

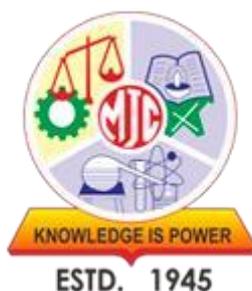
**Khandesh College Education Society's**  
**MOOLJI JAITHA COLLEGE, JALGAON**

“An **Autonomous** College Affiliated to K.B.C. North Maharashtra University Jalgaon”

[NAAC Accredited with A Grade, CGPA- 3.15 (3<sup>rd</sup> Cycle)| DST (FIST) Assisted College|

[UGC Honored “College of Excellence” (2014-2019)|

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## **INFORMATION BROCHURE**

**M.J. M.Sc. Common Entrance Test**

**(MJ-M.Sc. CET-2022)**

**For Admission to the Following Courses:**

**M.Sc. Organic Chemistry, M.Sc. Analytical Chemistry**

**and**

**M.Sc. Microbiology**

**To be held in**

**August 2022**

**For Academic Year 2022-23**

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## M.J. M.Sc. Common Entrance Test (MJ-M.Sc.-CET-2022):

A **Common Entrance Examination** (MJ-M.Sc.-CET-2022) is organized for admission to First Year Post Graduate Courses at **Moolji Jaitha College** (Autonomous), **Jalgaon** in the following subjects:

- ▶ Master of Organic Chemistry (M.Sc. Organic Chemistry )
- ▶ Master of Analytical Chemistry (M.Sc. Analytical Chemistry)
- ▶ Master of Microbiology (M.Sc. Microbiology)

### General Instructions:

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1. The registration process for MJ-M.Sc.-CET-2022 will be online.
2. The student will have to visit the M. J. College website to register for the MJ-M.Sc.-CET-2022. i.e. <https://mjcollege.kces.in/>
3. MJ-M.Sc.-CET-2022 Examination fees Rs.500/- must be paid through online mode only.
4. It is compulsory for the students to qualify the MJ-M.Sc.-CET-2022 to get admission to the above mentioned courses.
5. For registration process, candidate must provide at least one **valid mobile number** and **e-mail ID** for creation of user ID. Candidate should adhere to the rules and regulations of the college for the smooth conduct of MJ-M.Sc.-CET-2022.
6. Candidates should scan all the required documents in .jpeg/.jpg format and keep ready to upload online with registration form. [Document size: Photo & Sign: 10kb-100kb, All other documents: 10kb-500kb].
7. Applications with incorrect/wrong information will not be considered in the process of entrance examination.
8. Registered candidates for above mentioned courses will be intimated only through the registered mobile no. and/or e-mail ID.
9. For any technical assistance for online application, the 'Admission Process Help Centre' is available in the college at PG Lab. Department of Geography of the college.

### Eligibility Criteria and Intake Capacity:

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1. Candidates appeared/passed in concerned subject (Chemistry/Microbiology) at T.Y.B. Sc.
2. Course Specific Eligibility Criteria and intake capacity is as given below:

| Sr. No. | Course                     | Specific Eligibility | Intake Capacity |
|---------|----------------------------|----------------------|-----------------|
| 1       | M.Sc. Organic Chemistry    | B.Sc. (Chemistry)    | 20              |
| 2       | M.Sc. Analytical Chemistry | B.Sc. (Chemistry)    | 20              |
| 3       | M.Sc. Microbiology         | B.Sc. (Microbiology) | 20              |

3. Any change in intake capacity/seats by University will be applicable for this process.

### General criteria:

1. A candidate is considered to be eligible for admission to the above mentioned post graduate courses offered by the college, if he/she has secured at least 50% (or equivalent CGPA) marks at graduation (45% marks for backward class i.e. SC/ST/DT/NT/OBC/SBC category candidates from Maharashtra state).
2. In addition to the above criteria, the candidate must have to be appeared and qualified in the MJ-M.Sc.-CET-2022 Examination to be held by the College.
3. The admission for these courses will be totally based on the marks obtained in the MJ-M.Sc.-CET-2022 and by adopting the rules of reservation policy given by Government of Maharashtra.
4. The marks of T.Y.B.Sc., S.Y.B.Sc will be considered to resolve the tie while preparing merit lists.
5. In case of any dispute or discrepancy regarding grant of seat and eligibility, the decision taken by the Hon'ble Principal shall be final.

