

## **BITSAT EXAMINATION SYLLABUS PART IV MATHEMATICS OR BIOLOGY**

### **1. Algebra**

1.1 Complex numbers, addition, multiplication, conjugation, polar representation, properties of modulus and principal argument, triangle inequality, roots of complex numbers, geometric interpretations.

1.2 Theory of Quadratic equations, quadratic equations in real and complex number system and their solutions, relation between roots and coefficients, nature of roots, equations reducible to quadratic equations.

1.3 Arithmetic, geometric and harmonic progressions, arithmetic, geometric and harmonic means, arithmeticogeometric series, sums of finite arithmetic and geometric progressions, infinite geometric series, sums of squares and cubes of the first  $n$  natural numbers.

1.4 Logarithms and their properties.

1.5 Exponential series.

1.6 Permutations and combinations, Permutations as an arrangement and combination as selection, simple applications.

1.7 Binomial theorem for a positive integral index, properties of binomial coefficients.

1.8 Matrices and determinants of order two or three, properties and evaluation of determinants, addition and multiplication of matrices, adjoint and inverse of matrices, Solutions of simultaneous linear equations in two or three variables.

1.9 Sets, Relations and Functions, algebra of sets applications, equivalence relations, mappings, one-one, into and onto mappings, composition of mappings.

1.10 Mathematical Induction

1.11 Linear Inequalities, solution of linear inequalities in one and two variables.

### **2. Trigonometry**

2.1 Trigonometric ratios, functions and identities.

2.2 Solution of trigonometric equations.

2.3 Properties of triangles and solutions of triangles

2.4 Inverse trigonometric functions

2.5 Heights and distances

## 3. Two-dimensional Coordinate Geometry

3.1 Cartesian coordinates, distance between two points, section formulae, shift of origin.

3.2 Straight lines and pair of straight lines: Equation of straight lines in various forms, angle between two lines, distance of a point from a line, lines through the point of intersection of two given lines, equation of the bisector of the angle between two lines, concurrent lines.

3.3 Circles and family of circles : Equation of circle in various form, equation of tangent, normal & chords, parametric equations of a circle , intersection of a circle with a straight line or a circle, equation of circle through point of intersection of two circles, conditions for two intersecting circles to be orthogonal.

3.4 Conic sections : parabola, ellipse and hyperbola their eccentricity, directrices & foci, parametric forms, equations of tangent & normal, conditions for  $y=mx+c$  to be a tangent and point of tangency.

## 4. Three dimensional Coordinate Geometry

4.1 Direction cosines and direction ratios, equation of a straight line in space and skew lines.

4.2 Angle between two lines whose direction ratios are given

4.3 Equation of a plane, distance of a point from a plane, condition for coplanarity of three lines.

## 5. Differential calculus

5.1 Domain and range of a real valued function, Limits and Continuity of the sum, difference, product and quotient of two functions, Differentiability.

5.2 Derivative of different types of functions (polynomial, rational, trigonometric, inverse trigonometric, exponential, logarithmic, implicit functions), derivative of the sum, difference, product and quotient of two functions, chain rule.

5.3 Geometric interpretation of derivative, Tangents and Normals.

5.4 Increasing and decreasing functions, Maxima and minima of a function.

5.5 Rolle's Theorem, Mean Value Theorem and Intermediate Value Theorem.

## 6. Integral calculus

6.1 Integration as the inverse process of differentiation, indefinite integrals of standard functions.

6.2 Methods of integration: Integration by substitution, Integration by parts,

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integration by partial fractions, and  
integration by trigonometric identities.

6.3 Definite integrals and their properties, Fundamental Theorem of Integral Calculus and its applications.

6.4 Application of definite integrals to the determination of areas of regions bounded by simple curves.

## **7. Ordinary Differential Equations**

7.1 Variables separable method.

7.2 Solution of homogeneous differential equations.

7.3 Linear first order differential equations

## **8. Probability**

8.1 Addition and multiplication rules of probability.

8.2 Conditional probability

8.3 Independent events

8.4 Discrete random variables and distributions

## **9. Vectors**

9.1 Addition of vectors, scalar multiplication.

9.2 Dot and cross products of two vectors.

9.3 Scalar triple products and their geometrical interpretations.

## **10. Statistics**

10.1 Measures of dispersion

10.2 Measures of skewness and Central Tendency

## **11. Linear Programming**

11.1 Formulation of linear Programming

11.2 Solution of linear Programming, using graphical method.

OR

## **BIOLOGY SYLLABUS**

### **1: Diversity in Living World**

1.1 Biology - its meaning and relevance to mankind

1.2 What is living; Taxonomic categories and aids; Systematics and Binomial system of nomenclature.

1.3 Introductory classification of living organisms (Two-kingdom system, Five-kingdom system);

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- 1.4 Plant kingdom - Salient features of major groups (Algae to Angiosperms);
- 1.5 Animal kingdom - Salient features of Nonchordates up to phylum, and Chordates up to class level.

