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**SATHYABAMA**

INSTITUTE OF SCIENCE AND TECHNOLOGY  
(DEEMED TO BE UNIVERSITY)  
CATEGORY - 1 UNIVERSITY BY UGC




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for Eight Consecutive Years



**SAEEE 2024** ALL INDIA ENTRANCE EXAMINATION

**ENGINEERING | ARCHITECTURE**

Last Date to Apply:  
6<sup>th</sup> April, 2024

For Details, Contact: 96000 38122 | 044-2450 0600 | 044-2450 2436  
Toll-Free Number: 1800 425 1770  [www.sathyabama.ac.in](http://www.sathyabama.ac.in)



**SATHYABAMA**  
**ALL INDIA ONLINE ENTRANCE**  
**EXAMINATION – 2024**

**For Admission to**

**B. E, B. TECH., B. ARCH. Programmes**

**SAEEE 2024**

**INFORMATION BROCHURE**



**SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY**

**CATEGORY 1 DEEMED TO BE UNIVERSITY**

Accredited with Grade "A++" by NAAC | 12B Status by UGC | Approved by AICTE

## CHANCELLOR'S MESSAGE



Sathyabama is the epitome of excellence for various domains of research and academics. Sophisticated infrastructure supports the vision and mission of the institution with a value addition of dedicated, highly qualified teaching fraternity. We uphold our value system with continuous efforts in implementation.

The Institution offers 50 undergraduate programmes and 27 postgraduate programmes in diverse fields of education. State of the art Library, International Research Centre and Sathyabama Research Park provides rich experience of learning and thereby fulfilling students' thirst for success. The research activity is progressive and proactive with numerous active projects, which were sanctioned by various reputed national organizations.

Inclusive model of education is followed in the institution; students from diverse backgrounds study and excel in their chosen field of interest. Chancellor's merit scholarship scheme is offered to meritorious students to support and encourage their efforts in academics.

Students are our asset; commitment is the secret of our success; our values are our strengths. Students, Parents, Industrial and Academic partners support has been immense in our journey. We are happy to share that "Sathyabama All India Entrance Examination (SAEEE)" is going to be conducted in the month of April, 2024. We invite young minds to our fold every year and so become instrumental in the journey of our success.

Dr Mariazeena Johnson  
Chancellor  
Sathyabama Institute of Science and Technology

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## I. INTRODUCTION

Sathyabama Institute of Science and Technology aims to provide higher education with high quality teaching and research. The Institution has attained greater heights under the guidance of Founder Chancellor Dr. JEPPIAAR, M.A., B.L., Ph.D., and dynamic leadership of Chancellor Dr. MARIAZEENA JOHNSON, B.E., M.B.A., M.Phil., Ph.D., President Dr. MARIE JOHNSON, B.E., M.B.A., M.Phil., Ph.D., well supported by the Vice Presidents Mr. J. ARUL SELVAN, Ms. MARIA BERNADETTE TAMILARASI, Ms. MARIA CATHERINE JAYAPRIYA and Vice Chancellor Dr. T. SASIPRABA M.E., Ph.D. The Institution offers 50 Undergraduate Programmes, 27 Postgraduate Programmes, 5 Online Programmes, 5 Online and Distance Learning Programmes, 1 Diploma Programme, 12 Part Time Programmes and Ph.D., Programmes in Engineering, Technology, Arts, Science, Management, Dental, Pharmacy, Law and Nursing. Admission to Undergraduate Engineering, Technology and Architecture Programmes are based on the Sathyabama All India Entrance Examination conducted, every year.

The Institution is accredited with A++ Grade in Cycle III by National Accreditation and Assessment Council (NAAC). Ten Undergraduate Engineering Programmes and One Post Graduate Programme are accredited by National Board of Accreditation (NBA), New Delhi. Further, three Undergraduate Engineering Programmes are internationally accredited by Accreditation Board for Engineering and Technology (ABET), USA. The Institute is consistently ranked one among the top 100 Universities in India by National Institute of Ranking Framework (NIRF). The Institution is ranked one among the 45 Indian Institutions in QS Ranking. The Institution is ranked in 1201-1500 position by Times Higher Education World University Rankings 2023, 501+ position in the Times Higher Education Asia University Rankings, 2023.

## II. ELIGIBILITY CRITERIA FOR ADMISSION

Candidates can choose any of the following programmes (refer page no.3) based on the eligibility criteria. Candidates should have passed the qualifying examination with first class/grade either in March/April 2023 or should be appearing for the same in March/April 2024. The candidate's date of birth should be on or after 1<sup>st</sup> January, 2004.

In addition to this, candidates should have passed the 10<sup>th</sup> class or Equivalent Examination in March/April 2021 or after, with minimum aggregate of 60% marks or "6.0" CGPA.

### NOTE:

- **CANDIDATES PASSED IN COMPARTMENTAL CLASS / GRADE (OR) PASSED WITH ARREAR/s EITHER IN 10<sup>th</sup> CLASS OR IN 12<sup>th</sup> CLASS ARE NOT ELIGIBLE FOR ADMISSION.**
- **NON RESIDENT INDIAN (NRI), DIPLOMA HOLDERS AND CANDIDATES OF FOREIGN ORIGIN NEED NOT APPEAR FOR SAEED 2024.**

## ELIGIBILITY CRITERIA

### UG PROGRAMMES IN ENGINEERING AND ARCHITECTURE

S.NO.	PROGRAMME	ELIGIBILITY
1.	B.E. – Computer Science and Engineering	A Pass 10+2 level examination with Mathematics, Physics and any one of the subjects (Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/ Biotechnology/ Technical Vocational subject/ Agriculture/ Engineering Graphics/ Business Studies/ Entrepreneurship) with a minimum of 45% aggregate in three subjects (40% in case of students belongs to reserved category)
2.	B.E. – Computer Science and Engineering with Specialization in Artificial Intelligence	
3.	B.E. – Computer Science and Engineering with Specialization in Artificial Intelligence and Machine Learning	
4.	B.E. – Computer Science and Engineering with Specialization in Artificial Intelligence and Robotics	
5.	B.E. – Computer Science and Engineering with Specialization in Block Chain Technology	
6.	B.E. – Computer Science and Engineering with Specialization in Data Science	
7.	B.E. – Computer Science and Engineering with Specialization in Internet of Things	
8.	B.E. – Computer Science and Engineering with Specialization in Cyber Security	
9.	B.TECH – Information Technology	
10.	B.E. – Electronics and Communication Engineering	
11.	B.E. – Electrical and Electronics Engineering	
12.	B.E. – Mechanical Engineering	A Pass 10+2 level examination with Mathematics, Physics and Chemistry with a minimum of 45% aggregate in three subjects (40% in case of students belongs to reserved category)
13.	B.E. – Mechatronics	
14.	B.E. – Aeronautical Engineering	
15.	B.E. – Civil Engineering	
16.	B.TECH – Chemical Engineering	

