

CBSE | DEPARTMENT OF SKILL EDUCATION

CURRICULUM FOR SESSION 2024-2025

Foundation Skills for Sciences (Pharmaceutical & Biotechnology)

(Subject Code - 421)

CLASS – X

COURSE OVERVIEW:

Life Sciences Sector is a key futuristic sector globally comprising of Pharmaceutical, Biotechnology and Medical Devices. The Indian life-sciences sector as world 3rd largest global player and with large Indian and MNC companies along with several medium and small companies together comprising of approximately 8000 active companies has seen a growth at 8 percent CAGR over the last 5 years and continue to have double digit growth projections for next five years. Sector is currently employing 10 Lacs workforce and despite of COVID-19 pandemic impact, is expected to create 6.3 Lacs new opportunities till 2026 in an optimal growth scenario.

COURSE OUTCOMES:

On completion of the course, students should be able to:

1. Apply effective oral and written communication skills to interact with people and customers;
2. Identify the principal components of a computer system;
3. Demonstrate the basic skills of using computer;
4. Demonstrate self-management skills;
5. Demonstrate the ability to provide a self-analysis in context of entrepreneurial skills and abilities;
6. Demonstrate the knowledge of the importance of green skills in meeting the challenges of sustainable development and environment protection;
7. Discuss Life Sciences Industry and Opportunities in Pharmaceutical and Biotechnology
8. Demonstrate different methods of Hygiene, cleaning and sanitization at workplace as well in class & laboratory
9. Adopt different environment sustainable best practices as habits
10. Follow Safety rules in case of any emergency, accident or disaster and best practices

11. Demonstrate Good Documentation Practice (GDP) and Data integrity for all Portfolio, practical file and classwork/homework
12. Demonstrate emotional stability and sensitivity towards genders, cultures and specially-abled persons.

COURSE REQUIREMENTS:

The learner should have the basic knowledge of science.

COURSE DURATION:

Class X	200 hrs.
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SCHEME OF UNITS

CLASS	THEORY	PRACTICAL	TOTAL
Class X	50 marks	50 marks	100 marks

This course is a planned sequence of instructions consisting of units meant for developing employability and vocational competencies of students of Class X opting for skill subject along with other education subjects.

The unit-wise distribution of hours and marks for Class X is as follows:

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CLASS – X (Session 2024-2025)

Total Marks: 100 (Theory-50 + Practical-50)

	UNITS	NO. OF HOURS for Theory and Practical		MAX. MARKS for Theory and Practical
Part A	Employability Skills			
	Unit 1: Communication Skills-II	15		2
	Unit 2: Self-management Skills-II	10		2
	Unit 3: Information and Communication Technology Skills-II	15		2
	Unit 4: Entrepreneurial Skills-II	10		2
	Unit 5: Green Skills-II	10		2
	Total	60		10
Part B	Subject Specific Skills	Theory	Practical	
	Unit 1: Fundamental of Scientific Sales and Marketing	10	20	8
	Unit 2: Standard operating procedures and fundamental elements of quality	10	10	5
	Unit 3: Handling glassware in laboratory	5	15	7
	Unit 4: Chemical storage and handling in laboratory	10	10	5
	Unit 5: Fundamental science for medicine manufacturing	10	20	8
	Unit 6: Fundamental of Innovation and Research to resolve real life problems	15	15	7
	Total	60	90	40
Part C	Practical Work			
	Practical File/ Student Portfolio			20
	Project work/Field Visit			10
	Demonstration of skill competency via activities			10
	Viva			10
	Total			50
	Grand Total	210		100

DETAILED CURRICULUM/TOPICS FOR CLASS X

Part-A: EMPLOYABILITY SKILLS

S. No.	Units	Duration in Hours
1.	Unit 1: Communication Skills-II	15
2.	Unit 2: Self-management Skills-II	10
3.	Unit 3: Information and Communication Technology Skills-II	15
4.	Unit 4: Entrepreneurial Skills-II	10
5.	Unit 5: Green Skills-II	10
	TOTAL DURATION	60

NOTE: For Detailed Curriculum/ Topics to be covered under Part A: Employability Skills can be downloaded from CBSE website.