### Rules of Entrance Examination:

1. The student has to attend the MJ-M.Sc.-CET-2022 exam in the college campus through online mode using computer.
2. The examination link and pass codes will be given to a student at the time of examination.
3. The student should carry their hall ticket during the examination.
4. The student must attempt the examination on the specified day and time of the MJ-M.Sc.-CET-2022.
5. The question paper will consist of only objective questions (MCQs).
6. Entrance examination consists of single paper of 90 minutes duration containing 100 questions carrying maximum of 100 mark i.e. 1 mark per question.
7. In case of any dispute or discrepancy regarding rules of examination, the decision taken by the Hon'ble Principal shall be final.

## **Registration Process:**

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1. Visit official college website <https://mjcollege.kces.in/>
2. Click on "Admissions 2022-23" on home page to apply for MJ-M.Sc.-CET-2022.
3. OR directly visit to <https://www.kcesmjc.in/>.
10. Then click on 'New Student Admission', then click on Apply Online button given before the respective courses (M.Sc. Organic Chemistry /Master of Analytical Chemistry / M.Sc. Microbiology) and create candidate's user ID using valid mobile number and e-mail ID. Email ID must be properly entered while applying online.
4. Again login at same site through 'Already Registered Student' link and fill all the required details carefully along with valid Aadhar Card details.
5. Scan and attach all required original documents specified in the application form with latest colored passport size photograph and signature for procuring of identity card. Document/s claiming for reservation must be properly uploaded, otherwise candidate will be treated in General/Open category.
6. Documents must be properly scanned and uploaded.
7. Pay the registration fees Rs.500/- online.
8. Preview all the information entered once again and edit, if required, before submission. Submit the application form by clicking the "Submit Application" button.

## **Process after Registration:**

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1. The list of eligible candidates for appearing to the MJ-M.Sc.-CET-2022 will be made available on the college website.
2. The list of eligible candidates for appearing to MJ-M.Sc.-CET-2022 will not be published in any newspaper or will not be communicated to any candidate personally by post.
3. After the examination, the result will be declared on college website and general merit list will be published.
4. If the candidate has any objection related to the result or merit list, he/she may contact the Admission Counseling Center/ Admission counselors and submit his/her objection with proper documents within two days only.
5. After that, allocation list (Round wise) for the respective subject will be published online by adopting the rules of reservation given at the end of notification.

6. Selected students have to confirm their admission within THREE DAYS in person in the college, failure to which will be considered as cancellation of candidature.
7. The candidate, who has not reported after seat allocation for admission, will not be considered for further round of allocation.
8. In case of any dispute or discrepancy regarding seat allocation, the decision taken by the Hon'ble Principal shall be final.

### Schedule of Activity:

| Sr. No. | Activity   | Scheduled date(s) |
|---------|--|-------------------|
| 1.      | Availability of Online Information Brochure and application form.            | 08-08-2022        |
| 2       | Last date for filling up of on-line application form.                        | 23-08-2022        |
| 3       | Online Verification of Application Forms                                     | From 10-08-2022   |
| 4       | Display of list of eligible candidates for MJ-M.Sc.-CET 2022                 | 25-08-2022        |
| 5       | Last date of receipt of objections in written form/ through email (if any)   | 26-08-2022        |
| 6       | Availability of hall ticket  | 27-08-2022        |
| 7       | <b>Entrance Examination (Chemistry)</b>                                      | <b>29-08-2022</b> |
| 8       | <b>Entrance Examination (Microbiology)</b>                                   | <b>30-08-2022</b> |
| 9       | Display of Result on college website   | 01-09-2022        |
| 10      | Last date of receipt of objections regarding result in written form (if any) | 03-09-2022        |

**Note:** email your queries/complaints at [rdp.mjc@kces.in](mailto:rdp.mjc@kces.in), if any.

### Details of Admission Counselors:

| Sr. No. | Name of Counselor     | Contact No. | Subject              |
|---------|-----------------------|-------------|----------------------|
| 1       | Dr. Rajendra D. Patil | 7350849551  | Organic Chemistry    |
| 2       | Mr. Sandip N. Padvi   | 9665723973  | Organic Chemistry    |
| 3       | Dr. Jayashri D Bhirud | 8623869053  | Analytical Chemistry |
| 4       | Mrs. Sonal B uplapwar | 8208019024  | Analytical Chemistry |
| 5       | Dr. Leena D. Dhake    | 8766887087  | Microbiology         |
| 6       | Mr. Prasad M. Nikume  | 8308712643  | Microbiology         |

Note: For any query/enquiry please contact to admission counselors.

