

# **Yashwantrao Chawhan Arts, Commerce & Science College, Lakhandur**

## **Programme Outcome, Programme Specific Outcome & Course Outcomes**

### **Faculty of Arts**

#### **➤ Program: B. A.**

**Programme Outcome:** This program is expected to imbue in students with certain quality for the preparation of future life and carrier. This program may develop trained professionals for various sectors such as administration, banking, transport, travel, literature, academics, print and television media, etc. They will develop with human values, social service and as responsible and dutiful citizen.

#### **Programme Specific Outcome:**

The students should possess the necessary knowledge and skills at end of the B. A degree course to be employed in as Manager, Teacher, Government jobs, Reporter, etc.

#### **Course Outcomes:**

##### **ENGLISH**

A student, who has taken English as course, is expected to develop on following outcomes - basic knowledge of English as Language, read and understand Grammar, Literature, critical thinking in English and speaking and understanding English culture via literature and other materials.

##### **ENGLISH LITERATURE**

Students opting for English Literature are expected to target following outcomes: Develop understanding of English as language, grammar and culture, communication, knowledge in literature, translation and critical study of development of English language.

##### **MARATHI**

- Creating an interest in language, culture and literature.

- Opportunities in translation, transformation and media thereby creating jobs
- Developing language and exchange with other languages
- Increasing the critical attitude about anthropological and other research studies.

## **MARATHI LITERATURE**

- Creating an interest in local language and critical analysis of literature published.
- Opportunities in translation, transformation and media thereby creating jobs
- Developing language and exchange with other languages especially with cultural values.

## **PALI & PRAKRIT**

- Understanding the language, its transition and literature in Pali and Prakrit which are old languages.
- Understanding historical perspective in the culture and values of Pali and Prakrit, the old languages of India.
- Translation and popularization by publication in translated languages.

## **ECONOMICS**

- Developing analytical skills for understanding markets, competition, government policies and its impact, data collection and sampling techniques and various growth patterns of developing economics and economic planning.

## **HOME ECONOMICS**

- Students are expected to develop knowledge about various components of diet, essential minerals, vitamins, for health.
- Develop various culinary skills, and economic importance of businesses based on food, and culinary delicacies, tourism based on culture, diet and culinary dishes.

## **POLITICAL SCIENCE**

- Students are expected to develop knowledge about political system of the nation and comparative understanding of national and international politics.
- Getting knowledge of the Constitution of India.
- Understanding the responsibilities, mechanism and functions of Government and laws.

## **SOCIOLOGY**

- Students would develop concept of social institutions, caste system, religion, nationalism, social values and culture, various factors affecting social harmony, equality and justice.
- Getting the knowledge of the works of social reformers, freedom fighters, social thinkers.

## **HISTORY**

- Students is expected to develop understanding of various historical events, international and national events, social-political figures, thinkers, and impact on society.

## **GEOGRAPHY**

- Students would develop concept of geographical structure, various agricultural practices, environmental issues, sustainable development
- Students would develop skills for survey, analysis and comparative study of various factors affecting geological, environmental status and economic impact.

## **MUSIC**

- Students would develop basic understanding of the concept of vocal and instrumental music and structure of various ragas, taan and styles of Hindustani classical music and contemporary music.
- Students are expected to develop vocal singing and playing various instruments for personal pleasure and public (solo, concert, orchestra, plays, drama, etc.)

## **PSYCHOLOGY**

- This course enable students with ability to measure attitude, aptitude, interest, adjustment, skills
- Analysis of stress and development of stress management skills.

- Development or enhancement of problem solving skills for coping different problems in life.

## **PUBLIC ADMINISTRATION**

- Students would develop understanding of theories of public administration, develop skills in managing a public sector or nonprofit organization, resource management, accounting and budgeting in government and nonprofits, evaluate role of community groups in local government, collect data, conduct a literature review, analyze data, write and explain findings, and present results orally and/or in writing.

### **Program: M. A.**

**Programme Outcome:** This program could provide well trained professionals for the Industries, Banking Sectors, Insurance Companies, Financing companies, Transport Agencies, Warehousing etc., to meet the well trained manpower requirements. The graduates will get hands on experience in various aspects acquiring skills for Marketing Manager, Selling Manager, Over all Administration abilities of the Company.

### **Programme Specific Outcome :**

The students should possess the knowledge, skills and attitudes during the end of the MA degree course. By virtue of the training they can become an Manager, Accountant , Management Accountant, cost Accountant, Bank Manager, Auditor, Company Secretary, Teacher, Professor, Stock Agents, Government jobs etc.,

### **Course Outcomes :**

## **MARATHI**

- Students will demonstrate an appropriate level of expertise in literary history, literary theory, and rhetoric.
- Students will demonstrate high-level proficiency in literary research and in the synthesis of research.
- Students will demonstrate critical and analytical skills in the interpretation and evaluation of literary texts.
- Students will demonstrate a command of written academic English, including the abilities to a) organize and present material in a cogent fashion, b) formulate and defend original arguments, c) employ

effectively the language of their discipline and d) write under time constraints.

- Students will demonstrate a reading knowledge of at least one foreign language.

## **PALI & PRAKRIT**

- Students will develop deep understanding of language, literature in Pali and Prakrit.
- Demonstrate an appropriate level of expertise in literary history.
- Students will demonstrate high-level proficiency in literary research and in the synthesis of research.
- Students will demonstrate critical and analytical skills in the interpretation and evaluation of literary texts.

## **SOCIOLOGY**

- Examine the roles and responsibilities of individuals, groups, and institutions in larger society, displaying understanding of the complex relationships between human behaviour and the social context.
- Propose a plan of research for a sociological problem or issue, including conceptualization of the problem, review of pertinent literature, design of a research study, and identification of methods appropriate for exploring the problem or issue.
- Apply various theoretical perspectives to issues in society, showing how a perspective frames each issue, that is, how we understand the issue, the kinds of questions we can ask about it, and the kinds of research methods we can apply to answering the questions.

## **ECONOMICS**

- Recognize economic problems and alternative economic systems, Identify compile, interpret, and analyze quantitative economic data by expressing relationships between concepts through graphs, statistical or econometric analysis.
- Describe monetary and fiscal policy and the processes that impact unemployment, inflation, exchange rates, balance of payments, or economic growth in a global context.
- Use microeconomic tools and concepts to address public policy issues such as competition, environmental protection, financial regulation, innovation and intellectual property, labor law, or taxation and collect, integrate information from a variety of sources, assessing its meaning, accuracy, and timeliness; discuss the bias and variance of possible

measurement and estimation procedures; and recognize the agendas of points of view of various purveyors of data and analysis.

## **GEOGRAPHY**

- The M.A. in Geography program prepares students for careers in both the academic field and non-academic jobs in various private and governmental agencies, in areas such as urban/economic geography, social geography, physical/environmental geography, and geographic information technology.
- Students learn geographic thought, research techniques, and topical specialties while preparing to conduct original research. Within this broad framework, the program is sufficiently flexible to meet individual career objectives. The M.A. in geography is designed to be a two academic year program.

## **Faculty of Commerce**

### **➤ Program: B. Com.**

**Programme Outcome :** This program could provide well trained professionals for the Industries, Banking Sectors, Insurance Companies, Financing companies, Transport Agencies, Warehousing etc., The graduates will get hands on experience in various aspects acquiring skills for Marketing Manager, Selling Manager, Over all Administration abilities of the Company.

### **Programme Specific Outcome :**

The students should possess the knowledge, skills and attitudes during the end of the B.com degree course. By virtue of the training they can become an Manager, Accountant , Management Accountant, cost Accountant, Bank Manager, Auditor, Company Secretary, Teacher, Professor, Stock Agents, Government jobs etc.,

### **Course Outcomes :**

Students who have taken admission to this program of B.Com are expected to concentrate upon the following outcomes.

- a. Commercial sense.
- b. Develop managerial skills.
- c. Entrepreneurial skill.
- d. Budgeting policy.
- e. Human Resources Management.
- f. Develop Numerical ability.
- i. Well versed with business regularity framework.

## **Faculty of Science**

### **➤ Program: B. Sc.**

#### **Programme Outcome :**

Students taking admission to this program of B.Sc. are expected to get equipped with following outcomes:

- Explaining the basic Scientific principles, Theories and Methods
- Develop scientific thinking
- Create awareness about scientific values, thinking and problem solving attitude among the student.
- Ability to handle the unexpected situation by critically analyzing the problem.
- Understand the issues related to society, nature and environment with existing and future possible solutions.

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#### **Programme Specific Outcome :**

The students should possess the knowledge, skills and attitudes during the end of the B.com degree course. By virtue of the training they can become an Manager, Accountant , Management Accountant, cost Accountant, Bank Manager, Auditor, Company Secretary, Teacher, Professor, Stock Agents, Government jobs etc.,

#### **Course Outcomes :**

##### **ENGLISH**

- Develop communication and writing skills for basic understanding of published literature and for communicating various scientific thoughts, news, essays, theories, solutions, examinations, Interviews, competitions, etc.

##### **MARATHI**

- Develop communication and writing skills in local language for communication to regional population about various scientific concepts, theories, programs, teaching, translating scientific thoughts, news, essays, theories, solutions, interviews, competitions, etc.

##### **ZOOLOGY**



- Understand and improving the knowledge about criteria for animal classification, study of model animals, features and comparative understanding of their development, ecological role, habitat, adaptations, evolutionary relationship, etc.
- Develop understanding of scientific study of animal habitat and environmental impact.

## **BOTANY**

- Develop knowledge about different groups of plants, their ecological, medicinal, economic advantages.
- Developing skills to identify plants, understand physiology, inheritance, biochemical and metabolic activities.
- Develop horticultural skills, and understanding environmental issues and give sustainable solutions.