Part-B – SUBJECT SPECIFIC SKILLS

S. No.	Units	Duration in Hours
1.	Unit 1: Fundamental of Scientific Sales and Marketing	30
2.	Unit 2: Standard operating procedures and fundamental elements of quality	20
3.	Unit 3: Handling glassware in laboratory	20
4.	Unit 4: Chemical storage and handling in laboratory	20
5.	Unit 5: Fundamental science for medicine manufacturing	30
6.	Unit 6: Fundamental of Innovation and Research to resolve real life problems	30
	TOTAL DURATION	150

UNIT 1: Fundamental of Scientific Sales and Marketing

LEARNING OUTCOMES	THEORY	PRACTICAL
1. Introduction to Sales and Marketing	<ol style="list-style-type: none">1. Understanding the concepts of sales and marketing2. Differentiating between sales and marketing3. Exploring the importance of sales and marketing in business4. Overview of the scientific approach in sales and marketing	<ol style="list-style-type: none">1. Conducting a market research project
2. Market Research and consumer Behavior	<ol style="list-style-type: none">1. Understanding the role of market research in sales and marketing2. Conducting surveys and interviews3. Factors influencing consumer behavior4. Understanding consumer needs and want	<ol style="list-style-type: none">1. Collecting and analyzing data2. Analyzing consumer buying decisions based on case studies3. Developing marketing strategies based on consumer behavior analysis
3. Marketing Mix , Advertising and Promotion	<ol style="list-style-type: none">1. Introduction to the marketing mix (4Ps: Product, Price, Place, Promotion)2. Introduction to advertising and promotion3. Types of advertising media and Creating effective advertisements	<ol style="list-style-type: none">1. List down different Creating effective advertising techniques2. Developing and implementing a digital marketing campaign using social media and other digital platforms

UNIT 2: Standard operating procedures and fundamental elements of quality

LEARNING OUTCOMES	THEORY	PRACTICAL
1. Standard Operating Procedures(SOP) and its importance	<ol style="list-style-type: none">1. Discuss standard operating procedures in life sciences sector2. Discuss SOP development process and framework3. Explain with the help of example how SOPs help finding of what, why, how, when and who of a process4. Discuss the types of SOP and maintenance with time	<ol style="list-style-type: none">1. Demonstrate how to prepare SOP

2. Identify fundamental elements of Quality Assurance	<ol style="list-style-type: none"> 1. Discuss the role of Quality assurance in life sciences sector 2. Elaborate on QMS (quality management system) 3. Explain the use of quality manual in pharmaceutical industry 4. Discuss organizational structure and responsibility 	<ol style="list-style-type: none"> 1. Make a flowchart of your responsibility as a quality assurance person 2. Create a checklist for quality assurance in your lab
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UNIT 3: Handling glassware in laboratory

LEARNING OUTCOMES	THEORY	PRACTICAL
1. Glassware in life sciences industry / science labs	<ol style="list-style-type: none"> 1. Discuss the types of glassware used in pharma, biotech industry/ science lab 2. Discuss class A and class B glassware 3. Explain the process of glassware and their advantages in life sciences industry 	<ol style="list-style-type: none"> 1. List down different glassware used in pharmaceuticals industry 2. List down importance of each glassware in school lab
2. Handling of glassware	<ol style="list-style-type: none"> 1. Explain the need of proper handling of glassware 2. Discuss SOP for glassware handling 3. Discuss labeling and proper storage of glassware 4. Discuss GDP for glassware devices 5. Discuss glassware handling while heating and cooling 4. Explain the glassware cleaning SOPs 	<ol style="list-style-type: none"> 1. Demonstrate how to handle glassware devices as per SOP. 2. Demonstrate how to identify class A and class B glassware mix-up