## Allocation of seats:

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1. The percentage of allocation of seats for various types of candidates in the Home University (HU), Other than Home University (OU), Institutional (Management) Quota, and Industry Sponsored Seats is as follows:
  - i) Candidates graduated from KBC NMU, Jalgaon : 70%
  - ii) Candidates graduated from other universities : 10%
  - iii) Seats to be allotted through management quota : 20%
2. Industry sponsored seats: one (01) seat for first ten (10) intake capacities, subject to maximum two per course.

## Reservation Policy for admissions:

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All the reservations given below shall be applicable to candidates belonging to Maharashtra state only subject to the fulfillment of the eligibility criteria specified by respective authorities from time to time.

### 1. Reservation for backward class category candidates:

The percentage of seats reserved for candidates of backward class categories belonging to Maharashtra state is as given below. The percentage of reservation is the percentages of the seats available for Maharashtra candidates. Backward class candidates shall claim the category to which they belong to at the time of submission of application form.

| Sr. No. | Category of Reservation                                       | Percentage of Seats Reserved |
|---------|---|------------------------------|
| 01      | Scheduled Castes and Schedule Caste converts to Buddhism (SC) | 13%                          |
| 02      | Schedule Tribes (ST)  | 7.0 %                        |
| 03      | Vimukta Jati (VJ)/De Notified Tribes(DT) (NT-A)               | 3.0%                         |
| 04      | Nomadic Tribes 1 (NT-B)                                       | 2.5%                         |
| 05      | Nomadic Tribes 2 (NT-C)                                       | 3.5%                         |
| 06      | Nomadic Tribes 3 (NT-D)                                       | 2.0%                         |
| 07      | Other Backward Classes (OBC)                                  | 19.0%                        |
| 08      | <b>Total</b>  | <b>50%</b>                   |

### 2. Reservation for wards of defense service personnel:

Five percent (5%) seats out of total sanctioned intake capacity of colleges as a whole separately, subject to a maximum of one seat in each subject coming under admission procedure shall be reserved for wards of ex-service personnel who are from Maharashtra state.

**3. Reservation for persons with disability candidates:**

Five percent (5%) seats of total sanctioned intake capacity of college as a whole separately, subject to a maximum of one (01) seat in subject coming under admission procedure shall be reserved for candidates with disability.

The allotment of seats reserved for the candidates with disability shall be done on the basis of merit. The candidates claiming reservation under this category shall submit the Physical Disability certificates.

**Note:** - Candidates with disability should note that on admission to degree course they will not be given any exemptions or additional facility in the academic activities other than those which may be provided by the college.

If the reservation quota remains vacant then 2% seats of total intake capacity of college as a whole separately will be offered to SBC category.

**4. Reservation for EWS (Economical Weaker Section) Candidate:**

As per the provisions in Government Resolution No. राआधो -4019/प्र.क्र..31/16-अ, dated 12<sup>th</sup> February, 2019, **10% seats** shall be reserved for EWS candidates. These seats shall be filled by the Competent Authority through admission procedure as per the policies of the Government declared from time to time. The change suggested by Govt. will be applicable for this process.

**5. Candidates applying for any reservation from above must submit respective certificate while applying online for MJ-M.Sc.-CET 2022.**

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## CHEMISTRY

### Subject Wise Weightage in MJ-M.Sc.-CET 2022 Examination in Chemistry:

| Sr. No | Subject             | % Weightage (Approx.) | No. of. MCQ Type questions (Approx.) expected |
|--------|---------------------|-----------------------|---|
| 1      | Physical Chemistry  | 25                    | 25  |
| 2      | Inorganic Chemistry | 25                    | 25  |
| 3      | Organic Chemistry   | 25                    | 25  |
| 4      | General Chemistry   | 25                    | 25  |
|        | <b>Total</b>        | <b>100</b>            | <b>100</b>                                    |

### Physical Chemistry:

#### **Electrolytic Conductance**

Electrolytic conductance, equivalent conductance, determination of conductance, variation of conductance with concentration, equivalent conductance at infinite dilution, Kohlrausch's law and its applications, conductometric titration.