17.	B.TECH – Biotechnology	A Pass 10+2 level examination with Physics, Chemistry and any one of the subjects (Mathematics /Biology / Biotechnology) with a minimum of 45% aggregate in three subjects (40% in case of students belongs to reserved category)
18.	B.TECH – Biomedical	
19.	B.ARCH. - Architecture	A pass in the 10+2 / HSC / ICSE or equivalent examination with Mathematics, Physics and Chemistry with a minimum average of 50% marks in Mathematics, Physics and Chemistry and a valid NATA marks (National Aptitude Test in Architecture)

### III. INSTRUCTIONS

#### 1. PRIMARY INFORMATION TO ALL CANDIDATES APPLYING FOR SAEED 2024

- Candidates are required to meet the requisite eligibility criteria for admission into a programme before applying for SAEED 2024
- Based on 12th standard syllabus, SAEED 2024 will be conducted in Mathematics / Biology, Physics and Chemistry
- SAEED 2024 will be conducted only through online mode
- Permitting a candidate to appear for the SAEED 2024 or counselling does not entitle the right for admission
- The candidates will be shortlisted for Counselling, based on their performance in SAEED 2024
- Candidates who have been offered Provisional Admission after counselling should submit the relevant original documents, such as SSLC Mark Sheet, HSC Mark sheet, Transfer Certificate, etc. to the Institution at the time of admission. If not, the admission will stand cancelled
- After the admission, at a later point of time if any discrepancy or malpractice is noticed in the submitted documents, the candidate's admission will be cancelled by the Institution

#### 2. ADMISSION PROCEDURE

The admission to B.E., / B.Tech., / B.Arch., programmes is done solely on the basis of the performance in the SAEED 2024 conducted by Sathyabama Institute of Science and Technology.

The candidates will be shortlisted and called for Counselling based on their performance in the SAEED 2024. On the day of counselling the branch of study will be allotted depending on the availability of seat and provisional admission order will be issued on the same day.

**ALLOTMENT OF BRANCH ONCE MADE DURING THE COUNSELLING IS FINAL AND CANNOT BE CHANGED UNDER ANY CIRCUMSTANCES.**

#### 3. PROCEDURE TO APPLY B.E /B.Tech. / B.Arch. – SAEED 2024

##### APPLICATION FORM - ONLINE MODE

Candidates should use online submission of application which is available at [www.sathyabama.ac.in](http://www.sathyabama.ac.in). Candidates should fill the application and verify all the details entered. After the verification of the details, online payment of Rs.1000 + Bank Charges should be made either by using Net Banking/Credit Card/Debit Card/PAYTM. Payment can also be made through offline (only by Indian Bank Challan mode) at any one of the INDIAN BANK branches.

**The candidates who have submitted the applications through online mode need not send any printed forms/account statement/bank or institution challan copy etc. unless otherwise requested by the Institution authorities. But they should note the application number, login username and password for future reference (application number must be required to track their application and to book the slot for online examination). Applications without the fee payment will not be considered.**

**Note: Application fee once paid or repeated payment for same application will not be refunded under any circumstances**



#### **4. SAEED 2024 INSTRUCTIONS**

##### **a. SAEED 2024 WILL BE CONDUCTED THROUGH ONLINE MODE ONLY.**

##### **b. TRACK YOUR SAEED 2024 APPLICATION**

- After submission of application by online, candidates can track his/her application through the website <https://www.sathyabama.ac.in/> by entering the application number
- E-mail may be sent to [entranceexam2024@sathyabama.ac.in](mailto:entranceexam2024@sathyabama.ac.in) for any assistance to track the application by mentioning the application number, candidate name, father's name, mobile number and date of birth of the candidate

##### **c. SAEED 2024 EXAMINATION DATE & TIME**

**AFTER SUBMISSION OF SAEED 2024 APPLICATION FORM THE CANDIDATE IS REQUESTED TO VISIT SATHYABAMA WEBSITE AND CHECK THE EMAIL FOR FREQUENT UPDATES.**

#### **5. INFORMATION TO CANDIDATES BY SMS & E-MAIL AT DIFFERENT STAGES OF SAEED 2024 AND ADMISSION PROCESS**

**Through mobile and e-mail:** All candidates will be updated with information regarding SAEED 2024, through SMS and e-mail. Please ensure that correct mobile number and e-mail ID are provided in the online application.

#### **6. RESULTS OF THE SAEED2024**

- The SAEED 2024 results will be published on <https://www.sathyabama.ac.in/>
- As the examination is in online mode, there is no provision for revaluation or retotaling. No correspondence in this regard will be entertained further

#### **7. COUNSELLING PROCEDURE AND ADMISSION**

- The date for counselling will be published in our website [www.sathyabama.ac.in](http://www.sathyabama.ac.in) after the publication of results. Candidates can attend the Counselling either through online or attend in person as per the counselling schedule. Details regarding dates and fee will be mentioned in the counselling call letter
- Change of date of counselling is not permissible. If a candidate does not appear for counselling on the date specified, his/her seat shall be allocated to the succeeding candidate in the order of merit

#### **8. REQUIRED DOCUMENTS IN ORIGINAL TO BE SUBMITTED DURING COUNSELLING**

The candidate should produce the following documents in original along with one set of photocopies while reporting for counselling. Candidates will not be allowed to participate in the counselling process without these documents

- Counselling call letter
- SAEED 2024 Hall Ticket
- NATA score card (for B.Arch only)
- Secondary school (Class X) mark sheet
- HSC Mark sheet (Class XII) or Intermediate college Mark sheet

If a candidate fails to produce any of these documents, he/she will not be considered for counselling.

- CANDIDATE WHO SECURE THE ADMISSION THROUGH ONLINE COUNSELLING MODE NEED TO SUBMIT THE ABOVE MENTIONED DOCUMENTS ON THE DAY OF COMMENCEMENT OF CLASSES
- The branch of study will be allotted as per the marks secured in the SAEED 2024 and availability of seats on that particular date at the counselling. After the allotment of branch of study, provisional admission letter will be issued to the candidate
- A candidate should make a decision before the payment of the fee, whether he/she should join the programme based on the branch allotted to him/her at the time of counselling
- A candidate can also attend the counselling through online to select the preferred branch of Course and make the online payment of counselling fees
- On the day of counselling if the opted branch is not available, the candidate need not pay the fee. Fee paid once will not be refunded under any circumstances

#### IV. IMPORTANT DATES

Commencement of Online Application Forms	17 <sup>th</sup> November, 2023 (Friday)
Last Date for Applying	6 <sup>th</sup> April, 2024 (Saturday)
Dates of Online SAEED 2024	In the Month of April 2024 <b>(Phase-I)</b> In the Month of May 2024 <b>(Phase-II)</b>

#### V. QUESTION PAPER PATTERN

SAEED 2024 will be conducted in the following two patterns. Candidate can appear any one pattern or both based on the subject studied in the qualifying examination (refer ELIGIBILITY CRITERIA for choice of course). Exam duration is 60 minutes.