## **CHEMISTRY**

- Creating basic understanding of chemical nature of substances, chemical reactions, basic properties of natural elements and their compounds.
- Develop working knowledge of instruments, developing practical skills, awareness of environmental issue.

## **PHYSICS**

- Develop scientific thinking, ability and techniques for understanding physical nature of the systems, both theoretical and experimental, problems and their solutions.
- Understanding knowledge of general concepts in physics such as sound, wave, friction, forces and laws of motion and use of mathematics, current, circuits, energy, and use of these concepts for mankind.
- Working knowledge of various instruments for measurement of various physical properties of matter.

## **MICROBIOLOGY**

- Understanding microbial world, isolation and culture of bacteria, cultures from soil, rhizosphere, skin, water, air, milk, etc.
- Ability to use laboratory instruments like Compound microscope, autoclave, spectrophotometer, colorimeter, PH meter, Electrophoresis, Centrifuge, etc.

- Preparing for a career in a pathology, pharmaceutical industry, medical industry, laboratory and research institutes, biotechnology.
- Understanding role of microbes in environment, health, agriculture and usage in sustainable development.

## **GEOLOGY**

- Developing skills for understanding the components of rocks, minerals, development of various geological features on earth.
- Developing skills to identify various subsurface feature, excavations, mining, analysis, and usage of minerals, metals, petroleum products, etc.

## **ELECTRONICS**

- Developing skills for usage of various electronic circuits, making and repair.
- Understanding roles of various electronic components in circuits, design and make new systems.
- Understanding role of various electronic systems in industry, medical, biotechnology, communication, space science and other fields.

## **COMPUTER SCIENCE**

- Developing skills for usage of computers, repairs and communication through use of computer systems, office work, automation, and digital literacy.
- Effectively create design software for various industry purposes, execute and prepare databases, input and output analysis of various data samples.
- Prepare for carrier in various industries including information technology, medical, manufacturing, processing, sociology, sciences, automation, animation, movies, etc.

## **MATHEMATICS**

- Ability to calculate and reason to design complex and critical financial models for Bank and Insurance Companies.
- Ability to understand both concrete and abstract problems.
- Ability to make critical observations.
- Ability to accurately organize, analyze and interpret data.
- Develop the mathematical logic which is very useful for solving

- mathematical reasoning problems.

➤ **Program: M. Sc.**

**Programme Outcome :** This program could provide well trained professionals for the Statistic Institutes, Government Census agencies, Social Data management, Survery, NGOs, Banking Sectors, Insurance Companies, Financing companies, etc., to meet the well trained manpower requirements.

**Programme Specific Outcome :**

This students admitted in this program would develop skills necessary for analysis of complex data, trends, structures, and may be as suitable employees for Statistic Institutes, Government Census agencies, Banking Sectors, Insurance Companies, Financing companies, etc., to meet the well trained manpower requirements.

**Course Outcomes :**

**MATHEMATICS**

- Ability to calculate and reason to design complex and critical financial models for Bank and Insurance Companies.
- Ability to understand both concrete and abstract problems.
- Ability to make critical observations.
- Ability to accurately organize, analyze and interpret data.
- Develop the mathematical logic which is very useful for solving mathematical reasoning problems.

Our graduates (BA, BCom, BSc) have various avenues for further studies, including pursuing postgraduate degrees in the subjects opting for subject they studied at the undergraduate. Additionally, they are eligible for a wide range of competitive exams such as MPSC, UPSC, Staff Selection Commission, Clerical, Banks and other PSUs sectors, etc. Besides opting for State Government jobs in Forest, Police and Agriculture Services, Medical and Hospital Services they have opportunities in the private sector, based on the skills acquired at our institution. The students securing B+ (Plus) in Post-Graduation are eligible for NET, SET, GATE, PET examinations. The Science graduates are also eligible for DMLT, Pathology, Pharma, QC/QA officer, Food Technician, Clinical Research, IT & Computer Services, Medical Representatives, ONGC, etc. The college is committed to transparency and timely communication, ensuring that students are aware of the admission process, important dates, and fee structures following University guidelines. Faculty members actively engage in student counseling during admissions, providing insights into program outcomes and course outcomes for informed decision-making.

#### Outcomes And Scope

- All the passing Undergraduate students are eligible for Post-Graduation (Master's Degree).
- All degree holders (UG & PG) are eligible for MPSC, UPSC, Staff selection commission, Clerical, Banks and other PSUs sectors, Forest Services, Agriculture Services Recruitment Board, Medical/Hospital Services, etc.
- The graduate students are also become eligible for job oriented or commercial courses.
- The students are also eligible for Private Sector jobs.
- The students securing B+ (Plus) in Post-Graduation are eligible for appearing in NET, SET, GATE, PET examinations as well as can opt for research work.
- The Science graduates especially biological sciences are eligible for DMLT, Pathology, Lab Technician, X-ray Technician, Pharmaceutical Companies, Quality Control Officer, Quality Assurance Officer, Food Technician, Clinical Research, IT & Computer Services, Interior/Exterior Designer, Medical Representatives, Water Testing, Geological Survey, Oil Exploration, ONGC, etc.

# M.A. in History

## Program Objectives

- **Deepen Knowledge:** Equip students with a comprehensive understanding of the past and present, encompassing both India and the wider world.
- **Critical Analysis:** Foster a critical lens for examining Indian society, economy, political systems, and cultural expressions through the lens of history.
- **Career Preparation:** Cultivate the skills and knowledge necessary for success in diverse career paths.
- **Intellectual Curiosity:** Ignite a passion for lifelong learning and independent research in students.
- **Historiographical Awareness:** Introduce students to the various historical writing traditions, both Indian and international.

## Program Outcomes:

Upon graduation, M.A. in History students will demonstrate the ability to:

- **Analyze Historical Causality:** Explain the factors that contribute to major historical events and their outcomes.
- **Master Historical Methodology:** Apply the rigorous methods of historical research and analysis.
- **Evaluate Historical Evidence:** Critically assess the credibility and value of historical sources.
- **Engage with Historiography:** Understand and analyze the evolution of historical interpretation.
- **Navigate Historical Periods:** Possess in-depth knowledge of Indian history and the broader 20th-century modern world.
- **Embrace Cultural Diversity:** Appreciate the richness and complexities of diverse cultures.
- **Engage in Contemporary Debates:** Analyze and contribute to ongoing discussions in historical scholarship.
- **Utilize Research Skills:** Effectively utilize the research tools and techniques employed by professional historians.

## M.A. in Political Science

### Program Objectives:

- **Updating Political Knowledge:** Equip students with a comprehensive understanding of core political concepts, theories, ideologies, and institutions. (Align with courses in political theory, comparative politics, American government, etc.)
- **Sharpen Research and Analysis Skills:** Foster the ability to critically analyze political data, conduct research using various methodologies, and effectively communicate findings. (Align with courses in research methods, statistics, policy analysis, etc.)
- **Develop Critical Thinking and Argumentation:** Cultivate the ability to critically evaluate political arguments, construct well-reasoned arguments, and engage in productive discourse. (Align with courses in political philosophy, political communication, debate, etc.)
- **Prepare for Professional Careers:** Equip students with the knowledge and skills necessary for success in careers related to politics, public policy, research, and non-profit organizations. (Align with courses in public administration, campaign management, international relations, etc.)
- **Promote Civic Engagement:** Foster informed and responsible citizens who actively participate in the political process and critically analyze contemporary political issues. (Align with courses in contemporary political issues, political participation, civic engagement, etc.)

### Program Outcomes:

Graduates of the M.A. in Political Science program will be able to:

- **Analyze Political Systems:** Critically evaluate the structures, functions, and challenges of various political systems across the globe. (Courses: Comparative Politics, International Relations)
- **Apply Political Theory:** Effectively utilize political theories to explain and analyze real-world political phenomena. (Courses: Political Theory, Political Philosophy)
- **Conduct Independent Research:** Formulate research questions, gather and analyze data using quantitative and qualitative methodologies, and present findings in a clear and concise manner. (Courses: Research Methods, Statistics)
- **Construct and Defend Arguments:** Develop well-supported arguments, engage in civil discourse, and persuasively communicate political ideas in written and oral formats. (Courses: Political Communication, Debate)
- **Evaluate Public Policy:** Analyze the development, implementation, and effectiveness of public policies. (Courses: Public Policy Analysis, Policymaking)
- **Navigate Global Politics:** Demonstrate a strong understanding of contemporary issues in international relations and global politics. (Courses: International Relations, Global Security)
- **Stay Informed:** Continuously engage with current political events and trends, critically analyzing them from various perspectives. (Capstone projects, seminars on current issues)
- **Demonstrate Ethics:** Adhere to ethical principles in research, professional conduct, and civic engagement. (Seminars on ethics in political science)

## Course Outcome of M. Com (BUSINESS STUDIES) Program

After getting M.Com degree students study advance business purpose skill in M.Com.(Business Studies) course. M.Com students get privilege in jobs of all commercial, Industrial organization and market area specially for exploration work. Government and Non-Government Department like Ministry of HRDC, Indian Companies of Business Organizations, Cyber Laws etc. Public Sector and Private sector. They Also get opportunities in consultancy work. Students can able to get job in various government and Non-Government sector as Financial Executives, Financial Advisor, International Traders, Banker etc.

