULE - 10
### (Life system - 2)

a) **Circulation :** Composition and functions of blood. Blood coagulation (Process in brief). Anti Coagulant. Blood groups - ABC system and Rh factor. Anatomy of the heart - Junctional tissues of the heart, origin and propagation of cardiac impulse. Histological structure of Arteries. / Veins and Capillaries. Blood pressure, Cardiac cycle and Cardiac output. Mechanism of breathing. Definition of Tidal volume, Total lung capacity, Residual volume, Vital capacity, Expiratory and inspiratory Reserve volume, Dead space. Transport of $O_2$ and $CO_2$ through blood.

b) **Excretion :** Definition of Excretion. Excretory products of animal (general) Human kidney and its unit - Structure and function of both. Ultra filtration reabsorption, Hypertonic urine formation Normal and Abnormal constituents of urine. Accessory excrertory organs - Skin, Liver, Salivary glands.

c) **Scope, importance and applications of Biology :**

Basic ideas on - i) Amniocentesis ii) Test tube babies and Cloning iii) Cancer, Hepatitis, AIDS and STD. iv) Plant cell and Tissue culture. v) Sperm and Ova Bank vi) Diagnostics instruments ECG, EEG/Imaging instruments - USG, CT Scan X-ray/Therapeutic - Laser Therapy and Dializer.

**INFORMTION REGARDING QUESTION PATTERN**

- Four different subjects, namely Physics, Chemistry, Mathematics and Biology will have four different question papers.
- Full marks for each question paper of Physics, Chemistry, Mathematics and Biology will be **100.**
- Duration of Examination of each paper will be **2 hours.**
- The questions of the examination will be framed on the basis of the Syllabi of Tripura Joint Entrance Examination which is in force w.e.f. 2008. The syllabus for each subject is divided into **10 Modules**. A Module carries **10 marks**.
- Question paper for each subject will be of Multiple Choice Question (MCQ) type.
- There will be **50 (fifty)** compulsory MCQs, taking **5 (five)** questions from each Module for the subject of Physics, Chemistry, Mathematics and Biology.
- Each question will carry **2 (two)** marks, i.e. total marks for a question paper will be of **100 (50x2)** for each subject.
- Each question will have four options (i.e. A,B,C,D) out of which the correct /Closest option (A/B/C/D) is only to be indentified.
- After selecting the correct/closest answer the candidate will have to fill the corresponding circle (i.e. A/B/C/D) in appropriate space provided in OMR Sheet.
- No mark will be deducted for wrong answer.


**Chairman**
**Tripura Board of Joint Entrance Examination**