- Mathematics, Physics and Chemistry - 60 Questions (20 Questions from each section)
- Biology, Physics and Chemistry - 60 Questions (20 Questions from each section)

**EACH QUESTION CARRIES ONE MARK AND NO  
NEGATIVE MARKS FOR WRONG ANSWERS**

## **IMPORTANT INFORMATION**

- Admission only through merit basis(Admission through third party / middle men are not encouraged)
- SAEEE 2024 application fee Rs.1000/- (Plus Bank Charges Applicable). Application cost once paid or repeated payment for the same application number will not be refunded under any circumstances
- Candidates are requested to enter and shade the correct mobile number properly in datasheet
- Results/Counselling call letter should be only downloaded from our website and will not be sent by post
- Candidates are advised to check the SMS, e-mail frequently for any regular updates
- Candidates are advised to visit [www.sathyabama.ac.in](http://www.sathyabama.ac.in) for regular updates regarding SAEEE 2024
- For any assistance, candidate can send an e-mail to [entranceexam2024@sathyabama.ac.in](mailto:entranceexam2024@sathyabama.ac.in) by clearly mentioning their application number, name of the candidate, father's/guardian's name, mobile number, date of birth
- Contact 044 – 2450 2436, 044 - 2450 0600, 96000 38122 (between 9.00 A.M and 4.00 P.M except public holidays) for any query regarding SAEEE 2024
- All candidates who have submitted application for SAEEE 2024 are requested to note their application number. Application number is required to track their application and for any future correspondence.



## VI. QUICK LINKS

- [ACCREDITATION AND ACCOLADES](#)
- [STUDENT HANDBOOK](#)
- [CURRICULUM AND REGULATIONS](#)
- [SCHOOLS](#)
- [SCHOLARSHIP SCHEME](#)
- [HOSTEL FACILITY](#)
- [STATE OF ART LIBRARY](#)
- [STUDENTS CLUB](#)
- [RESEARCH CENTERS](#)
- [PLACEMENT](#)
- [PUBLICATIONS](#)
- [STARTUP](#)
- [SEED FUND](#)
- [PATENTS](#)
- [INTERNSHIP](#)
- [TESTIMONIAL](#)
- [360° SATHYABAMA CENTRE FOR ADVANCED STUDIES](#)
- [360° SATHYABAMA ST.PAUL'S BLOCK](#)

## VII. SYLLABUS

# PHYSICS

### UNIT 1: PHYSICS AND MEASUREMENT

Physics, technology and society, SI units, Fundamental and derived units. Least count, accuracy and precision of measuring instruments, Errors in measurement, Significant figures. Dimensions of Physical quantities, dimensional analysis and its applications.

### UNIT 2: KINEMATICS

Frame of reference. Motion in a straight line: 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. Scalars and Vectors, Vector addition and Subtraction, Zero Vector, Scalar and Vector products, Unit Vector, Resolution of a Vector. Relative Velocity, Motion in a plane, Projectile Motion, Uniform Circular Motion.

### UNIT 3: LAWS OF MOTION

Force and Inertia, Newton's First Law of motion; Momentum, 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. Static and Kinetic friction, laws of friction, rolling friction. Dynamics of uniform circular motion: Centripetal force and its applications.

### UNIT 4: WORK, ENERGY AND POWER

Work done by a constant force and a variable force; kinetic and potential energies, work energy theorem, power. Potential energy of a spring, conservation of mechanical energy, conservative and non conservative forces; Elastic and inelastic collisions in one and two dimensions.

### UNIT 5: ROTATIONAL MOTION

Centre of mass of a two-particle system, Centre of mass of a rigid body; Basic concepts of rotational motion; Moment of a force, torque, angular momentum, conservation of angular momentum and its applications; moment of inertia, radius of gyration. Values of moments of inertia for simple geometrical objects, parallel and perpendicular axes theorems and their applications. Rigid body rotation, equations of rotational motion.

### UNIT 6: GRAVITATION

The universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth. Kepler's laws of planetary motion. Gravitational potential energy; gravitational potential. Escape velocity. Orbital velocity of a satellite. Geo-stationary satellites.

### UNIT 7: PROPERTIES OF SOLIDS AND LIQUIDS

Elastic behavior, Stress-strain relationship, Hooke's Law, Young's modulus, bulk modulus, modulus of rigidity. Pressure due to a fluid column; Pascal's law and its applications. Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, Reynolds number. Bernoulli's principle and its applications.

Surface energy and surface tension, angle of contact, application of surface tension - drops, bubbles and capillary rise. Heat, temperature, thermal expansion; specific heat capacity, calorimetry; change of state, latent heat. Heat transfer-conduction, convection and radiation, Newton's law of cooling.

### **UNIT 8: THERMODYNAMICS**

Thermal equilibrium, zeroth law of thermodynamics, concept of temperature. Heat, work and internal energy. First law of thermodynamics. Second law of thermodynamics: reversible and irreversible processes. Carnot engine and its efficiency.

### **UNIT 9: KINETIC THEORY OF GASES**

Equation of state of a perfect gas, work done on compressing a gas. Kinetic theory of gases - assumptions, concept of pressure. Kinetic energy and temperature: rms speed of gas molecules; Degrees of freedom, Law of equipartition of energy, applications to specific heat capacities of gases; Mean free path, Avogadro's number.

### **UNIT 10 : 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 a wave. 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 in sound

### **UNIT 11 : ELECTROSTATICS**

Electric charges: Conservation of charge, Coulomb's law-forces 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 a uniform electric field. Electric flux, Gauss's law and its applications to find field due to infinitely long uniformly charged straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell. Electric potential and its calculation for a point charge, electric dipole and system of charges; Equipotential surfaces, Electrical potential energy of a system of two point charges in an electrostatic field. Conductors and insulators, Dielectrics and electric polarization, capacitor, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, Energy stored in a capacitor.

### **UNIT 12 : CURRENT ELECTRICITY**

Electric current, Drift velocity, Ohm's law, Electrical resistance, Resistances of different materials, V-I characteristics of Ohmic and non ohmic conductors, Electrical energy and power, Electrical resistivity, Colour code for resistors; Series and parallel combinations of resistors; Temperature dependence of resistance. Electric Cell and its Internal resistance, potential difference and emf of a cell, combination of cells in series and in parallel. Kirchhoff's laws and their applications. Wheatstone bridge, Metre bridge. Potentiometer - principle and its Applications.