#### **Surface Chemistry**

Adsorption, mechanism of adsorption, factors affecting adsorption of gases by solids, difference between adsorption and absorption, types of adsorption: physical and chemical adsorption, adsorption of gases by solid, types of adsorption isotherms: Freundlich adsorption isotherm and Langmuir adsorption isotherm.

#### **Gaseous State**

The kinetic theory of ideal gases, assumptions of kinetic theory of gases, kinetic gas equation and its significance, Graham's law, kinetic energy of translation, deviation of real gases from ideal behavior, reasons for deviation, compressibility factor, van der Waal's equation, its applications.

#### **Solutions**

Types of solutions, different way of expressing the concentration of solution, ideal and non-ideal solutions, Raoult's law and its limitation, vapour pressure of actual liquid pairs the vapour pressure of ideal solution, classification of binary solution of completely miscible liquids ((Type-I, Type-II and Type- III ) on the basis of Raoult's law).

#### **Colligative Properties**

Lowering of vapour pressure of solvent, calculation of molecular weight of solute from lowering of vapour pressure of solvent, boiling point elevation of solution, calculation of molecular weight of solute from boiling point elevation of solution, freezing point depression of solution, calculation of molecular weight of solute from depression in freezing point, osmosis and osmotic pressure.

#### **Electrochemistry**

Electromotive force and its measurements, reversible and irreversible cells, standard cell, cell reaction and emf, convention regarding sign of emf, single electrode potential, standard hydrogen and calomel reference electrodes, calculation of single electrode potential, calculation of cell emf from single electrode potential,

thermodynamics and emf,  $\Delta G$ ,  $\Delta H$ ,  $\Delta S$  from emf data, thermodynamics of electrode potential (Nernst equation), standard potential and equilibrium constant.

### **Chemical Thermodynamics**

enthalpy and entropy, Helmholtz free energy, Gibb's free energy and, fugacity and activity concepts, standard free energy change of formation, criteria of equilibrium, Clapeyron equation and its use, Clausius-Clapeyron equation, different form of Clausius-Clapeyron equation and its applications.

### **Quantum Chemistry**

Failures of classical mechanics, origin of quantum mechanics, particle aspect of radiation: blackbody radiation, photoelectric effect, Compton Effect, de Broglie's hypothesis: Matter waves, Heisenberg uncertainty principle, application of Heisenberg's principle, interpretation of wave function, significance of  $\psi$  and  $\psi^2$ , normalization of wave function, operators and operator algebra, Eigen functions and Eigen values.

### **Chemical Kinetics**

Reaction rates, effect of temperature, pressure, catalyst and other factors on reaction rates, order and molecularity of a reaction, derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal initial concentrations of reactants), half-life of a reaction, pseudo order reactions, general methods for determination of order of a reaction, effect of temperature on reaction rate, Arrhenius equation.

### **Phase Equilibrium**

Phases, components and degrees of freedom of a system, criteria of phase equilibrium, Gibbs phase rule and its thermodynamic derivation, derivation of Clausius-Clapeyron equation and its importance in phase equilibria. phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics.

### **Investigation of Molecular Structure**

Dipole moment, induced dipole moment, electrical polarization of molecules. orientation of dipole in an electric field, Debye equation. method of determination of dipole moment, vapour temperature method, molecular structure and dipole moment, interaction of electromagnetic radiation with molecules, various types of spectra rotational, vibration and electronic energy levels; with principle and example of each type.

### **Nuclear Chemistry**

Introduction, radioactive elements, types of radioactive decay, decay schemes, general characteristic of radioactive decay, decay kinetics, decay constant, half-life period, mean life, units of radioactivity, nuclear fusion / fission reactions

### **Photochemistry**

Laws of photochemistry, quantum yield, examples of low and high quantum yields, consequence of light absorption by atoms and molecules, Jablonski diagram, fluorescence, phosphorescence, quenching, photosensitized gas reaction,  $H_2$  and  $O_2$ ,  $H_2$  and CO, chemiluminescence.