Semester	Course/Paper Code	Course/Paper Name	Outcome of Course
MCom.1St Sem	C1	Organizationally Behaviour	Student can able to learn ornganizational Behaviour theory and apply in business organisation
	C2	Business Laws	Student can learn about provisions of Indian Nigotiable Act and Cyber Laws
	C3	Managerial Economics	Students can able to identify various elements of cost and relates the same with output and revenue under a given market conditions.
	E2	International Business	Student can able to critically evaluate international trade theories

MCom 2nd Sem	C1	Indian Financial System	Students can get evaluate the role of regulatory bodies in capital market operations
	C2	Company Law	Can able to understand provisions related to appointment of directors and auditor's
	C3	Project Management	Design and demonstrate the project execution plan for a given project.
	E2	Basics of GST	Determine the value of taxable goods and services and input tax credit



## Course Outcome of M. Sc. Botany

After getting M.Sc. degree students get privilege in jobs of all Botanical organizations in Academic, Research and industrial Field. In Academic students get Jobs in Teaching Profession in School and Colleges. In Research Field, students get Jobs as JRF, SRF, and as Scientists in various CSIR, DRDO, CICR Research Labs in India as well as abroad. In Industrial Field students get Jobs in Food Industry, Seed Industry, Pharmaceutical industry, cosmetic industry etc.

### M. Sc. Botany Semester I

<b>Course/Paper Code</b>	<b>Course/Paper Name</b>	<b>Outcome of Course</b>
<b>Core 1 (1T1)</b>	<b>Paper 1 Microbiology, Algae and Fungi</b>	The student is able to trace the phylogenetic relationship among the algae and fungi their economic importance.
<b>Core 2 (1T2)</b>	<b>Paper 2 Bryophytes &amp; Pteridophytes</b>	The student acknowledges the diversity among lower plants in the class.
<b>Core 3 (1T3)</b>	<b>Paper 3 Paleobotany and Gymnosperms</b>	The student is sensitised about the paleoclimate, fossil flora and the process of fossilisation.
<b>Core 4 (1T4)</b>	<b>Paper 4 Cytology and Genetics</b>	The student employs the knowledge of Genetics and induced mutations for crop improvement.
<b>Pract. Core 1 &amp; 2 (1P1)</b>	<b>Practical 1 Algae, fungi, Bryophytes</b>	The diversity among the microbes and lower plants is revealed to the student in the Laboratory.
<b>Pract. Core 3 &amp; 4 (1P2)</b>	<b>Practical 2 Pteridophytes, Gymnosperms, Paleobotany, Cytology &amp; Genetics</b>	The student is sensitised about the fossil flora. Diversity of Gymnosperms in the laboratory and field. The student is equipped with techniques to prepare stains and study chromosomes.

## M. Sc. Botany Semester II

Course/Paper Code	Course/Paper Name	Outcome of Course
<b>Core 5</b>  <b>(2T1)</b>	<b>Paper 5</b>  <b>Plant Physiology and Biochemistry</b>	The student realises the role and mechanism of physical and chemical factors affecting the plant life. The student learns to manipulate the physiological processes to enhance the crop yield and for crop improvement.
<b>Core 6</b>  <b>(2T2)</b>	<b>Paper 6 – Plant Development and Reproduction</b>	The student understood correlation between various part of plant, Structural variation in stem of various groups of plant, structural advantage to plant in response to habitat, reproductive system in plants
<b>Core 7</b>  <b>(2T3)</b>	<b>Paper 1 – Cell and Molecular Biology-I</b>	The student is sensitised to cell structure and function, Biochemical energetics etc.
<b>Core 8</b>  <b>(2T4)</b>	<b>Paper 8- Angiosperms-I and Ethnobotany</b>	Students understood about Ancestors of Angiosperms with their Time and Place of Origin, Primitive Living Angiosperm Inter-relationship of Angiosperm with other existing groups.
<b>Pract. Core 5 &amp; 6</b>  <b>(2P1)</b>	<b>Practical 3- Plant Physiology, Plant Biochem., Plant Development &amp; Reproduction</b>	The student learns to prepare buffers, solutions and carries-out the experiment. The student is trained in routinely used molecular techniques. The student learns to handle the equipment in the laboratory. The student is able to present the data and interpret the results.
<b>Pract. Core 7 &amp; 8</b>  <b>(2P2)</b>	<b>Practical 4- Cell and Molecular Biology I, Angiosperms I</b>	The student studies structure of cell, isolation of cell organelles, DNA, Protein etc. Technical processes in Taxonomy of plants.

## M. Sc. Botany Semester III

Course/Paper Code	Course/Paper Name	Outcome of Course
<b>Core 9 (3T1)</b>	<b>Paper 9 – Plant Ecology and Conservation Biology</b>	The student realises the role and mechanism of physical and chemical factors affecting the plant life. The student learns to manipulate the physiological processes to enhance the crop yield and for crop improvement.
<b>Core 10 (3T2)</b>	<b>Paper 10 - Angiosperms-II</b>	The student understood correlation between various part of plant, Structural variation in stem of various groups of plant, structural advantage to plant in response to habitat, reproductive system in plants
<b>Core Elective 1 (3T3)</b>	<b>REPRODUCTIVE BIOLOGY OF ANGIOSPERM</b>	The student is sensitised to reproductive parts and mechanism in plants
<b>Foundation Course 1 / Core Subject Centric 1  (3T4)</b>	<b>Aesthetic Botany</b>	The student learns about Phytogeography, Gardening, Floriculture, Landscaping
<b>Pract. Core 9 &amp; 10  (3P1)</b>	<b>Practical 5- Plant Ecology and Conservation Biology and Angiosperms II</b>	The student is able to present the data and interpret the results about ecological experiments
<b>Pract. Core Elective 1 (3P2)</b>	<b>REPRODUCTIVE BIOLOGY OF ANGIOSPERM</b>	The student studied various techniques used in reproductive mechanism in plants

## M. Sc. Botany Semester IV

Course/Paper Code	Course/Paper Name	Outcome of Course
<b>Core 11</b> <b>(4T1)</b>	<b>Paper 13</b> <b>Cell and Molecular</b> <b>Biology-II</b>	The student realises the role and mechanism of physical and chemical factors affecting the plant life. The student learns to manipulate the physiological processes to enhance the crop yield and for crop improvement.
<b>Core 12</b> <b>(4T2)</b>	<b>Paper 14</b> <b>Plant</b> <b>Biotechnology</b> <b>and Plant</b> <b>Breeding</b>	The student understood correlation between various part of plant, Structural variation in stem of various groups of plant, structural advantage to plant in response to habitat, reproductive system in plants
<b>Core</b> <b>Elective 2</b> <b>(4T3)</b>	<b>REPRODUCTIVE</b> <b>BIOLOGY OF</b> <b>ANGIOSPERM</b>	The student is sensitised to reproductive parts and mechanism in plants
<b>Foundation Course 2 /</b> <b>Core Subject Centric 2</b> <b>(4T4)</b>	<b>Paper 16</b> <b>Plant Resource</b>	The student learns about Economic botany, Pharmacognosy, phytochemistry, and Industrial Botany.
<b>Pract. Core 11, 12 &amp;</b> <b>Elective 2</b> <b>(4P1)</b>	<b>Practical 7</b> <b>Cell and</b> <b>Molecular</b> <b>Biology-II,</b> <b>Plant</b> <b>Biotechnology</b> <b>and Plant</b> <b>Breeding</b>	The student is able to prepare experimental framework of cell and molecular Biology, Biotechnology and plant Breeding
<b>Project</b> <b>(4 PROJ 1)</b>	<b>Practical 8</b> <b>Project</b>	The student sensitised about the research framework, academic writing and research methodology.

## Course Outcome of M. Sc. Chemistry Program

By the end of the course, the students will be able to:

1. Join school or junior college as Chemistry teacher.
2. Prepare for competitive exams like MPSC,SET,UPSC,NET,GATE,CAT.
3. Join NET/SET/Ph.D qualified students as assistant professor.
4. Analyze and grasp abstract ideas to apply them to important practical problems.
5. Develop strong analytical skills and a broad-based background in the Chemistry sciences to join research and pharmaceutical industry.

### M.Sc. CHEMISTRY Semester-I

Course/Paper Code	Course/Paper Name	Outcome of Course
MCH1T01	Inorganic Chemistry	1. Understand Stereochemistry and bonding in main group compound and metal ligand bonding. 2. Understand Metal-ligand equilibria in solution. 3. Understand the reaction mechanism of Transition metal complexes. 4. Understand the Borohydride compounds and metal-metal bonds..
MCH1T02	Physical Chemistry	1 Understand the concept of classical thermodynamics. 2. Understand the concept of Gibbs function and phase equilibrium. 4.chemical Kinetics and catalytically reaction 3. Understand the surface phenomenon of macromolecules and chemical kinetics of reactions.
MCH1T03	Analytical Separation Techniques	1.To study statistical analysis of chemical reactions. 2. To understand separation techniques involved in purification process. 3. Students will be able to perform volumetric and gravimetric analysis. 4. To study the conceptual understanding of electrochemical analysis.
MCH1T04	Research Methodology	1 Literature Survey: 2 Research Methodology for Chemistry 3. Chemical Safety and Ethical Handling of Chemicals: 4. Data Analysis:

MCH1P01	Inorganic Chemistry Practical	<ol style="list-style-type: none"> <li>1. Prepare inorganic complexes and their analysis.</li> <li>2. Perform quantitative analysis of different metal salts.</li> <li>3. Able to perform qualitative analysis of rare earth metals.</li> <li>4. To understand gravimetric and spectrometric analysis of complexes</li> </ol>
MCH1P02	Physical Chemistry Practical	<ol style="list-style-type: none"> <li>1. To determine molecular wt. of polymer by viscosity method.</li> <li>2. To study the kinetics of chemical reactions. 3. To determination of heat of reaction, entropy change and equilibrium constant of the reaction between metallic zinc and Cu<sup>+2</sup> ions in solution. 4. To determine equivalent conductance of weak electrolyte at infinite dilution by kaulrausch's Method.</li> </ol>