### **UNIT 13: MAGNETIC EFFECTS OF CURRENT AND MAGNETISM**

Biot - Savart law and its application to current carrying circular loop. Ampere's law and its applications to infinitely long current carrying straight wire and solenoid. Force on a moving charge in uniform magnetic and electric fields. Cyclotron. Force on a current-carrying conductor in a uniform magnetic field. Force between two parallel current carrying conductors-definition of ampere. Torque experienced by a current loop in uniform magnetic field; Moving coil galvanometer, its current sensitivity and conversion to ammeter and voltmeter. Current loop as a magnetic dipole and its magnetic dipole moment. Bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements. Para-, dia- and ferro- magnetic substances. Magnetic susceptibility and permeability, Hysteresis, Electromagnets and permanent magnets.

### **UNIT 14 : ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENTS**

Electromagnetic induction; Faraday's law, induced emf and current; Lenz's Law, Eddy currents. Self and mutual inductance. Alternating currents, peak and rms value of alternating current/ voltage; reactance and impedance; LCR series circuit, resonance; Quality factor, power in AC circuits, wattless current. AC generator and transformer.

### **UNIT 15 : ELECTROMAGNETIC WAVES**

Electromagnetic waves and their characteristics. Transverse nature of electromagnetic waves. Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, Xrays, gamma rays). Applications of e.m. waves.

### **UNIT 16 : OPTICS**

Reflection and refraction of light at plane and spherical surfaces, mirror formula, Total internal reflection and its applications, Deviation and Dispersion of light by a prism, Lens Formula, Magnification, Power of a Lens, Combination of thin lenses in contact, Microscope and Astronomical Telescope (reflecting and refracting) and their magnifying powers. Wave optics: wave front and Huygens' principle, Laws of reflection and refraction using Huygen's 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 polarized light; Brewster's law, uses of plane polarized light and Polaroids.

### **UNIT 17 : DUAL NATURE OF MATTER AND RADIATION**

Dual nature of radiation. Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation; particle nature of light. Matter waves-wave nature of particle, de Broglie relation. Davisson-Germer experiment.

### **UNIT 18 : ATOMS AND NUCLEI**

Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum. Composition and size of nucleus, atomic masses, isotopes, isobars; isotones. Radio activity 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, nuclear fission and fusion.



## **UNIT 19 : 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 (OR, AND, NOT, NAND and NOR). Transistor as a switch.

## **UNIT 20 : COMMUNICATION SYSTEMS**

Propagation of electromagnetic waves in the atmosphere; Sky and space wave propagation, Need for modulation, Amplitude and Frequency Modulation, Bandwidth of signals, Bandwidth of Transmission medium, Basic Elements of a Communication System (Block Diagram only).

# **CHEMISTRY**

## **UNIT 1: SOME BASIC CONCEPTS IN CHEMISTRY**

Matter and its nature, Dalton's atomic theory; Concept of atom, molecule, element and compound; Physical quantities and their measurements in Chemistry, precision and accuracy, significant figures, S.I. Units, dimensional analysis; Laws of chemical combination; Atomic and molecular masses, mole concept, molar mass, percentage composition, empirical and molecular formulae; Chemical equations and stoichiometry.

## **UNIT 2: STATES OF MATTER**

Classification of matter into solid, liquid and gaseous states.

### **Gaseous State:**

Measurable properties of gases; Gas laws - Boyle's law, Charles's law, Graham's law of diffusion, Avogadro's law, Dalton's law of partial pressure; Concept of Absolute scale of temperature; Ideal gas equation; Kinetic theory of gases (only postulates); Concept of average, root mean square and most probable velocities; Real gases, deviation from Ideal behaviour, compressibility factor, van der Waals equation, liquefaction of gases, critical constants.

### **Liquid State:**

Properties of liquids - vapour pressure, viscosity and surface tension and effect of temperature on them (qualitative treatment only).

### **Solid State:**

Classification of solids: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea); Bragg's Law and its applications; Unit cell and lattices, packing in solids (fcc, bcc and hcp lattices), voids, calculations involving unit cell parameters, imperfection in solids; Electrical, magnetic and dielectric properties.

## **UNIT 3 : ATOMIC STRUCTURE**

Discovery of sub-atomic particles (electron, proton and neutron); Thomson and Rutherford atomic models and their limitations; Nature of electromagnetic radiation, photoelectric effect; Spectrum of hydrogen atom, Bohr model of hydrogen atom - its postulates, derivation of the relations for energy

of the electron and radii of the different orbits, limitations of Bohr's model; Dual nature of matter, de-Broglie's relationship, Heisenberg uncertainty principle. Elementary ideas of quantum mechanics, quantum mechanical model of atom, its important features, and concept of atomic orbitals as one electron wave functions; Variation of  $\psi$  and  $\psi^2$  with  $r$  for 1s and 2s orbitals; various quantum numbers (principal, angular momentum and magnetic quantum numbers) and their significance; shapes of s, p and d - orbitals, electron spin and spin quantum number; Rules for filling electrons in orbitals aufbau principle, Pauli's exclusion principle and Hund's rule, electronic configuration of elements, extra stability of half-filled and completely filled orbitals.

#### **UNIT 4: CHEMICAL BONDING AND MOLECULAR STRUCTURE**

Kossel - Lewis approach to chemical bond formation, concept of ionic and covalent bonds.

**Ionic Bonding:** Formation of ionic bonds, factors affecting the formation of ionic bonds; calculation of lattice enthalpy.

**Covalent Bonding:** Concept of electronegativity, Fajan's rule, dipole moment; Valence Shell Electron Pair Repulsion (VSEPR) theory and shapes of simple molecules.

**Quantum mechanical approach to covalent bonding:**

Valence bond theory - Its important features, concept of hybridization involving s, p and d orbitals; Resonance.

**Molecular Orbital Theory** - Its important features, LCAOs, types of molecular orbitals (bonding, antibonding), sigma and pi-bonds, molecular orbital electronic configurations of homonuclear diatomic molecules, concept of bond order, bond length and bond energy. Elementary idea of metallic bonding. Hydrogen bonding and its applications.

#### **UNIT 5 : CHEMICAL THERMODYNAMICS**

Fundamentals of thermodynamics: System and surroundings, extensive and intensive properties, state functions, types of processes.

**First law of thermodynamics** - Concept of work, heat internal energy and enthalpy, heat capacity, molar heat capacity; Hess's law of constant heat summation; Enthalpies of bond dissociation, combustion, formation, atomization, sublimation, phase transition, hydration, ionization and solution.