### **Crystal Structure**

Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes, laws of crystallography - Law of constancy of interfacial angles, Law of rational indices,

Miller indices, X-ray diffraction by crystals, Bragg's law and Bragg's method, structures of NaCl, KCl and CsCl, Defects in crystals: Shottkey and Frenkel defects.

### **Inorganic Chemistry:**

**Periodic properties:** Atomic and ionic size, Ionization energy, Electron affinity, Electro negativity, Ionic equilibrium

**s-and p-block element:** Electronic configuration, variation in properties of s and p block elements: atomic radii, ionization energy, metallic character, oxidation state, reactivity.

**d-block elements:** Elements of first, second and third transition series, General characteristics of d-block elements.

**Ionic equilibria :** Strong and weak acids and bases, degree of dissociation, dissociation constants of acids and bases, PH and POH, ionic product of water, numericals. Buffer solution.

**Volumetric analysis:** Molecular weight, formula weight, equivalent weight, calculation of equivalent weight of acids, bases, oxidizing and reducing agents, units of concentration – molarity, normality, formality.

### **Chemical bonding and structure**

Attainment of stable configuration, types of bonds, metallic bond- free electron theory, Lewis concept. Heitler- London theory and Pauling- Slater theory. Types of overlap.

### **Solvents, solutions Acids and Bases**

Donar and acceptor properties. Molten salts, solvents for electrochemical reactions, purity of solvents, Lux-flood concept, Lewis concept, differentiating and levelling solvents, Hard and soft acids and bases.

**Coordination chemistry :** Double salts and coordination compounds, co-ordination complexes and complex ions,

coordination number, types of ligands, Nomenclature.

**Valence Shell Electron Pair Repulsion Theory (VSEPR), and shapes of covalent molecules:** Sidgwick – Powell theory, effect of lone pairs and electronegativity, Shapes of simple molecules and ions, applications and limitations.

**Valance Bond Theory (VBT):** Assumptions of VBT, shortcoming of VBT, Examples of square planar, tetrahedral and octahedral complexes.

**Crystal Field Theory (CFT):** Crystal Field Stabilization Energy (CFSE), Crystal field effect, CFT and magnetic properties. distribution of electrons in d orbital. Limitations and advantages, Jahn-Teller effect.

**Molecular Orbital Theory (MOT):** Assumptions, sigma bonding in tetrahedral and octahedral complexes, pi bonding in tetrahedral and octahedral complexes, sigma and pi bonding in square planar complexes, charge transfer spectra.

**Organometallic compounds:** Classification based on nature of metal-carbon bond, Bonding in pi-metal organometallic complexes, Ferrocene, aromaticity of cyclic  $C_nH_n$  ligands. Ziegler-Natta catalyst. Inert gas rule.

### **Bioinorganic Chemistry**

Introduction of Bioinorganic Chemistry, role of myoglobin and hemoglobin in biological systems. Metallo-enzymes

### **Environmental chemistry:**

Air pollutant, particulates, effect on visibility and materials. Smog, pesticides and their adverse side effects, insecticides,

fungicides, herbicides, rodenticides. Water pollutants.

### **Cement and Lime**

Classification of cement, Ingredients and their role, Manufacture and setting process, Quick setting cements. Manufacture of lime and applications

### **Fertilizers**

Plant Nutrients, Different types of fertilizers, need for fertilizers, requisite qualities of fertilizers, symptom of deficiency.

### **Alloys**

Classification, Ferrous and Non-ferrous alloys, properties, Manufacture of steel, Removal of silicon, decarburization.

**Metals and metallurgy:** Nanomaterials. Conductors, insulators & semiconductors, Inorganic Polymers.

## **Organic Chemistry:**

**Basic Organic Chemistry:** IUPAC Nomenclature, Structural effects, covalent bond fission, aromaticity, types of reagents, types of organic reactions, acid and base concept, and hybridization.

**Properties, preparation and reactions of:** hydrocarbons (alkanes, alkenes and alkynes), haloalkanes and haloarenes, alcohols, aldehydes and ketones, carboxylic acids and their derivatives, and amines.