### M.Sc. CHEMISTRY Semester-II

Course/Paper Code	Course/Paper Name	Outcome of Course
MCH2T05	Organic Chemistry	<ol style="list-style-type: none"> <li>1. Understand the nature and bonding and reactive intermediate in organic chemistry.</li> <li>2. Study stereochemistry of organic compound.</li> <li>3. Study the reaction mechanism and reactivity of organic compounds i.e. Aliphatic nucleophilic substitution reaction, aromatic nucleophilic and electrophilic substitution reaction.</li> </ol>
MCH2T06	Analytical Chemistry	<p>To understand classical methods and separation techniques: calibration, validation and computers</p> <ol style="list-style-type: none"> <li>2. To study instrumental techniques: electro analytical techniques.</li> <li>3. To perform volumetric and gravimetric analysis. 4. To understand and perform Optical methods of analysis.</li> </ol>
MCH2T07	Instrumental Methods of Analysis	<ol style="list-style-type: none"> <li>1. Understand use of radioanalytical chemistry.</li> <li>2. Know about the Optical methods of analysis.</li> <li>3. Gain knowledge about electrochemical methods of analysis such as stripping voltammetry, adsorptive stripping voltammetry, cyclic voltammetry.</li> <li>4. To understand Fluorometry, phosphorimetry, Nephelometry and turbidimetry, Photoacoustic spectroscopy</li> </ol>
MCH2P03	On Job Training/Field Project	<ol style="list-style-type: none"> <li>1. On-the-job training (OJT) is one of the most influential and well-established ways of teaching students the skills and knowledge needed to work in a professional environment.</li> <li>2. Prepare ppt presentation.</li> <li>3. Improve presentation skill and teaching communication skill</li> </ol>

MCH2P04	Organic Chemistry Practical	<ol style="list-style-type: none"> <li>1. Perform organic qualitative analysis for structure determination.</li> <li>2. Students will be able to perform single stage preparations.</li> <li>3. Carry out purification of the compounds by crystallization, TLC and chromatographic techniques.</li> </ol>
MCH2P05	Analytical Chemistry Practical	<ol style="list-style-type: none"> <li>1. Understand Sampling and quantification.</li> <li>2. Study modern separation techniques such as gas Chromatography, liquid chromatography, supercritical fluid chromatography.</li> <li>3. To understand Optical methods of analysis</li> </ol>

### M.Sc. CHEMISTRY Semester-III

Course/Paper Code	Course/Paper Name	Outcome of Course
MCH3T08	Spectroscopy	<ol style="list-style-type: none"> <li>1. To understand the idea of space groups and to learn the theory of molecular symmetry. To gain skill to apply group theory. - To know the basics principle of different techniques employed in molecular spectroscopy.</li> <li>2.- To study the origin, instrumentation and important applications of Microwave, Mossbauer, Raman, IR and EPR techniques. –</li> <li>3. To enable the students to elucidate the structure of compounds by analyzing the spectral data.</li> </ol>
MCH3T09	Advance Organic Chemistry	<ol style="list-style-type: none"> <li>1. To study the chemical and biological catalysis, remarkable properties of enzymes, mechanism of enzyme action and co-enzyme chemistry. –</li> <li>2. To get insight into the chemistry of heterocyclic. –</li> <li>3. To impart the students thorough idea in the chemistry of nucleic acids, lipids and vitamins. –</li> <li>4. To get an idea about dyes, pharmaceutical chemistry and polymer chemistry with their applications in daily as well as industrial applications.</li> </ol>
MCH3T10	Advance Analytical Chemistry	<ol style="list-style-type: none"> <li>1. Know the use of organ analytical chemistry.</li> <li>2. Understand the procedure for analysis of ores and cement.</li> <li>3. To gain the knowledge about water pollution and analysis.</li> <li>4. To understand the air pollution and analysis.</li> </ol>

MCH3T11	Organic Chemistry Special-I	<ol style="list-style-type: none"> <li>1. To study Photochemistry and pericyclic reactions of organic compounds.</li> <li>2. Understand oxidation and reduction methods in chemical methods.</li> <li>3. Gain the knowledge about chemistry of P, S, Si, and Boron compounds.</li> <li>4. Use of Organo silicon compounds in organic synthesis</li> </ol>
MCH3P06	Organic Chemistry Practical	<ol style="list-style-type: none"> <li>1. Prepare inorganic complexes and their analysis.</li> <li>2. Perform quantitative analysis of different metal salts.</li> <li>3. Able to perform qualitative analysis of rare earth metals.</li> <li>4. To understand gravimetric and spectrometric analysis of complexes</li> </ol>
MCH3P07	Research Project (RP)	<ol style="list-style-type: none"> <li>1. Learn different techniques of research used in analysis.</li> <li>2. Prepare ppt presentation.</li> <li>3. Improve presentation skill and teaching communication skill.</li> </ol>

#### M.Sc. CHEMISTRY Semester-IV

Course/Paper Code	Course/Paper Name	Outcome of Course
MCH4T12	Spectroscopy	<ol style="list-style-type: none"> <li>1. Study spectroscopic techniques for structure determination.</li> <li>2. Study Nuclear magnetic Resonance Spectroscopy which is useful for structure determination.</li> <li>3. Study diffraction technique which is useful for structure determination</li> </ol>
MCH4T13	Advance Inorganic Chemistry	<ol style="list-style-type: none"> <li>1. Understand nanoparticle and nanostructural material.</li> <li>2. Learn coordination polymer and their characterization.</li> <li>3. Understand organotransition metal inorganic chemistry and their reactions.</li> <li>4. Understand catalysis and optical sensor for metal ions.</li> </ol>
MCH4T14	Advance Physical Chemistry	<ol style="list-style-type: none"> <li>1. Understand chemical thermodynamics.</li> <li>2. Understand corrosion and corrosion analysis.</li> <li>3. Understand and uses of Radiation chemistry.</li> <li>4. Learn electrical and thermal properties of solids.</li> </ol>



MCH4T15	Organic Chemistry Special-II	<ol style="list-style-type: none"><li>1. Understand chemistry of natural products.</li><li>2. Importance of alkaloids and prostaglandins in biological systems.</li><li>3. To gain the knowledge about carbohydrate, amino acids, protein and peptides.</li></ol>
MCH4P08	Research Project (RP)	<ol style="list-style-type: none"><li>1. To provide students with exposure to a variety of research projects and activities in order to enrich their academic experience. –</li><li>2. To provide opportunity for students to develop skills in presentation and discussion of research topics in a public forum.</li></ol>

## Course Outcomes: MSc GEOLOGY

### GEOLOGY SEM1

Course/Paper code	Course / Paper Name	Outcome of course
PAPER- 1	Mineralogy Crystallography Stratigraphy  Indian geology (1+1+1+1)	Types of bonding, Pauling's rule and co-ordination polyhedral; Crystal imperfection defects, twinning and zoning; Polymorphism, Concept of unit cell, Crystals, Crystalline solids and their formation, Principles of stratigraphy, Code of stratigraphic nomenclature of India, Physiographic divisions of India, Lithostratigraphy, Precambrian – Cambrian boundary with special reference to India, Paleozoic rocks of Spiti, Kashmir, and Kumaun Study of Gondwana Supergroup with reference to depositional environments
PAPER- II	Igneous Petrology Metamorphic Petrology (2+2)	Introduction to properties of magma (Temperature, Viscosity, and Volatile component), Internal structure of the earth, Melting (Batch, Fractional, and Continuous) and Generation of magma, Petrography and Petrogenesis of Basalt clan, Petrography and petrogenesis of andesite and associated rocks, Limits and Physico-Chemical controls of metamorphism (T, P and fluids), Types of metamorphism: Regional, contact, dynamic, hydrothermal, impact, retrograde and ocean floor metamorphism, Transient and steady state geotherms, Geothermal gradients and tectonics of orogenic belts, Protolith types and characteristic metamorphic minerals, Facies and sub-facies series (Classifications of Escola, Miyashiro and Yardley), Metamorphic zones, Metamorphic series.
RP/OJT/RM	General Principles Mapping Techniques Computer techniques, Softwares and Statistical Methods Instrumentation Techniques (1+1+1+1).	Hypothesis; Report writing; Aim and Objectives; Drafting a proposal; Funding proposal; literature survey; Plagiarism; Journals and types (Predatory); Citation Index; Impact matrices; Introduction to various types of research aids; DOI (Digital Object Identifier, Objectives of geological mapping; Precision required in geological mapping; Topographic maps and base maps for geological mapping; topographic and their numbering by survey of India; Types of geological maps and sections; Introduction to computer applications in geosciences; Geological data compilation, processing and presentation; Introduction to computer programming and Basic programming codes; Statistical analysis using various statistical softwares including excel, Thin section and polished section making; Sample etching, staining and model count techniques; Geological application of Cathodoluminescence

ELECTIVE - 2	Exploration Methods Basin Analysis and Sequence Stratigraphy	Stages of exploration, Scope, Objectives and methods of prospecting, Geological methods of surface and subsurface exploration, Guides of ore, Method of breaking the rock, Blast holes and their patterns, Explosives used for rock blasting, Drilling methods used in mineral exploration, Concept of Basin analysis, Sequence stratigraphy, its concept and evolution; Order and duration of sequences; Application and significance of stratigraphy
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## GEOLOGY SEM II