**Second law of thermodynamics;** Spontaneity of processes;  $\Delta S$  of the universe and  $\Delta G$  of the system as criteria for spontaneity,  $\Delta G^\circ$  (Standard Gibbs energy change) and equilibrium constant.

#### **UNIT 6 : SOLUTIONS**

Different methods for expressing concentration of solution - molality, molarity, mole fraction, percentage (by volume and mass both), vapour pressure of solutions and Raoult's Law Ideal and non-ideal solutions, vapour pressure - composition, plots for ideal and non-ideal solutions; Colligative properties of dilute solutions - relative lowering of vapour pressure, depression of freezing point, elevation of boiling point and osmotic pressure; Determination of molecular mass using colligative properties; Abnormal value of molar mass, van't Hoff factor and its significance.

## UNIT 7: EQUILIBRIUM

Meaning of equilibrium, concept of dynamic equilibrium.

**Equilibria involving physical processes:** Solid -liquid, liquid - gas and solid gas equilibria, Henry's law, general characteristics of equilibrium involving physical processes.

**Equilibria involving chemical processes:** Law of chemical equilibrium, equilibrium constants ( $K_p$  and  $K_c$ ) and their significance, significance of  $\Delta G$  and  $\Delta G^\circ$  in chemical equilibria, factors affecting equilibrium concentration, pressure, temperature, effect of catalyst; Le Chatelier's principle.

**Ionic equilibrium:** Weak and strong electrolytes, ionization of electrolytes, various concepts of acids and bases (Arrhenius, Br instead - Lowry and Lewis) and their ionization, acid - base equilibria (including multistage ionization) and ionization constants, ionization of water, pH scale, common ion effect, hydrolysis of salts and pH of their solutions, solubility of sparingly soluble salts and solubility products, buffer solutions.

## UNIT 8 : REDOX REACTIONS AND ELECTROCHEMISTRY

Electronic concepts of oxidation and reduction, redox reactions, oxidation number, rules for assigning oxidation number, balancing of redox reactions. Electrolytic and metallic conduction, conductance in electrolytic solutions, specific and molar conductivities and their variation with concentration: Kohlrausch's law and its applications. Electrochemical cells - Electrolytic and Galvanic cells, different types of electrodes, electrode potentials including standard electrode potential, half - cell and cell reactions, emf of a Galvanic cell and its measurement; Nernst equation and its applications; Relationship between cell potential and Gibbs' energy change; Dry cell and lead accumulator; Fuel cells; Corrosion and its prevention.

## UNIT 9 : CHEMICAL KINETICS

Rate of a chemical reaction, factors affecting the rate of reactions: concentration, temperature, pressure and catalyst; elementary and complex reactions, order and molecularity of reactions, rate law, rate constant and its units, differential and integral forms of zero and first order reactions, their characteristics and half - lives, effect of temperature on rate of reactions Arrhenius theory, activation energy and its calculation, collision theory of bimolecular gaseous reactions (no derivation).

## UNIT-10 : SURFACE CHEMISTRY

**Adsorption-** Physisorption and chemisorption and their characteristics, factors affecting adsorption of gases on solids - Freundlich and Langmuir adsorption isotherms, adsorption from solutions.

**Catalysis** - Homogeneous and heterogeneous, activity and selectivity of solid catalysts, enzyme catalysis and its mechanism.

**Colloidal state** - distinction among true solutions, colloids and suspensions, classification of colloids - lyophilic, lyophobic; multi molecular, macromolecular and associated colloids (micelles), preparation and properties of colloids - Tyndall effect, Brownian movement, electrophoresis, dialysis, coagulation and flocculation; Emulsions and their characteristics.

## **INORGANIC CHEMISTRY**

### **UNIT 11 : CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES**

Modern periodic law and present form of the periodic table, s, p, d and f block elements, periodic trends in properties of elements atomic and ionic radii, ionization enthalpy, electron gain enthalpy, valence, oxidation states and chemical reactivity.

### **UNIT 12 : GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF METALS**

Modes of occurrence of elements in nature, minerals, ores; Steps involved in the extraction of metals - concentration, reduction (chemical and electrolytic methods) and refining with special reference to the extraction of Al, Cu, Zn and Fe; Thermodynamic and electrochemical principles involved in the extraction of metals.

### **UNIT 13 : HYDROGEN**

Position of hydrogen in periodic table, isotopes, preparation, properties and uses of hydrogen; Physical and chemical properties of water and heavy water; Structure, preparation, reactions and uses of hydrogen peroxide; Classification of hydrides - ionic, covalent and interstitial; Hydrogen as a fuel.

### **UNIT 14 : S - BLOCK ELEMENTS (ALKALI AND ALKALINE EARTH METALS)**

Group - 1 and 2 Elements General introduction, electronic configuration and general trends in physical and chemical properties of elements, anomalous properties of the first element of each group, diagonal relationships. Preparation and properties of some important compounds - sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogen carbonate; Industrial uses of lime, limestone, Plaster of Paris and cement; Biological significance of Na, K, Mg and Ca.

### **UNIT 15 : P - BLOCK ELEMENTS - Group - 13 to Group 18 Elements**

General Introduction: Electronic configuration and general trends in physical and chemical properties of elements across the periods and down the groups; unique behaviour of the first element in each group.

#### **Groupwise study of the p block elements**

**Group 13** - Preparation, properties and uses of boron and aluminium; Structure, properties and uses of borax, boric acid, diborane, boron trifluoride, aluminium chloride and alums.

**Group 14** - Tendency for catenation; Structure, properties and uses of allotropes and oxides of carbon, silicon tetrachloride, silicates, zeolites and silicones.

**Group 15** - Properties and uses of nitrogen and phosphorus; Allotropic forms of phosphorus; Preparation, properties, structure and uses of ammonia, nitric acid, phosphine and phosphorus halides, (PCl<sub>3</sub>, PCl<sub>5</sub>); Structures of oxides and oxoacids of nitrogen and phosphorus.

**Group 16** - Preparation, properties, structures and uses of dioxygen and ozone; Allotropic forms of sulphur; Preparation, properties, structures and uses of sulphur dioxide, sulphuric acid (including its industrial preparation); Structures of oxoacids of sulphur.



**Group 17** - Preparation, properties and uses of chlorine and hydrochloric acid; Trends in the acidic nature of hydrogen halides; Structures of Interhalogen compounds and oxides and oxoacids of halogens.