## **2: Cell: The Unit of Life; Structure and Function**

- 2.1 Cell wall; Cell membrane; Endomembrane system (ER, Golgi apparatus/ Dictyosome, Lysosomes, Vacuoles); Mitochondria; Plastids; Ribosomes; Cytoskeleton; Cilia and Flagella; Centrosome and Centriole; Nucleus; Microbodies.
- 2.2 Structural differences between prokaryotic and eukaryotic, and between plant and animal cells.
- 2.3 Cell cycle (various phases); Mitosis; Meiosis.
- 2.4 Biomolecules - Structure and function of Carbohydrates, Proteins, Lipids, and Nucleic acids.
- 2.5 Enzymes - Chemical nature, types, properties and mechanism of action.

## **3: Genetics and Evolution**

- 3.1 Mendelian inheritance; Chromosome theory of inheritance; Gene interaction; Incomplete dominance; Co- dominance; Complementary genes; Multiple alleles;
- 3.2 Linkage and Crossing over; Inheritance patterns of hemophilia and blood groups in humans.
- 3.3 DNA -its organization and replication; Transcription and Translation;
- 3.4 Gene expression and regulation; DNA fingerprinting.
- 3.5 Theories and evidences of evolution, including modern Darwinism.

## **4: Structure and Function - Plants**

- 4.1 Morphology of a flowering plant; Tissues and tissue systems in plants; Anatomy and function of root, stem (including modifications), leaf, inflorescence, flower (including position and arrangement of different whorls, placentation), fruit and seed; Types of fruit; Secondary growth;
- 4.2 Absorption and movement of water (including diffusion, osmosis and water relations of cell) and of nutrients; Translocation of food; Transpiration and gaseous exchange; Mechanism of stomatal movement.
- 4.3 Mineral nutrition - Macro- and micro-nutrients in plants including deficiency disorders; Biological nitrogen fixation mechanism.
- 4.4 Photosynthesis - Light reaction, cyclic and non-cyclic photophosphorylation; various pathways of carbon dioxide fixation; Photorespiration; Limiting factors.
- 4.5 Respiration - Anaerobic, Fermentation, Aerobic; Glycolysis, TCA cycle; Electron transport system; Energy relations.

## 5: Structure and Function - Animals

5.1 Human Physiology - Digestive system - organs, digestion and absorption;

Respiratory system - organs, breathing and exchange and transport of gases.

5.2 Body fluids and circulation - Blood, lymph, double circulation, regulation of cardiac activity; Hypertension, Coronary artery diseases.

5.3 Excretion system - Urine formation, regulation of kidney function

5.4 Locomotion and movement - Skeletal system, joints, muscles, types of movement.

5.5 Control and co-ordination - Central and peripheral nervous systems, structure and function of neuron, reflex action and sensory reception; Role of various types of endocrine glands; Mechanism of hormone action.

## 6: Reproduction, Growth and Movement in Plants

6.1 Asexual methods of reproduction;

6.2 Sexual Reproduction - Development of male and female gametophytes; Pollination (Types and agents); Fertilization; Development of embryo, endosperm, seed and fruit (including parthenocarpy and elminth).

6.3 Growth and Movement - Growth phases; Types of growth regulators and their role in seed dormancy, germination and movement;

6.4 Apical dominance; Senescence; Abscission; Photo- periodism; Vernalisation;

6.5 Various types of movements.

## 7: Reproduction and Development in Humans

7.1 Male and female reproductive systems;

7.2 Menstrual cycle; Gamete production; Fertilisation; Implantation;

7.3 Embryo development;

7.4 Pregnancy and parturition;

7.5 Birth control and contraception.

## 8: Ecology and Environment

8.1 Meaning of ecology, environment, habitat and niche.

8.2 Ecological levels of organization (organism to biosphere); Characteristics of Species, Population, Biotic Community and Ecosystem; Succession and Climax. Ecosystem - Biotic and abiotic components; Ecological pyramids; Food chain and Food web;

8.3 Energy flow; Major types of ecosystems including agroecosystem.

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8.4 Ecological adaptations - Structural and physiological features in plants and animals of aquatic and desert habitats.

8.5 Biodiversity and Environmental Issues - Meaning, types and conservation strategies (Biosphere reserves, National parks and Sanctuaries), Air and Water Pollution (sources and major pollutants); Global warming and Climate change; Ozone depletion; Noise pollution; Radioactive pollution; Methods of pollution control (including an idea of bioremediation); Deforestation; Extinction of species (Hot Spots).

## 9: Biology and Human Welfare

9.1 Animal husbandry - Livestock, Poultry, Fisheries; Major animal diseases and their control. Pathogens of major communicable diseases of humans caused by fungi, bacteria, viruses, protozoans and elminthes, and their control.

9.2 Cancer; AIDS.

9.3 Adolescence and drug/alcohol abuse;

9.4 Basic concepts of immunology.

9.5 Plant Breeding and Tissue Culture in crop improvement.

## 10: Biotechnology and its Applications

10.1 Microbes as ideal system for biotechnology;

10.2 Microbial technology in food processing, industrial production (alcohol, acids, enzymes, antibiotics), sewage treatment and energy generation.

10.3 Steps in recombinant DNA technology - restriction enzymes, NA insertion by vectors and other methods, regeneration of recombinants

10.4 Applications of R-DNA technology in human health -Production of Insulin, Vaccines and Growth hormones, Organ transplant, Gene therapy.

10.5 Applications in Industry and Agriculture - Production of expensive enzymes, strain improvement to scale up bioprocesses, GM crops by transfer of genes for nitrogen fixation, herbicide-resistance and pest-resistance including Bt crops.