Course/Paper code	Course/Paper Name	Course Outcome
PAPER- 1	Sedimentology Palaeontology  Palaeobiology (2+1+1)	Liberation and flux of sediment; Texture of sedimentary rocks and their significance; Grain size parameters, Sedimentary environments and facies; facies model for fluvial, glacial, lacustrine, fluvioglacial, fluviolacustrine, delataic; siliciclastic shallow and deep marine environments; Carbonate platform- types and facies model; Sedimentation in major tectonic settings; Tectonics and Sandstone composition; Paleoclimate and paleo-environment analysis; Implication of facies in environmental interpretation , Fossil record and geological time scales; Types of fossils, modes of preservation of fossils and concepts of taphonomy, Approach to paleobotany; Classification of fossil plants; Evolutionary trend in angiosperm plants; Pre-Gondwana flora; A brief idea about Gondwana, and Paleogene flora of India
PAPER- 2	Geochemistry Structural Geology Techtonics (1+2+1)	Introduction to geochemistry; Atomic structures and properties of elements in the periodic table; Geochemical classification of elements; Origin and abundance of elements in the solar system and Earth; Variation diagrams (bivariate, multivariate, element ratio variation, enrichment- depletion , Laws of thermodynamics; Concept of internal energy, heat capacity, enthalpy and entropy; Gibbs free energy and chemical potential; fugacity and activity; Raoult's law and Henry's law; Principles of geothermobarometry, Theories of rock failure (Mohr-Coulomb, Shear Zones: Brittle and ductile shear zones, geometry and products of shear zones; Mylonites and cataclasites, their origin and significance
ELECTIVE - 2	Mineral Exploratiopn, Applied and Industrial Micropalentology Fractional crystallization, liquid lines of descent and lever rule	Stages of exploration; Scope, Objectives and methods of prospecting; Geological methods of surface and subsurface exploration; Guides of ore localization;; Explosives used for rock blasting; Alluvial exploration method; Solution method and leaching method; Sea bed exploration for manganese nodules; Coal bed methane, Drilling methods used in mineral exploration, Scope of Applied Micropaleontology; Modern field and laboratory techniques applied in microfossilsstudy, Advances in environmental micropaleontology

**GEOLOGY SEM III**

<b>Course/Paper code</b>	<b>Course/Paper Name</b>	<b>Course Outcome</b>
3T1	Hydrogeology and Watershed Management	Hydrological cycle, Groundwater quality and environmental aspects; Chemical characteristics of groundwater in relation to various uses – domestic, industrial and irrigation; Saline water intrusion in coastal and other, Surface and subsurface methods of groundwater exploration; Application of remote sensing in groundwater exploration, Artificial recharge to groundwater and rainwater harvesting; Management of groundwater resources
3T2	Geomorphology, Remote Sensing and GIS	Geomorphic concepts; Landforms: Role of Lithology, peneplanation, endogenous and exogenous forces responsible, climatic and tectonic factors and rejuvenation of landforms; Denudational processes, Fundamentals of EMR, radiation laws, black and grey body radiation, atmospheric effect in remote sensing, Orbit and Sun-synchronous aspect of satellite; Remote Sensing Sensor: Platforms and sensor resolution and calibration aspects of remotely sensed data, microwave sensor and False Colour Composite (FCC);, Principles and components of GIS; Geospatial data, data for GIS application, spatial data models and data structures
3T3	Core Elective 1 Mining Geology and Mineral Exploration	Application of Geology in mining; Geological work at an operating mine; Guides in the location of ore deposits- physiographic, lithologic, stratigraphic, mineralogic and structural guides, Mineral Exploration – its significance, necessity and objectives; Methods in mineral exploration- objectives and limitations of different methods, Fundamentals of geochemical prospecting; Geochemical environments, mobility and distribution in dispersion of elements in primary and secondary environments,
3T4	Core Subject Centric I 1) Environmental Geology & Engineering Geology (2+2)	Components of environmental geology; Atmospheric carbon-dioxide increase and global warming; Paleo-temperature estimation from ice cores, Problems of urbanization, human population and their impact on environment; Alternative sources of energy, Scope of geology in civil engineering and mining industry; Various stages of engineering geological investigations for civil engineering projects, Geological investigations for the various engineering projects: dams, reservoirs, landslides, tunnels, highways

**GEOLOGY SEM IV**

<b>Course/Paper code</b>	<b>Course/Paper Name</b>	<b>Course Outcome</b>
4T 1	Ore Geology and Ore Microscopy	Modern concept of ore genesis; Spatial and temporal distribution of ore deposits -a global perspective, Concept of ore bearing fluids, their origin and migration; Wall-rock alteration; Structural, physico-chemical and stratigraphic controls of ore localization, Petrological ore associations with Indian examples wherever feasible:, The ore microscope; preparation of polished section of ores
4T 2	Indian Mineral Deposits and Mineral Economics	Study of the following Indian ore deposits with reference to their mineralogy, Study of the following Indian ore deposits with reference to their mineralogy, Study of the following mineral deposits with reference to their mineralogy, mode of occurrence, origin, Concept of mineral economics; Significance of minerals in National economy; Use of various minerals in industries
4T 3	1) Exploration Geochemistry (4)	Geochemistry in mineral exploration: Brief history and present status; Geochemical cycle; Geochemical environments, Secondary dispersion and accumulation of elements, weathering, formation of soil, secondary dispersion patterns, Interpretation of geochemical anomalies including pathfinders and preparation of different geochemical maps and treatment of geochemical data, Biochemical, geobotanical and geozoological prospecting; Application of remote sensing in geobotanical exploration.
4T 4	(Core Subject Centric 2) Fuel Geology (Coal, Petroleum & Nuclear)	Origin of coal; Sedimentology of coal bearing strata; Structures associated with coal seams; Proximate and Ultimate analysis of coal, Coal Petrology – concept of ‘lithotype’, ‘maceral’ and ‘microlithotype; Classification and optical properties of macerals and microlithotypes, Petroleum:Different states, natural occurrences, chemical composition and physical properties of different fractions, Mineralogy and geochemistry of radioactive minerals; Mode of occurrence, origin, association and distribution of atomic minerals in nature.



## Course Outcome of M. Sc. Microbiology (NEP-2020)

Students after pursuing M.Sc. Microbiology degree have privilege in jobs of Government as well as Private Institutions of Medical, Pharma, Agriculture, Biotechnology, Water Quality/Treatment, Biological Waste Management, Food and Beverage Industry, Forensics etc. The students securing B+ (Plus) and above M.Sc. Microbiology are eligible for NET, SET, GATE, PET examinations and can pursue higher research degree PhD and/or apply for academic institutions as Assistant Professor. The courses are designed and approved by Board of Studies (Microbiology), RTM Nagpur University as per NEP-2020.

Course/Paper Code	Course/Paper Name	Outcome of Course
<b>MSc SEM I</b>		
<b>MM11T01</b>	<b>Microbial Metabolism</b>	<p><b>At the end of the course the student will be able to:</b></p> <p><b>1. understand Biochemical basis of life forms, 2. Learn the energy transformations in biological processes, 3. Understand the synthesis of biomolecules, 4. Understand synthesis and breakdown mechanisms in bacteria</b></p>
<b>MM11T02</b>	<b>Enzymology and Techniques</b>	<p><b>1. Understand general characteristics of enzymes, 2. Learn the different mechanisms of enzyme catalysis, 3. Gain an understanding of enzyme kinetics and regulation, 4. Understand various biochemical techniques based on enzymes like biosensors</b></p>
<b>MM11T03</b>	<p><b>1. Advance techniques in microbiology</b></p> <p><b>2. Membrane Structure and Signal Transduction</b></p>	<p><b>1. Learn the basic biophysical techniques, 2. Understand the design and working principle of various microscopes, 3. Understand the biomolecular separation and identification techniques, 4. Learn the advanced molecular techniques.</b></p> <p><b>1. Understand the structure and components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles, 2. Understand different advance technique used for cell membrane study, 3. Understand different advance technique used for cell</b></p>

		membrane study, 4. The student has a strong foundation on the functions of the cell.
MM11T04	Research Methodology	The student will be able to 1. Identify and describe the characteristics of different types of research, including basic, applied, and patent oriented research, 2. Apply scientific thinking, problem identification, 3. Apply descriptive and inferential statistical analysis techniques to analyse and interpret research data, 4. Develop technical writing, research reporting , research ethics, academic integrity.
MM11P01	Practical I	Student will be able to assay various enzymes, effect of various factors on enzyme activity, determination of glucose, protein, DNA, RNA, nitrate reduction, titration of amino acids, immobilization of enzyme, blood sugar by glucose biosensor
MM11P02	Practical II	Student will be able to learn subcellular organelles, isolation of marker enzymes, processes of molecular techniques, isolation and analysis of protein and industrially important microorganisms, statistical analysis of data
<b>MSc SEM II</b>		
MM12T05	Environmental Microbial Technology	Student will be able to understand microbial communities and their interactions, role of microorganisms in treatment of waste materials, factor responsible for global warming and restoration of degraded ecosystems.
MM12T06	Immunology and Immunodiagnostics	Student will be able to learn immune system organs, cells and receptors, molecular basis of antigen recognition, hypersensitivity reaction, antigen-antibody reaction, applications in treating human disease.
MM12T07	1. Microbial Metabolites 2. Pharmaceutical Microbiology	1. Student will acquaint with basics of microbial metabolites, newer bioactive molecules and immunomodulators, understand structure and mode of action of secondary metabolites, quorum sensing.