**Group 18** - Occurrence and uses of noble gases; Structures of fluorides and oxides of xenon.

## **UNIT 16 : d- and f –BLOCK ELEMENTS**

**Transition Elements** - General introduction, electronic configuration, occurrence and characteristics, general trends in properties of the first row transition elements – physical properties, ionization enthalpy, oxidation states, atomic radii, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, alloy formation; Preparation, properties and uses of  $K_2Cr_2O_7$  and  $KMnO_4$ .

**Inner Transition Elements** - Lanthanoids - Electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction. Actinoids - Electronic configuration and oxidation states.

## **UNIT 17 : CO-ORDINATION COMPOUNDS**

Introduction to co-ordination compounds, Werner's theory; ligands, co-ordination number, denticity, chelation; IUPAC nomenclature of mononuclear coordination compounds, isomerism; Bonding-Valence bond approach and basic ideas of Crystal field theory, colour and magnetic properties; Importance of coordination compounds (in qualitative analysis, extraction of metals and in biological systems).

## **UNIT 18 : ENVIRONMENTAL CHEMISTRY**

Environmental pollution - Atmospheric, water and soil. Atmospheric pollution - Tropospheric and Stratospheric - Tropospheric pollutants Gaseous pollutants: Oxides of carbon, nitrogen and sulphur, hydrocarbons; their sources, harmful effects and prevention; Green house effect and Globalwarming; Acid rain; Particulate pollutants: Smoke, dust, smog, fumes, mist; their sources, harmful effects and prevention. Stratospheric pollution- Formation and breakdown of ozone, depletion of ozone layer - its mechanism and effects.

Water Pollution - Major pollutants such as, pathogens, organic wastes and chemical pollutants; their harmful effects and prevention.

Soil pollution - Major pollutants such as: Pesticides (insecticides, herbicides and fungicides), their harmful effects and prevention. Strategies to control environmental pollution.

## **ORGANIC CHEMISTRY**

### **UNIT 19 : PURIFICATION AND CHARACTERISATION OF ORGANIC COMPOUNDS**

Purification - Crystallization, sublimation, distillation, differential extraction and chromatography - principles and their applications.

Qualitative analysis - Detection of nitrogen, sulphur, phosphorus and halogens. Quantitative analysis (basic principles only) - Estimation of carbon, hydrogen, nitrogen, halogens, sulphur, phosphorus. Calculations of empirical formulae and molecular formulae; Numerical problems in organic quantitative analysis.

## UNIT 20 : SOME BASIC PRINCIPLES OF ORGANIC CHEMISTRY

Tetravalency of carbon; Shapes of simple molecules - hybridization (s and p); Classification of organic compounds based on functional groups: - C = C - , - C h C – and those containing halogens, oxygen, nitrogen and sulphur; Homologous series; Isomerism - structural and stereoisomerism.

Nomenclature (Trivial and IUPAC) : Covalent bond fission - Homolytic and heterolytic: free radicals, carbocations and carbanions; stability of carbocations and free radicals, electrophiles and nucleophiles. Electronic displacement in a covalent bond- Inductive effect, electromeric effect, resonance and hyperconjugation. Common types of organic reactions - Substitution, addition, elimination and arrangement.

## UNIT 21 : HYDROCARBONS

Classification, isomerism, IUPAC nomenclature, general methods of preparation, properties and reactions.

Alkanes - Conformations: Sawhorse and Newman projections (of ethane); Mechanism of halogenations of alkanes.

Alkenes - Geometrical isomerism; Mechanism of electrophilic addition: addition of hydrogen, halogens, water, hydrogen halides (Markownikoff's and peroxide effect); Ozonolysis, oxidation, and polymerization.

Alkynes -Acidic character; Addition of hydrogen, halogens, water and hydrogen halides; Polymerization. Aromatic hydrocarbons - Nomenclature, benzene - structure and aromaticity; Mechanism of electrophilic substitution: halogenation, nitration, Friedel Craft's alkylation and acylation, directive influence of functional group in mono-substituted benzene.

## UNIT 22 : ORGANIC COMPOUNDS CONTAINING HALOGENS

General methods of preparation, properties and reactions; Nature of C-X bond; Mechanisms of substitution reactions. Uses; Environmental effects of chloroform, iodoform, freons and DDT.

## UNIT 23 : ORGANIC COMPOUNDS CONTAINING OXYGEN

General methods of preparation, properties, reactions and uses. ALCOHOLS, PHENOLS AND ETHERS

Alcohols: Identification of primary, secondary and tertiary alcohols; mechanism of dehydration. Phenols: Acidic nature, electrophilic substitution reactions: halogenation, nitration and sulphonation, Reimer - Tiemann reaction.

Ethers: Structure.

Aldehyde and Ketones: Nature of carbonyl group; Nucleophilic addition to  $>C=O$  group, relative reactivities of aldehydes and ketones; Important reactions such as Nucleophilic addition reactions (addition of HCN,  $NH_3$  and its derivatives), Grignard reagent; oxidation; reduction (Wolff Kishner and Clemmensen); acidity of  $\alpha$  - hydrogen, aldol condensation, Cannizzaro reaction, Haloform reaction; Chemical tests to distinguish between aldehydes and Ketones.

CARBOXYLIC ACIDS : Acidic strength and factors affecting it.

## **UNIT 24 : ORGANIC COMPOUNDS CONTAINING NITROGEN**

General methods of preparation, properties, reactions and uses. Amines: Nomenclature, classification, structure, basic character and identification of primary, secondary and tertiary amines and their basic character. Diazonium Salts: Importance in synthetic organic chemistry.

## **UNIT 25 : POLYMERS**

General introduction and classification of polymers, general methods of polymerization-addition and condensation, copolymerization; Natural and synthetic rubber and vulcanization; some important polymers with emphasis on their monomers and uses - polythene, nylon, polyester and bakelite.

## **UNIT 26 : BIOMOLECULES**

General introduction and importance of biomolecules.

**CARBOHYDRATES** - Classification: aldoses and ketoses; monosaccharides (glucose and fructose), constituent monosaccharides of oligosaccharides (sucrose, lactose, maltose) and polysaccharides (starch, cellulose, glycogen).

**PROTEINS** - Elementary idea of amino acids, peptide bond, polypeptides; Proteins: primary, secondary, tertiary and quaternary structure (qualitative idea only), denaturation of proteins, enzymes.

**VITAMINS** - Classification and functions.

**NUCLEIC ACIDS** - Chemical constitution of DNA and RNA. Biological functions of nucleic acids.

## **UNIT 27 : CHEMISTRY IN EVERYDAY LIFE**

Chemicals in medicines - Analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamins – their meaning and common examples. Chemicals in food - Preservatives, artificial sweetening agents - common examples. Cleansing agents - Soaps and detergents, cleansing action.