**Stereoisomerism:** Projection formulae, optical isomerism, geometrical isomerism, and conformational isomerism.

### **Heterocyclic and polycyclic aromatic compounds (Preparation and reactions):**

Five membered ring with one heteroatom, six membered ring with one heteroatom, and polycyclic aromatic compounds.

### **Synthetic Reagents (Preparation and reactions):**

Acetoacetic ester, and malonic ester

### **Organometallic compounds (Preparation and reactions):**

Organolithium compounds, organomagnesium compounds, organocopper compounds and organozinc compounds.

**Nucleophilic Substitution at Saturated Carbon:**  $S_N1$ , and  $S_N2$ : Mechanism, stereochemistry, regioselectivity and stereo specificity of substitution reaction. Factors affecting rate of  $S_N1$ , and  $S_N2$ .

**Electrophilic Addition to C=C:** Addition of halogens and hypohalous acids (HOX), hydroxylation, hydroboration-oxidation, hydrogenation, and ozonolysis.

**Nucleophilic Addition to C=O:** Addition of hydrogen cyanide, alcohols, thiols, water, and ammonia derivatives. Aldol reaction, Cannizzaro reaction, Perkin reaction, Wittig reaction, Reformatsky reaction, reduction reactions using  $NaBH_4$ , and  $LiAlH_4$ .

### **Aromatic Substitution Reactions:**

#### **Electrophilic substitution:**

Arenium ion mechanism, orientation and reactivity, nitration, sulfonation, halogenation, Friedal-Crafts reactions (alkylation and acylation), and Diazo Coupling reactions.

#### **Nucleophilic substitution:**

Addition-elimination ( $SNAr$ ), Elimination-addition (Benzyne) mechanism, and Chichibabin reaction.

**Elimination Reactions:**  $E1$ ,  $E2$ ,  $E1CB$  mechanism, dehydrohalogenation, dehalogenation, dehydration, Hoffmann

and Saytzeff's elimination, and Pyrolytic elimination.

### **Spectroscopy:**

#### **Mass spectroscopy:**

Nature of mass spectrum, Importance of molecular ion peak, isotopic peaks, base peak, nitrogen rule, rule of 13 for determination of empirical formula and molecular formula.

#### **Ultra Violet-Visible (UV-Vis)**

#### **Spectroscopy:**

Beer's law, excitations, conjugation effect, and Calculation of  $\lambda$ -max by Woodward and Fisher rules (for dienes and enone system).

#### **Infra-red Spectroscopy:**

Principle, fundamental modes of vibrations (3N-6, 3N-5), Types of vibrations (Stretching and bending), Regions of IR Spectrum: functional group region, finger print region and aromatic region, Characteristic IR absorption of functional groups.

#### **NMR Spectroscopy:**

Principles, magnetic and nonmagnetic nuclei, nuclear resonance, chemical shift, shielding, & deshielding effect, measurement of chemical shift, delta and Tau-scales, spin-spin coupling, coupling constants.

### **General Chemistry:**

#### **Analytical Chemistry:**

Role and basic concepts of Analytical chemistry. Types of analysis. Classification of Analytical methods. Selecting an analytical method, Sampling technique. Sample preparation. Selecting and

handling of reagents. Errors in chemical analysis.

#### **Conductometric titrations:**

Principle, Specific resistance. Equivalent conductance. Molecular conductance. Measurement of conductance.

#### **Gas Chromatography (GC):**

Principles, GC Columns and GC Detectors, column efficiency in chromatography

#### **Solvent Extraction:**

The Distribution Co-efficient, The Distribution Ratio, Percent Extracted

#### **Green Methods in Chemistry:**

Twelve principles of Green Chemistry, Microwave assisted synthesis, Ultrasound assisted reactions, and Green solvents

#### **Polymer Chemistry:**

Classification of polymers, chain growth polymerization, free radical polymerization.

#### **Industrial Chemistry:**

Basic requirements of chemical industries, Quality control, quality assurance, selectivity and yield, copyright act, patent act, trademarks

#### **Research Methodology:**

Citation index, Impact factor, H-index, UGC in fonet, E-books. The introduction of Search engines, Scirus, Google, Google Scholar, Introduction of Plagiarism and self Plagiarism.

#### **Practical Based:**

Volumetric and Gravimetric analysis, pH meter and potentiometer, Organic synthesis by green chemistry approach.