		2. Student will gain knowledge regarding drug discovery, drug development, production of various types of enzymes, antibiotics, new therapeutic drugs, mode of action of antimicrobial agents, regulatory practices, biosensor applications
MOJ2P01	On Job Training/ Field Project	Field experience will be able to give students current knowledge and hands-on practice of processes in industry
MM12P03	Practical III	Student will be able to perform techniques in environmental microbiology and understand different parameters in environmental microbiology
MM12P04	Practical IV	Student will be able to perform various diagnostic techniques in immunology, and gain knowledge of different bacterial diseases and their diagnosis.
<b>MSc SEM III</b>		
MM13T08	Microbial Diversity, Evolution and Ecology	Student will be able to learn various microbial community, their evolution and role in ecological processes
MM13T09	Molecular Biology and Genetics	Student will be able to learn the basics of biomolecules, structure and function, basics of genetics and processes
MM13T10	Recombinant DNA Technology and Nanobiotechnology	Student will be able to learn various biotechnological tools and techniques used in cloning, propagation, isolation, modification of DNA, and nano-technology usage in biotechnology
MM13T11	1. Drug and Disease Management 2. Bioinformatics	Student will be able to learn about drug product classifications, ingredients, sources, routes of administration, and factors that influence drug effects 2. To learn the concepts of Data compilation, storage, analysis, Mining, utilize data mining techniques and enhance its application in acquiring Biological Data, and learn large scale biological data analysis using Bioinformatics Softwares
MM13P05	Practical V	Student will be able to learn various biophysical techniques employed in biotechnology research

<b>MRP3P01</b>	<b>Research Project/Dissertation (Core)</b>	<b>Student will be able to hypothesize, problem identification, research methodology, experimental work, data compilation, analysis and report preparation.</b>
<b>MSc SEM IV</b>		
<b>MM14T12</b>	<b>Virology</b>	<b>Student will be able to learn virus architecture and classification, transmission and replication for medically important viruses and viral diseases.</b>
<b>MM14T13</b>	<b>Microbial Fermentation &amp; Techniques</b>	<b>Understanding the different types of fermentation processes, equipment used, and microbiological processes involved, fermented foods, beverages, microbial quality of milk and fermented products, control of spoilage.</b>
<b>MM14T14</b>	<b>Medical Microbiology and Parasitology</b>	<b>Students will learn pathogenic microorganisms and diseases transmission and control, types of parasites, life cycle, vectors, prevention and control.</b>
<b>MM14T15</b>	<b>1. Vaccinology 2. Bioethics, Biosafety and IPR</b>	<b>Learn about vaccine development, the diseases that vaccines target, and types of vaccines, vaccine production processes and biosafety regulations.</b>
<b>MRP4P02</b>	<b>Research Project/Dissertation (Core)</b>	<b>Student will be able to hypothesize, problem identification, research methodology, experimental work, data compilation, analysis and report preparation.</b>

# M.Sc. Physics

## Course Outcomes

M.Sc. Physics is a 4-semester course conducted by Yashwantrao Chawhan Arts, Commerce and Science College, Lakhandur as per the syllabus provided by Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur. Each semester students have to take four theory papers, two Practicals based on four theory papers, and a Seminar. The fourth semester has a six-month Research Project Work. Third and Fourth Semester has Two Elective papers. Coursework is according to theory papers, practicals, and seminars conducted throughout the program.

### **M. Sc. PHYSICS**

#### **Semester I**

#### **(Core 1) Paper 1: Mathematical Physics**

*Course outcome: Students will be able to*

- CO1. Understand the application of Vector analysis and curvilinear coordinates and Generalized Coordinates
- CO2. Demonstrate the theory and application of Tensor analysis, and Tensor algebra. Know Fourier series, Laplace Transforms and its applications.
- CO3. Analyze the application of Matrices and complex variables.
- CO4. Use of Partial differential equations and Boundary value problems –solutions. Understand the use of Bessel Functions Legendre Polynomials and Hermite Polynomials.

#### **(Core 2) Paper 2: Complex Analysis and Numerical Methods**

*Course outcome: Students will be able to*

- CO1. To get equipped with the understanding of the fundamental concepts of functions of a complex variable along with the concepts of analyticity, Cauchy-Riemann relations and harmonic functions.
- CO2. Evaluate complex contour integrals applying the Cauchy's integral theorem and

Cauchy's integral formula.

- CO3. Be aware of the use of numerical methods in modern scientific computing, numerical interpolation and approximation of functions
- CO4. Apply numerical differentiation and integration whenever and wherever routine methods are not applicable.

### **(Core 3) Paper 3: Electronics**

*Course outcome: Students will be able to*

- CO1. To study the basics of transistor and its working and implementation, various circuits like UJT, SCR and TRIAC, to know the principle of operation of photoelectric devices like photodiode, and LED
- CO2. To study applications of semiconductor devices in linear and digital circuits different biasing techniques.
- CO3. To outline summing amplifier, inverting and non-inverting configuration. To summaries various amplifier like summing amplifier and Schmitt trigger and understand the basic logic gates.
- CO4. Remember and understand the Basic principle of amplitude frequency and phase modulation

### **(Core 4) Paper 4: Electrodynamics I**

*Course outcome: Students will be able to*

- CO1. Describe the mathematical description of electromagnetic phenomena based on basic physical quantities.
- CO2. Illustrate vector potential and electric field of a localized current distribution using multipole expansion problems.
- CO3. Understanding of magnetic field, their law and boundary value problem.
- CO4. Apply Maxwell equations in analyzing the nature of electromagnetic fields due to time varying charge and current distribution.

### **LAB I Practical 1 (Core 1 and 2)**

*Course outcome: Students will be able to*

- CO1. Understand the basic concepts of Experimental and Computational Physics
- CO2. Solve the Computational problems and Write Programs.

### **LAB II Practical 2 (core 3 and 4)**

*Course outcome: Students will be able to*

- CO1. Demonstrate proper use of circuit connections of desired experiment.
- CO2. Review the observations taken during the experimentation and tabulate the results.

## M. Sc. PHYSICS

### Semester II

#### **(Core 5) Paper 5: Quantum Mechanics-I**

*Course outcome: Students will be able to*

- CO1. Understand General formulation of quantum mechanics. Know Stationary states and Eigen value problems.
- CO2. Remember and understand Fundamental postulates of Quantum mechanics.
- CO3. Demonstrate and interpret solutions of Schrodinger equation for simple problems.
- CO4. Remember and understand theory of angular momentum, spin matrices and compute Clebsch-Gordan Coefficient.

#### **(Core 6) Paper 6: Statistical Physics**

*Course outcome: Students will be able to*

- CO1. Remember and understand the concepts, basic idea of probability, phase space, macro and micro states.
- CO2. Understand to apply and formulate the Fermi-Dirac distribution to calculate thermal properties of electrons in metals and Bose-Einstein distribution to calculate properties of black body radiation.
- CO3. Demonstrate Fermi Dirac condensation on the basis of BCS theory and its application for free electron gas in metal
- CO4. Describe phase transition phenomenon using Ising model and Landau theory.

#### **(Core 7) Paper 7: Classical Mechanics**

*Course outcome: Students will be able to*

- CO1. To understand the fundamental concepts of the Lagrangian and the Hamiltonian methods and will be able to apply them to various problems;
- CO2. understand the physics of small oscillations and the concepts of canonical transformations and Poisson brackets. Learn Hamilton-Jacobi theory and its importance.

- CO3. To understand the basic ideas of central forces and rigid body dynamics.
- CO4. Understand Euler angles, Inertia tensor. Compute equations of motion for simple coupled systems

### **(Core 8) Paper 8: Electrodynamics II**

*Course outcome: Students will be able to*

- CO1. Use of Maxwell equations in analyzing the electromagnetic field due to time varying charge and current distribution. Describe the nature of electromagnetic wave and its propagation through different media and interfaces
- CO2. Explain charged particle dynamics and radiation from localized time varying electromagnetic sources
- CO3. Formulate and solve electrodynamic problems in relativistically covariant form in four-dimensional space-time
- CO4. Be familiar with some elementary phenomena and concepts in quantum electrodynamics.

### **LAB I Practical 3 (core 5 and 6)**

*Course outcome: Students will be able to*

- CO1. Tabulate the appropriate experimental data accurately and keep systematic record of general laboratory experiments.
- CO2. Interpret professional quality of textual and graphical presentations of laboratory data and computational results.

### **LAB II Practical 4 (core 7 and 8)**

*Course outcome: Students will be able to*

- CO1. Evaluate possible causes of discrepancy in practical experimental observations and results in comparison to theoretical results.
- CO2. Analyze various experimental results by developing analytical abilities to address real applications.

## M. Sc. PHYSICS

### Semester III

#### **(Core 9) Paper 9: Quantum Mechanics-II**

*Course outcome: Students will be able to*

- CO1. Solve simple problems using perturbation theory and be able to apply them to various quantum systems
- CO2. To understand the basics of time dependent perturbation theory and its application to semi-classical theory of atom radiation interaction. Solve barrier problem using WKB method
- CO3. To understand the theory of identical particles and its application to helium. To understand the idea of Born approximation and the method of partial waves.
- CO4. To aware the basic concepts of relativistic quantum mechanics. Know about Klein-Gordon equations, Dirac equations. Solve for Hydrogen atom using Dirac's theory.

#### **(Core 10) Paper 10: Solid State Physics and Spectroscopy**

*Course outcome: Students will be able to*

- CO1. Clear basic concept of crystal classes, lattices, symmetries and to understand the relationship between real and reciprocal lattice.
- CO2. Explore with the knowledge of different crystal defect and its influence on basic physical behavior of crystals and basic knowledge of dielectric properties of materials
- CO3. Understand the spectra of single and multiple electrons atoms including fine and hyperfine structure of alkaline, Helium like atoms, spin and relativity correction, different type of coupling such as L-S and J-J couplings.
- CO4. Understand and analyze the spectra of diatomic molecules such as electronic, rotational, vibrational spectra and a basic introductory idea about the Raman Spectroscopy.

#### **Paper – 11 (Core Elective 1) Atomic and Molecular Physics I**

*Course outcome: Students will be able to*

- CO1. Understand the atomic structure and spectra of typical one- electron and two-electron systems.