## **UNIT 28 : PRINCIPLES RELATED TO PRACTICAL CHEMISTRY**

- Detection of extra elements (N,S, halogens) in organic compounds; Detection of the following functional groups: hydroxyl (alcoholic and phenolic), carbonyl (aldehyde and ketone), carboxyl and amino groups in organic compounds
- Chemistry involved in the preparation of the following: Inorganic compounds: Mohr's salt, potash alum. Organic compounds: Acetanilide, p-nitroacetanilide, aniline yellow, iodoform
- Chemistry involved in the titrimetric exercise's - Acids bases and the use of indicators, oxalic- acid vs  $\text{KMnO}_4$ , Mohr's salt vs  $\text{KMnO}_4$
- Chemical principles involved in the qualitative salt analysis:

- Cations -  $\text{Pb}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{NH}_4^+$ . Anions-  $\text{CO}_3^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$  (Insoluble salts excluded)
- Chemical principles involved in the following experiments:
  - Enthalpy of solution of  $\text{CuSO}_4$
  - Enthalpy of neutralization of strong acid and strong base.
  - Preparation of lyophilic and lyophobic sols.
  - Kinetic study of reaction of iodide ion with hydrogen peroxide at room temperature.

## **MATHEMATICS**

### **UNIT 1 : SETS, RELATIONS AND FUNCTIONS**

Sets and their representation; Union, Intersection and Complement of sets and their algebraic properties; Power set; Relation, Types of relations, Equivalence relations, functions; one-one, into and onto functions, composition of functions.

### **UNIT 2 : COMPLEX NUMBERS AND QUADRATIC EQUATIONS**

Complex numbers as ordered pairs of reals, Representation of complex numbers in the form  $a+ib$  and their representation in a plane, Argand diagram, Algebra of complex numbers, Modulus and Argument (or Amplitude) of a complex number, square root of a complex number, triangle inequality, Quadratic equations in real and complex number system and their solutions. Relation between roots and coefficients, nature of roots, formation of quadratic equations with given roots.

### **UNIT 3 : MATRICES AND DETERMINANTS**

Matrices, Algebra of matrices, Types of matrices, Determinants and matrices of order two and three. Properties of determinants, Evaluation of determinants, Area of triangles using determinants. Adjoint and evaluation of inverse of a square matrix using determinants and elementary transformations, Test of consistency and solution of simultaneous linear equations in two or three variables using determinants and matrices.

### **UNIT 4 : PERMUTATIONS AND COMBINATIONS**

Fundamental principle of counting, permutation as an arrangement and combination as selection, Meaning of  $P(n,r)$  and  $C(n,r)$ , simple applications.

### **UNIT 5 : MATHEMATICAL INDUCTION**

Principle of Mathematical Induction and its simple applications.

### **UNIT 6 : BINOMIAL THEOREM AND ITS SIMPLE APPLICATIONS**

Binomial theorem for a positive integral index, general term and middle term, properties of Binomial coefficients and simple applications.

## UNIT 7 : SEQUENCES AND SERIES

Arithmetic and Geometric progressions, insertion of arithmetic, geometric means between two given numbers. Relation between A.M. and G.M. Sum upto n terms of special series:  $S_n$ ,  $S_{2n}$ ,  $S_{3n}$ . Arithmetic Geometric regression.

## UNIT 8 : LIMIT, CONTINUITY AND DIFFERENTIABILITY

Real - valued functions, algebra of functions, polynomials, rational, trigonometric, logarithmic and exponential functions, inverse functions. Graphs of simple functions. Limits, continuity and differentiability. Differentiation of the sum, difference, product and quotient of two functions. Differentiation of trigonometric, inverse trigonometric, logarithmic, exponential, composite and implicit functions; derivatives of order upto two. Rolle's and Lagrange's Mean Value Theorems. Applications of derivatives: Rate of change of quantities, monotonic – increasing and decreasing functions, Maxima and Minima of functions of one variable, Tangents and Normals.

## UNIT 9 : 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.

Evaluation of simple integrals of the type

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

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

$$\int \sqrt{a^2 \pm x^2} dx \quad \int \sqrt{x^2 - a^2} dx$$

Integral as limit of a sum. Fundamental Theorem of Calculus. Properties of definite integrals. Evaluation of definite integrals, determining areas of the regions bounded by simple curves in standard form.

## UNIT 10 : DIFFERENTIAL EQUATIONS

Ordinary differential equations, their order and degree. Formation of differential equations. Solution of differential equations by the method of separation of variables, solution of homogeneous and linear differential equations of the type:

$$\frac{dy}{dx} + p(x)y = q(x)$$

## UNIT 11 : CO-ORDINATE GEOMETRY

Cartesian system of rectangular co-ordinates in a plane, distance formula, section formula, locus and its equation, translation of axes, slope of a line, parallel and perpendicular lines, intercepts of a line on the coordinate axes.

Straight lines - 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.

Circles, conic sections Standard form of equation of a circle, general form of the equation of a circle, its radius and centre, 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 a circle, equation of the tangent. 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.

### **UNIT 12 : THREE DIMENSIONAL GEOMETRY**

Coordinates of a point in space, distance between two points, section formula, direction ratios and direction cosines, angle between two intersecting lines. Skew lines, the shortest distance between them and its equation. Equations of a line and a plane in different forms, intersection of a line and a plane, coplanar lines.

### **UNIT 13 : VECTOR ALGEBRA**

Vectors and scalars, addition of vectors, components of a vector in two dimensions and three dimensional space, scalar and vector products, scalar and vector triple product.

### **UNIT 14 : STATISTICS AND PROBABILITY**

Measures of Dispersion: Calculation of mean, median, mode of grouped and ungrouped data. Calculation of standard deviation, variance and mean deviation for grouped and ungrouped data. Probability: Probability of an event, addition and multiplication theorems of probability, Baye's theorem, probability distribution of a random variate, Bernoulli trials and Binomial distribution.

### **UNIT 15 : TRIGONOMETRY**

Trigonometrical identities and equations. Trigonometrical functions. Inverse trigonometrical functions and their properties. Heights and Distances.

### **UNIT 16 : MATHEMATICAL REASONING:**

Statements, logical operations AND, OR, IMPLIES, IMPLIED BY, IF AND ONLY IF. Understanding of Tautology, Contradiction, Converse and Contra positive

## **BIOLOGY**

### **UNIT I: DIVERSITY OF LIVING ORGANISM**

What is living? Biodiversity; Need for classification; Three domain of life; Taxonomy & Systematics; Concept of species and taxonomical hierarchy; Binomial nomenclature; Tools for study of Taxonomy-Museums, Zoos, Herbaria, Botanical gardens. Five kingdom classification; Salient features and classification of Monera; Protista and Fungi into major groups; Lichens; Viruses and Viroids. Salient features and classification of plants into major groups-Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms (three to five salient and distinguishing features and at least two examples of each category); Angiosperms – classification up to class, characteristic features and examples. Salient features and classification of animals-non chordate up to phyla level and chordate up to classes level (three to five salient features and at least two examples).