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*Note: For any queries related to syllabus please contact to subject counselors.*

## **Anatomy of cell & Microbial Taxonomy**

- Concept of prokaryotic and eukaryotic cell.
- Structure, Function and Chemical Composition of: Glycocalyx/capsule, Flagella, endoflagella, Pilli, Cell wall, sphaeroplasts, ribosomes, protoplasts.
- Cell Membrane: Structure, function and chemical composition of bacterial cell.
- Structure, Function and Chemical Composition of: Flagella, Cell wall, Nucleus, Mitochondria, Chloroplast, Golgi bodies, Ribosome, Lysosome.
- Whitakers' Five Kingdom system, Carl Woese's three Domain system
- Binomial Nomenclature and basic rules

## **Microscopy and Staining**

- Basics of Microscopy: Magnification, Resolution, Numerical Aperture, Illumination system.
- Microscope and its components and Types of microscopes.
- Concepts of Dyes and Stains, types of stain (Acidic, Neutral and Basic), Mordant and Fixative
- Methods of staining: Simple (Monochrome and Negative) and Differential (Gram and Acid fast)

## **Microbial Ecology**

- Concept of microbial ecology and types of microbial interactions
- Types of microbial interactions - Positive and Negative: Mutualism, Cooperation, Commensalism, Predation, Ammensalism

## **Isolation & Cultivation of Bacteria**

- Physical parameters: pH, temperature, water activity, Oxygen
- Types of bacteria, mode of their adaptations with respect to- Temperature requirement (psychrophiles, mesophiles, thermophiles), pH requirement (acidophiles, neutrophiles and alkaliphiles),
- Pure culture technique for bacteria: Streak plate, Pour plate, Spread plate
- Types of media: complex, synthetic, natural, selective, differential, enriched media
- Concept Auxotroph and Prototroph

## **Growth and Reproduction of Bacteria**

- Concept of Growth and Reproduction, Mechanism of binary fission, Fragmentation, Budding
- Synchronous and continuous culture growth, Phases of growth curve.
- Generation time and Growth rate

## **Control of Microbes**

- Concept of sterilization, parameters, TDT and TDR,
- Concept of D, Z and F value, TDT
- Indicators of Sterilization: Chemical and Biological system
- Validation of sterility in autoclave and LAF

## **Biomolecules**

- Carbohydrates: Definition and general functions, Classification: Mono, Oligo and Polysaccharide.
- Amino acids and Proteins – Basic structure and properties of amino acids
- Fatty acid and Lipids - Classification of lipids: simple, compound/ complex, derived

- Nucleic acid- Concept of nucleoside and nucleotide

### **Basic genetics, Gene transfer & Regulation mechanisms**

- DNA: Structure (Watson and Crick Model), Chargaff's Rule, RNA: Structure and significance of : mRNA, tRNA and rRNA.
- Replication of DNA - Modes of Replication: Conservative, Semiconservative, Dispersive, Meselson and Stahl Experiment,
- Mechanism of Bacterial DNA Replication: Initiation, Elongation, Termination ,
- Gene Transfer by Transformation , Development of competence, Factors affecting competence , Gene Transfer by Conjugation , F+, Hfr and F' strains, F plasmid
- Concept of Operon , Lac Operon - Structural organization , Positive and Negative Regulation , Lac Mutants , Tryptophan Operon: Repressible System and Attenuation
- Principle and Applications of: Blotting techniques: Dot and Slot blotting, Southern, Northern & Western Blotting , Autoradiography
- Gene Sequencing: Sanger's method, Maxam-Gilbert method , Polymerase Chain Reaction (PCR)

### **Viral genetics**

- Classification of viruses based on the genome (Baltimore) ,
- Salient features of the viral genome
- Structure of Double-Stranded DNA phages: T4 and Lambda
- Lytic and Lysogenic Cycle

### **Enzymology**

- Enzyme - Definition, General properties of enzymes, Enzyme

nomenclature and classification (IUBMB),

- Mechanism of enzymes catalysis: Fischer's Lock and key hypothesis, Koshland's Induced fit hypothesis
- Role of Enzymes in genetic engineering o DNA Polymerases, Terminal deoxynucleotidyl transferases, Kinases, Phosphatases & DNA Ligase
- Immobilization of Enzyme: Concept, Methods and Applications
- Enzyme Inhibition: o Reversible Inhibition: Competitive. Uncompetitive, Noncompetitive with examples , Irreversible Inhibition