- CO2. Learn about the physical interpretation of the Laser spectroscopy and its application.
- CO3. Analyses consequences to explain electronic, rotational, and vibrational spectra of diatomic molecules, explain IR spectroscopy. Know the basics of Raman spectroscopy and the nonlinear Raman effects
- CO4. Skill of empirical model developing is created by studying the Born-Oppenheimer approximation. Critical thinking ability is developed by studying the Franck Condon principle.

### **Paper – 12 (Foundation Paper I) S1.2 Nanoscience and Nanotechnology**

*Course outcome: Students will be able to*

- CO1. Clear basic concept of quantum approach for density of states for quantum well, wires and dots.
- CO2. Understanding the different methods of preparing nanostructure using chemical and physical process.
- CO3. Structural and chemical characterization of nano structure. Explore with the knowledge of different instrumentation useful to analyses materials at nanoscale.
- CO4. Understanding the properties nanomaterials for technology application.

### **LAB I Practical 5 (core 9 and 10)**

*Course outcome: Students will be able to*

- CO1. Understand how to apply and verify the theoretical concepts and facts through laboratory experiments.
- CO2. Basics of different components of spectroscopy in experimental setup.

### **LAB II Practical 6 (elective)**

*Course outcome: Students will be able to*

- CO1. Students will learn the sample preparation methods and sample handling.
- CO2. Students will acquire the ability to analyze the data obtained from the techniques.

## **M. Sc. PHYSICS**

### **Semester IV**

#### **(Core 11) Paper 13: Nuclear and Particle Physics**

*Course outcome: Students will be able to*

- CO1. Clear basic concept of nuclear properties; its size, radii, shape charge distribution, spin, parity, mass, nuclear stability and also to understand binding energy, semi empirical mass formula, liquid drop model, laws of radioactive decay.
- CO2. Gains the knowledge of elementary particles, decay of nuclei, their classification, characteristics, selection rule and their theories.
- CO3. Understand the concepts of the interaction of charged particles and electromagnetic radiation with matter along with principles of radiation detectors including G-M Counter, proportional counter, Na(Tl) Scintillation detectors, semiconductor detectors.
- CO4. Understand the interaction between elementary particles and the conservation laws in particle physics.

#### **(Core 12) Paper 14: Solid State Physics**

*Course outcome: Students will be able to*

- CO1. Understand the band theory of solid and introduction to quantum theory of magnetism.
- CO2. Understanding the lattice vibrations of a three-dimensional polyatomic vibrating crystal.
- CO3. Understand the free electron theory of metals and know the fundamental principles of semiconductors and be able to estimate the charge carrier mobility and density.
- CO4. Rigorous study of various theoretical treatments of superconductivity, including BCS theory and understanding the Josephson junction effects and their applications

#### **Paper – 15 (Core Elective 1) Atomic and Molecular Physics II**

*Course outcome: Students will be able to*

- CO1. Remember and understand the time-dependent and independent perturbation theory and Fourier transform.
- CO2. Understand the saturation and absorption spectroscopy and its application.

CO3. Understand the theory of stimulated Raman scattering and fluorescence spectroscopy

CO4. Understand the Matrix isolation spectroscopy, Fourier transforms spectroscopy and

Application of group theory

### **Paper – 16 ((Foundation Paper II) S2.2: Experimental Techniques in Physics**

*Course outcome: Students will be able to*

CO1. Remember and explain different types of radiation, their sources and detectors which are commonly used in experimental techniques. Clear the conceptual understanding of functionality of different types of sensors

CO2. Demonstrate different X-ray and thermal analysis based experimental techniques used for materials characterization in Physics

CO3. Understand the different microscopy study Morphological Characterization and instrumentation for Magnetic Characterization

CO4. Understanding principle, instrumentation and working of Spectroscopic characterization for spectroscopy analysis

### **LAB I Practical 7**

*Course outcome Students will be able to*

CO1. Apply appropriate laboratory techniques to measure semiconductor device characteristics.

CO2. Understand the mode and decay behaviour of various particles.

### **Project (Code: 4PROJ1)**

Every student is required to carry out a project work in semester IV. The project can be of following types. A) Experimental Project Work; OR B) Field Based Project Work; OR C) Review writing based Project Work. The knowledge gained during their project work play a key role in the students' career to pursue Ph. D degree and start their career in research in scientific institutions.

*Course outcome: Students will be able to*

CO1. Develop the critical thinking ability and communication skills.

CO2. Understand and apply the scientific method.

CO3. Develop the aptitude to work on a scientific problem and look for alternative solution.

CO4. Write their findings in a form of a thesis and defend it by presenting it in front of their teachers and examiners.

CO5. Experience and embrace the habit of ethical practice in performing experiments and communicating them.

**Seminar (Code: 1S1, 2S1, 3S1 and 4S1)**

CO1. Class seminars are conducted every semester to develop and test the communication skills of students. Students will be able to comprehend the current research and should be able to put forward major ideas in front of their colleagues and teachers. Students will be evaluated on the basis of their presentation and questions and answer session.

### Outcomes of M.Sc. (Zoology)

M.Sc. Zoology (CBCS) Program: M.Sc. Zoology is a 4 semester course. All four semesters comprise of four theory papers. In addition, First semester under study consists of two skill-based Practicals while Second semester entails an On Job Training (OJT) along with two skill-based Practicals. Furthermore, Third semester comprises of one skill based practical based on electives and a Minor Research Project. The Fourth semester comprises of Major Research Project based discipline specific core (DSC).

Paper Code	Paper Name	Course outcomes
<b>MZO1T01</b>	Biology of Non- Chordata	Students will be able to identify, classify, describe, discuss and explain invertebrate specimen in the field as well as maintain and organize museum specimen. Develop a skill to demonstrate and explain different anatomical systems, physiological body processes and diversity of invertebrates, animal architecture and functions. Create the awareness of the economic importance, significance and explain structural and functional relationship between invertebrate phyla. Assess and evaluate a taxonomic status of primitive members of arthropods and molluscs. Describe and analyze the sea star's body plan, elucidate the origins and evolutionary significance of echinoderm larval forms, comprehend the mechanism of movements based on fluid filled cavities in invertebrates and identify and classify minor invertebrate specimen. Perform the whole mount preparations of given invertebrate material.
<b>MZO1T02</b>	Cell Biology and Genetics	Students will be able to describe and explain the structure and function of plasma membrane through fluid mosaic model, types of membrane proteins, transport and organization of cytoskeleton, cell organelles and endomembrane system. Differentiate and illustrate the mechanism of Cell division, cell cycle regulation, types of cell signalling, signal transduction pathways and various receptors involved in cell signalling. Describe and differentiate the types and functions of cellular communication, cell adherence molecule and extracellular matrix interaction. Differentiate Mendelian, non-Mendelian inheritance and solve the problems of inheritance based on probability. Explain, differentiate and compare codominance, incomplete dominance, gene interactions, linkage, crossing over, sex limited and sex influenced characters. Illustrate and differentiate the mode of inheritance of polygenic and monogenic traits, role of

		genetic and environmental factors of inheritance, inbreeding and its consequences and deduce coefficient of inbreeding and consanguinity. Explain, distinguish and describe the mutation and its types, structural and numerical alterations of chromosomes as well as the extra chromosomal inheritance, maternal inheritance, microbial genetics, genetic mapping and human genetics by using pedigree analysis and types of genetic disorders. They could demonstrate metaphasic chromosomes, Barr body and Polytene chromosomes.
<b>MZO1T03</b>	Digestive and Excretory Physiology	The students will be able to differentiate and compare the types, anatomical structures, secretory and endocrine cells present in the histological structure, mechanism of secretion along with the neural and chemical control secretion of different digestive glands such as the salivary gland, stomach, pancreas, liver and intestine etc. along with movement of GIT. Demonstrate the effects of various factors on the activity of digestive enzymes. Describe, explain and compare gut-brain axis, mechanism of digestion of various biomolecules such as carbohydrates, proteins and lipids and disorders associated with the GIT. Describe, explain and compare the anatomy of kidney, types and ultrastructure of nephron, mechanism of urine formation, concentration and dilution of urine and normal and abnormal constituents of urine along with micturition. Determine the regulation of urine and body fluid concentration and volume along with water, electrolyte and acid base balance. Describe, explain and compare mechanism of ADH, RAAS system, renal clearance, physiology of nitrogen excretion and causes, symptoms and treatments of renal failure. They will be able to qualitatively demonstrate the presence of various normal and abnormal constituents of urine. Further, they will demonstrate the presence of normal and abnormal urine crystals.
<b>MZO1T04</b>	Research Methodology	Students will be able to learn, describe and imbibe animal ethics in research, as well as various guidelines provided by IAEC and CCSEA. Students will be able to compare the model organisms used in biological science. They will be able to discuss and determine the animal facilities to laboratories, transportation, hygiene, environment, maintenance, ethical, legal and policy issues. Encourage students to pursue their interests in research and to investigate selecting appropriate methodology of scientific research. Students could design the