Unit 4: Chemical storage and handling in laboratory

LEARNING OUTCOMES	THEORY	PRACTICAL
1. Chemical storage techniques	<ol style="list-style-type: none"> 1. Elaborate on different types of chemicals used in pharmaceuticals and biotechnology industry 2. Discuss labeling and storage of chemicals 3. Elaborate on handling hazardous chemicals with safety and precautions 	<ol style="list-style-type: none"> 1. Prepare a list of all the chemicals used in your laboratory 2. Check if the labeling is proper or not

2. Chemical handling	<ol style="list-style-type: none"> 1. Discuss chemical handling according to SOP 2. Explain documentation practices for reagents and stocks used 3. Handling of chemicals with proper safety as per the respective SDS 4. Describe destruction procedure of laboratory reagents and acids 	<ol style="list-style-type: none"> 1. Prepare two separate list of hazardous and non-hazardous chemicals 2. Check the status label on the containers for the correct product name, batch number, container number etc.
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Unit 5: Fundamental science for medicine manufacturing

LEARNING OUTCOMES	THEORY	PRACTICAL
1. Introduction to Medicine Manufacturing and Chemistry of Medicines	<ol style="list-style-type: none"> 1. Overview of the pharmaceutical industry and medicine manufacturing processes 2. Basic principles of organic chemistry related to medicine manufacturing 	<ol style="list-style-type: none"> 1. List down few manufacturing industries.
3. Manufacturing Processes and Regulatory Requirements	<ol style="list-style-type: none"> 1. Overview of different manufacturing processes 2. Introduction to regulatory authorities and their roles in medicine manufacturing 3. Good Manufacturing Practices (GMP) in production 	<ol style="list-style-type: none"> 1. Analyzing real-world case studies related to medicine manufacturing
4. Pharmaceutical Industry Trends and Future Developments	<ol style="list-style-type: none"> 1. Current trends and advancements in medicine manufacturing 2. Emerging technologies and their impact on the pharmaceutical industry 	<ol style="list-style-type: none"> 1. Future prospects and challenges in the field 2. Exploring career opportunities in medicine manufacturing

UNIT 6: Fundamental of Innovation and Research to resolve real life problems

LEARNING OUTCOMES	THEORY	PRACTICAL
1. Introduction to Innovation and Research	<ol style="list-style-type: none">1. Understanding the concepts of innovation and research2. Exploring the importance of innovation and research in problem-solving3. Identifying real-life problems and challenges	<ol style="list-style-type: none">1. Identifying and analyzing real-life problems in the local community or school2. Conducting surveys, interviews, or observations to gather data
2. Research Design and Methodology	<ol style="list-style-type: none">1. Introduction to research design and methodology2. Different types of research (qualitative, quantitative, mixed-methods)	<ol style="list-style-type: none">1. Developing research plans and selecting appropriate research methods2. Designing questionnaires or interview guides for data collection
3. Innovation Process	<ol style="list-style-type: none">1. Understanding the innovation process and its stages2. Idea generation techniques (brainstorming, mind mapping, etc.)3. Evaluating and selecting ideas for implementation	<ol style="list-style-type: none">1. Conduct Brainstorming and generating innovative ideas to address identified problems
4. Intellectual Property and Patenting	<ol style="list-style-type: none">1. Introduction to intellectual property rights2. Understanding patents and their significance in innovation	<ol style="list-style-type: none">1. Conducting research to identify existing patents related to innovative solutions

CLASSROOM ACTIVITIES

Classroom activities are an integral part of this course and interactive lecture sessions, followed by discussions should be conducted by trained teachers. Teachers should make effective use of a variety of instructional or teaching aids, such as audio-video materials, colour slides, charts, diagrams, models, exhibits, hand-outs, online teaching materials, etc. to transmit knowledge and impart training to the students.