### **Metabolic pathways & Bioenergetics**

- Basic metabolic pathway: Glycolysis and Kreb's cycle, Gluconeogenesis , Cori cycle, HMP Shunt , Shuttle pathways (Malate aspartate and Glycerol phosphate shuttles)
- Laws of thermodynamics: First, Second, Third , Concept of Gibes free energy, entropy and enthalpy
- Fatty acid oxidation - Beta oxidation , Catabolism of proteins - Transamination , Deamination (Oxidative and Non-oxidative)

### **Bio-analytical techniques**

- Absorption spectrum, Beer's and Lambert's law, Chromatography - Paper and Thin layer
- Electrophoresis - Agarose gel, Poly acrylamide gel (PAGE), SDS-PAGE

### **Fermentation Technology**

- Fermenter - Criteria for fermenter design, Structure of a Typical Fermenter and its parts Impeller, baffles, sparger, stuffing box, etc, Measurement and control of fermentation parameters: pH,

temperature, dissolved oxygen, foaming and aeration, Cell disruption : Mechanical, Physical and Chemical methods.

- Large scale production w.r.to microorganisms involved, inoculums preparation, fermentation media, fermentation process - Citric acid, Amylase, Penicillin, Cyanocobalamin, Alcohol/Beer Production
- Methods of strain improvement based on -
- Modification of permeability, Mutation, r-DNA technology
- Methods to study/screen mutation: Fluctuation test, Replica plate technique, Ames test, Repair of Mutation: photo activation, excision repair.
- Screening of industrially important microorganisms: Primary and Secondary screening examples: vitamin, antibiotic producers, Microbial culture - Culture collection centres and their role: National (NCIM) International (ATCC).

### **Diseases and Clinical Microbiology**

- Respiratory disease: Tuberculosis, Diptheria , Emerging disease: Swine flu, COVID-19 , Gastrointestinal diseases: Typhoid and Cholera
- Diagnosis of infection- Collection of pathological sample- Blood, urine, sputum, stool, throat swab, CSF , Serological tests - Widal, VDRL, Malaria, HIV DOT ELISA
- Microbiological tests - Microscopy, isolation, antibiotic sensitivity and M.D.R., M.I.C
- Advanced diagnostics: PCR/RT-PCR, DNA. Probe.

### **Basic Immunology & Immunological Disorders**

- Concepts in antigen and antibody - Adjuvants and Carriers, T-dependent and T-independent antigens ,
- Characteristics of antigen (Foreignness, Molecular size and Heterogeneity), Antigenicity versus Immunogenicity , Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic)
- Major Histocompatibility Complex - Definition , Structure and Functions of MHC Class I & II molecules
- Complement - Classical and Alternative cascade, Biological consequences of complement Activation
- Types of Hypersensitivity with examples , Autoimmunity and autoimmune disease (Rheumatoid arthritis, myasthenia gravis)

### **Food Preservation Techniques**

- Temperature-dependent control , Low temperature: Chilling and freezing , High temperature
- Chemical preservatives: Sulfur dioxide, Nitrites and nitrates& Organic acids (Acetic and Lactic acids)
- Pasteurization: Principle and Types Canning: Concept and Method
- Use of radiations: Microwave, UV and Ionizing

### **Interdisciplinary microbiology**

- Bioinformatics - Concept , Biological databases: nucleic acid database, protein database Role and examples of software tools e.g. BLAST, FASTA.
- Intellectual Property Rights and Protection - Concepts of Patents, Copyrights, Trademarks , GATT and TRIP , Patenting - need for patents , Patenting of Biological materials

### **Soil Microbiology & Methods of Plant**

**disease control**

- Rhizosphere: concept, microorganisms, significance and Rhizosphere engineering Disease Triangle (Host, environment and pathogen), concept of Disease cycle
- Plant disease control - Chemical control: fungicides, bactericides etc. Biological control: microbial herbicides & insecticides
- Integrated pest management

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*Note: For any queries related to syllabus, please contact to subject counselors.*

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