		<p>experiments properly. They will be able to write scientific reports, research proposals, patents, review articles, and will be aware of major funding agencies. Improve the knowledge of computer skills. They will be able to use basic computer programmes such as MS-Office, Coral Draw, and Photoshop. Students will analyse and use statistics to analyse data in biological research. They will be able acquainted with AI and its use in Life Science as well as to apply various statistical tools like central tendency, dispersion, skewness, and kurtosis measures to analyze results in the research work. They also learn measures of relationship tests of hypothesis testing of significance and know about statistical software. Students will also able to learn and acquainted with IPR and Patent registration.</p>
<p><b>MZO2T05</b></p>	<p>Biology of Chordata</p>	<p>Students will be able to describe and recognize unique characters, life functions, connecting link between nonchordates and chordates and the diversity of urochordates, cephalochordates, cyclostomes and fish. Describe the structural, physiological and evolutionary correlation of different vertebrates; elaborate how kidneys represented successful evolutionary responses to the surrounding environmental pressures. List some migratory bird species, conduct bird tracking and watching activity. Facilitate students to explore the world of cetaceans and the marine environment. Gain a better understanding of the forces that drive evolution, speciation and the diversity of life on our planet. Identify, describe and differentiate the basic structure and functions of the central and peripheral nervous systems and define learning and memory. Compare and contrast the organization and evolution of the vertebrate circulatory system and heart. Describe specialized sensory organs of vertebrates and relate their role to their habitat. Comprehend the gradual development and evolutionary history of man. Identify, classify, describe and explain vertebrate specimen in the field as well as maintain and organize museum specimen. Develop a skill to demonstrate and explain different anatomical systems of vertebrate, and perform whole mount preparations of given vertebrate materials, different steps of microtomy and staining procedure. They could use, handle and maintain the instruments like microtome and oven. Students will able to identify, demonstrate, explain and compare the histological structure and functions of internal organs of</p>

		vertebrates.
<b>MZO2T06</b>	Advanced Developmental Biology	Students will be able to differentiate and explain the basic developmental concept of insects, cast differentiation in insects, amphibian metamorphosis and aves with its hormonal control and regeneration process in vertebrates. Illustrate and classify the type, structure, function and hormones of the placenta, analyse the cell differentiation, organ formation, cell death, and multiple physiological levels of aging. They will be able to analyse the process of advanced cattle breeding with the help of MOET, cloning techniques, acquire knowledge about embryonic sexing to diagnose the genetic disorder, the economic and clinical significance of embryonic stem cells. Comprehend birth control method that uses the body's immune response and classical contraceptive techniques to prevent pregnancy. Explain different anti-androgen and anti-spermiogenic compounds and also discuss transgenic animals that elevated the potential of biological research for human welfare. They will able to demonstrate the development of <i>Lymnea</i> and mounting of Chick embryo.
<b>MZO2T07</b>	Mammalian Reproductive Endocrinology	Students will be able to comprehend the structural and functional aspect of hypothalamus. Illustrate regulations and feedback mechanism of various neurohormones, neurotransmitters and neural signals, structural and physiological role of pituitary. Elucidate the histological organization of endocrine glands, gonads and correlate it with the health issues. Describe and explain the non-steroidal regulators of reproduction, the hypothalamic-pituitary axis with the help of gonads, adrenal and thyroid gland, the mechanism of biosynthesis, mode of action and function of reproductive hormones such as estrogen, progesterone, androgen and inhibin that are involved in sexuality and fertility. Prepare, identify, differentiate and explain the histological slides of endocrine gland.
<b>MZO2P03</b>	On Job Training	Students will gain hands on training of any activity associated with Zoology
<b>MZO3T08</b>	Parasitology and Immunology	Students will be able to illustrate and differentiate life cycle, mode of transmission, infection and treatment of various bacterial infection and viral infections such as covid, dengue, hepatitis. Describe, explain, classify and differentiate organs of immune system, innate immunity, adaptive immunity, antigen, antibodies, toxin anti-toxin and their cellular target. Demonstrate antigen-antibody interaction with the help of ODD. Illustrate the maturation,



		activation, differentiation of T and B cell, inheritance of MHC molecules and various pathways of complement system. Classify, describe and differentiate various types of cytokines, hypersensitivity, autoimmunity and immunodeficiency diseases. Explain and describe activation and migration of leucocyte, mast cell, transplantation, tumor immunology, various infectious diseases and vaccines. Illustrate and differentiate working principle and significance of immunotechniques such as RIA and ELISA.
<b>MZO3T09</b>	Wild Life and Avian Biology	Students will explain, describe and analyze importance of wildlife and its conservation, international conservation bodies, predator-prey relationship, population dynamics of ungulates and carnivores. They could also explain, describe and analyze morphology, morphometry of birds, birds diversity, techniques of bird counting, bird breeding population and breeding group maps, bird hotspots, bird sanctuaries and role of birds in ecosystem.
<b>MZO3T10</b>	Comparative Endocrinology	Students will be able to identify, classify, differentiate, describe and explain different types of cells and organs of neuroendocrine system of invertebrates. Illustrate the role of hormones in the regulation of various physiological processes in invertebrates such as metamorphosis, reproduction and colour change mechanisms. Describe, explain, and differentiate the hypothalamo-hypophysial system, structure, hormones, functions and feedback mechanisms of pituitary, thyroid, parathyroid, pancreas, gastrointestinal tract and adrenal gland. Comprehend the role of hormones in pharmaceuticals, including contraception, sex hormones, cancer, immune system and immune regulating hormones (IRH). Raise awareness about the significance of pharmaceutical applications. Students could demonstrate compare the preparation of histological slides of endocrine glands.
<b>MZO3T11</b>	Mammalian Reproductive Physiology –Female	Students will be able to understand and evaluate the different processes and hormonal control of ovarian cycle. Describe and specify the mechanism and hormonal control of uterine cycle in different mammalian species. Comprehend the structure, function, regulation, anomalies and disease of female reproductive tract. Discuss the physiological and hormonal reasons behind bodily changes at puberty, the importance of prostaglandins in reproduction. Recognize the anatomical structure and development of breasts, mechanism of synthesis, secretion and ejaculation of milk via hormonal

		influence. They could detect and confirm the pregnancy by using female urine sample.
<b>MZO3P07</b>	Research Project (RP) Minor Work	After completion of minor research project, the student will be able to search research articles online and offline. Draft scientific writeup and submit in the form of report. They will be able to check the script for plagiarism. Discuss particular topic and could arrange it in a proper manner. Learn and write bibliography by various styles.
<b>MZO4T12</b>	Biotechniques, Biostatistics, Toxicology and Bioinformatics	Students will be able to elaborate, discuss and describe sterilization, animal cells, tissue culture, primary culture, cell lines, cell quantification, and growth kinetics and cryopreservation technique. Describe, demonstrate and explain the principle and working mechanism of sedimentation, centrifugation, TLC, gas chromatography and electrophoretic technique. Illustrate and explain the biostatistical measures such as central tendency, dispersion, probability, sampling types, methods and significance test. Describe and explain neuronal genetics, environmental components in the development of animal behaviour, organization and functions of animal ethics. Illustrate and explain about the significance of toxicity test in the projects and research. Describe and explain the importance and scope of bioinformatics, various biological databases such as BLAST and FASTA, PSI-BLAST etc. and various program runs for the construction of phylogenetic tree like MEGA. Students could construct, analyze and interpret phylogenetic tree.
<b>MZO4T13</b>	Radiation and Chronobiology	The students will be able to define and explain the scope and significance of radiobiological scope in human welfare. Identify ionizing radiation, linear energy transfer, radiation dose and units and conceptualize the radiation types. Describe, explain and analyze application of radiology and gainful and harmful effects of radiation. Comprehend the concept of circadian rhythm, central clock system and peripheral clock system. Students will describe, explain and analyze centers of biological clock, relevance of biological clock in human welfare, mechanism of regulation of biological clock and effects of irregularity of biological clock and its remedies.
<b>MZO4T14</b>	Molecular Biology and Biotechnology	Students will be able to analyse the basics of cellular genome, organization of genetic material, fundamental process of duplication of genetic material in

		<p>prokaryotes and eukaryotes important for cell division. Evaluate the different types of DNA damage and repair mechanism. Illustrate the fundamentals of various mobile DNA elements useful in horizontal gene transfer, evolutionary process and gene expression in prokaryotes and eukaryotes. Explain the mechanisms and regulation of operon models significant in regulation of gene expression in prokaryotes. Illustrate the fundamental process of protein synthesis with explanation of antisense and ribozyme technology. They could differentiate and distinguish DNA sequencing and gene amplification methods, cloning by different cloning vectors for recombinant DNA technology. Explain and describe the applications of molecular biology and biotechnology. They could demonstrate and estimate DNA, RNA, Protein and Carbohydrates.</p>
<b>MZO4T15</b>	Respiratory and Reproductive Physiology	<p>The students will be able to describe and explain the physiological anatomy of the respiratory system and illustrate the mechanism of respiration along with breathing and the exchange of respiratory gases at the pulmonary surface. Illustrate the mechanism of transport of respiratory gases (O<sub>2</sub> and CO<sub>2</sub>) by blood. Describe and explain lung volumes and capacities, and partial pressure of gases. Illustrate and compare the neural and chemical regulation of respiration, hypoxia and cyanosis. Describe, explain and compare artificial respiration, oxygen therapy and various infectious respiratory diseases (COVID-19, SARS, Swine Flu). Describe and explain the structure of the male and female reproductive systems, hormonal regulation, menstrual cycle, menstrual abnormalities, andropause and menopause. Describe and explain the mechanism and hormonal regulation of pregnancy, development of mammary glands along with synthesis, secretion, ejection and composition of milk and effects of lactation on the menstrual cycle. Compare and differentiate physiological roles of ovarian and testicular steroid hormones. They could illustrate the causes, symptoms and treatment of infertility in males and females along with In-Vitro Fertilization (IVF). They will be able to demonstrate the percentage of lactose in the milk. Further they will be able to demonstrate the effects of various factors on the dissolved oxygen of water.</p>
<b>MZO4P08</b>	Research Project (RP) Major Work	<p>After completion of major research project student will be able to select proper problem (Title). Plan and develop experimental design for projects. Select and learn to use the proper methods and materials for his/her research work.</p>

		Analyse and interpret the results. Draft the scientific write up and submit in the form of thesis. Learn and write bibliography by various styles.
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