## UNIT II: STRUCTURAL ORGANISATION IN ANIMALS AND PLANTS

Morphology and modifications; Tissues; Anatomy and functions of different parts of flowering plants: Root, stem, leaf, inflorescence cymose and racemose, flower, fruit and seed (To be dealt along with the relevant practical of the Practical Syllabus). Animal tissues; Morphology, anatomy and functions of different system (digestive, circulatory, respiratory, nervous and reproductive) of an insect (cockroach). (A brief account only)

## UNIT III: CELL STRUCTURE AND FUNCTION

Cell theory and cell as the basic unit of life; Structure of prokaryotic and eukaryotic cell; Plant cell and animal cell; Cell envelope, cell membrane, cell wall; Cell organelles – structure and function; Endomembrane system- endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, micro bodies; Cytoskeleton, cilia, flagella, centrioles (ultra-structure and function); Nucleus-nuclear membrane, chromatin, nucleus. Chemical constituents of living cells: Biomolecules-structure and function of proteins, carbohydrates, lipid, nucleic acids, Enzymes-types, properties, enzymes action. Cell division: Cell cycle, mitosis, meiosis and their significance.

## UNIT IV: PLANT PHYSIOLOGY

**Transport in plants:** Movement of water, gases and nutrients; Cell to cell transport-Diffusion, facilitated diffusion, active transport; Plant-water relations-Imbibition, water potential, osmosis, plasmolysis; Long distance transport of water-Absorption, apoplast, symplast, transpiration pull, root pressure and guttation; Transpiration-Opening and closing of stomata; Uptake and translocation of mineral nutrients-Transport of food, phloem transport, Mass flow hypothesis; Diffusion of gases (brief mention). Mineral nutrition: Essential minerals, macro and micronutrients and their role; Deficiency symptoms; Mineral toxicity; elementary idea of Hydroponics as a method to study mineral nutrition; Nitrogen metabolism-Nitrogen cycle, biological nitrogen fixation.

**Photosynthesis:** Photosynthesis as a means of Autotrophic nutrition; Where does photosynthesis take place, How many pigments are involved in Photosynthesis (Elementary idea); Photochemical and biosynthetic phases of photosynthesis; Cyclic and non-cyclic photophosphorylation; Chemiosmotic hypothesis; Photorespiration; C<sub>3</sub> and C<sub>4</sub> pathways; factors affecting photosynthesis.

**Respiration:** Exchange of gases; Cellular respiration – glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); Energy relations-Number of ATP molecules generated; Amphibolic pathways; Respiratory quotient.

**Plant growth and development: Seed germination;** Phases of plant growth and plant growth rate; Conditions of growth; Differentiation, dedifferentiation and redifferentiation; sequence of developmental process in a plant cell; Growth regulators-auxin, , cytokinin, ethylene, ABA; Seed dormancy; Vernalisation: Photoperiodism.

## UNIT V: HUMAN PHYSIOLOGY

**Digestion and absorption:** Alimentary canal and digestive glands, Role of digestive enzymes and gastrointestinal hormones; Peristalsis, digestion, absorption and assimilation of proteins, carbohydrates and fats; Calorific value of proteins, carbohydrates and fat (for box item not to be evaluated); Egestion; Nutritional and digestive disorders-PEM, indigestion, constipation, vomiting, jaundice, diarrhea.

**Breathing and Respiration:** Respiratory organs in animals (recall only); Respiratory system in humans; Mechanism of breathing and its regulation in humans-Exchange of gases, transport of gases and regulation of respiration, Respiratory volume. Disorders related to respiration-Asthma, Emphysema, Occupational respiratory disorders.

**Body fluids and circulation:** Composition of blood, blood groups, coagulation of blood; Composition of lymph and its function; Human circulatory system-Structure of human heart and blood vessels; Cardiac cycle, cardiac output, ECG; Double circulation; Regulation of cardiac activity; Disorders of circulatory system-Hypertension, Coronary artery disease, Angina pectoris, Heart failure.

**Excretory products and their elimination:** Modes of excretion – Ammonotelism, ureotelism, uricotelism; Human excretory system-structure and function; Urine formation, Osmoregulation; Regulation of kidney function-Renin-angiotensin, Atrial Natriuretic Factor, ADH and Diabetes insipidus; Role of other organs in excretion; Disorders-Uraemia, Renal failure, Renal calculi, Nephritis; Dialysis and artificial kidney.

**Locomotion and Movement:** Types of movement – ciliary, flagellar, muscular; Skeletal muscle-contractile proteins and muscle contraction; Skeletal system and its functions (To be dealt with the relevant practical of Practical syllabus); Joints; Disorders of muscular and skeletal system – Myasthenia gravis, Tetany, Muscular dystrophy, Arthritis, Osteoporosis, Gout.

**Neural control and coordination:** Neuron and nerves; Nervous system in humans-central nervous system & peripheral nervous system and visceral nervous system; Generation and conduction of nerve impulse; Reflex action; Sensory perception; Sense organs; Elementary structure and function of eye and ear.

**Chemical coordination and regulation:** Endocrine glands and hormones; Human endocrine system-Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads; Mechanism of hormone action (Elementary Idea); Role of hormones as messengers and regulators, Hypo-and hyperactivity and related disorders (Common disorders e.g. Dwarfism, Acromegaly, Cretinism, goiter, exophthalmic goiter, diabetes, Addison's disease).

## **Reproduction**

**Reproduction in organisms:** Reproduction, a characteristic feature of all organisms for continuation of species; Modes of reproduction-Asexual and sexual reproduction; Modes- Binary fission, sporulation, budding, gemmule, fragmentation; vegetative propagation in plants.

**Sexual reproduction in flowering plant:** Flower structure; Development of male and female gametophytes; Pollination-types, agencies and examples; Outbreeding devices; Pollen- Pistil interaction; Double fertilization; Post fertilization events-Development of endosperm and embryo, Development of seed and formation of fruit; Special modes-apomixis, parthenocarpy, polyembryony; Significance of seed and fruit formation. Human Reproduction: Male and female reproductive systems; Microscopic anatomy of testis and ovary; Gametogenesis-spermatogenesis & oogenesis; Menstrual cycle; Fertilisation embryo development upto blastocyst formation, implantation; Pregnancy and placenta formation (Elementary idea); Parturition (Elementary idea); Lactation (Elementary idea)



# **SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY  
(DEEMED TO BE UNIVERSITY)**



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