PRACTICAL WORK IN LABORATORY/WORKSHOP

Practical work may include but not limited to hands-on-training, simulated training, role play, case based studies, exercises, etc. Equipment and supplies should be provided to enhance hands-on learning experience of students. Only trained personnel should teach specialized techniques. A training plan that reflects tools, equipment, materials, skills and activities to be performed by the students should be submitted by the teacher to the Head of the Institution.

FIELD VISITS/ EDUCATIONAL TOUR (Virtual/Physical)

In field visits, children will go outside the classroom to obtain specific information from experts or to make observations of the activities through virtual. A checklist of observations to be made by the students during the field visits should be developed by the teachers for systematic collection of information by the students on the various aspects. Principals and Teachers should identify the different opportunities for field visits within a short distance from the school or through virtual.

SKILL ASSESSMENT (PRACTICAL)

Assessment of skills by the students should be done by the assessors/examiners on the basis of practical demonstration of skills by the candidate, Practical examination allows candidates to demonstrate that they have the knowledge and understanding of performing a task. This will include hands-on practical exam and viva voce. For practical, there should be a team of two evaluators. The same team of examiners will conduct the viva voce.

Project Work (individual or group project) is a great way to assess the practical skills on a certain time period or timeline. Project work should be given on the basis of the capability of the individual to perform the tasks or activities involved in the project. Projects should be discussed in the class and the teacher should periodically monitor the progress of the project and provide feedback for improvement and innovation. When the class returns after the field visit (Virtual/Physical), each group might be asked to use the information that they have gathered to prepare presentations or reports of their observations. Project work should be assessed on the basis of practical file or student portfolio.

Viva voce allows candidates to demonstrate communication skills and content knowledge. Audio or video recording can be done at the time of viva voce. The number of external examiners would be decided as per the existing norms of the Board and these norms should be suitably adopted/adapted as per the specific requirements of the subject. Viva voce should also be conducted to obtain feedback on the student's experiences and learning during the project work/ (Virtual/Physical) field visits.

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Student Portfolio is a compilation of documents that supports the candidate's claim of competence. Documents may include reports, articles, photos of products prepared by students in relation to the unit of competency.

LIST OF EQUIPMENT AND SUPPORT MATERIAL:

The tools, equipment and materials required for training are quite expensive, therefore; only basic tools, equipment and accessories should be procured by the Institution so that the routine tasks can be performed by the students regularly for practice and acquiring adequate practical experience.

1. Color-coded waste bin bag
2. Color-coded waste container
3. CO2 Type Fire Extinguisher,
4. ABC Type Fire Extinguisher
5. Personal Protective Equipment
6. Gowning material
7. Cleaning agents (soap/alconox etc.)
8. Glassware for cleaning
9. Half Face Mask
10. Gloves (Nitrile, {Heat, acid, chemical} resistant, washing etc.)

TEACHER'S/ TRAINER'S QUALIFICATION AND GUIDELINES:

Qualification and other requirements for appointment of vocational teachers/trainers on contractual basis should be decided by the State/UT. The suggestive qualifications and minimum competencies for the vocational teacher should be as follows:

QUALIFICATION	MINIMUM COMPETENCIES	AGE LIMIT
Graduation in Sciences (as per CBSE guidelines for 9 th Class teacher with relevant Subjects) related from a recognized Institute /University, with at least 1year work/ teaching experience	Effective communication skills (oral and written) Basic computing skills.	18-above years (as on Jan. 01(year). Age relaxation to be provided as per Govt. rules.
Post-graduation in Sciences (as per CBSE guidelines for 9 th Class teacher with relevant Subjects) related from a recognized Institute /University, with at least 1 year work/ teaching experience	Effective communication skills (oral and written) Basic computing skills.	18-above years (as on Jan. 01(year). Age relaxation to be provided as per Govt. rules.

Vocational Teachers/Trainers form the backbone of Vocational Education being imparted as an integral part of *Samagra Shiksha*. They are directly involved in teaching of vocational subjects and also serve as a link between the industry and the schools for arranging industry visits (Virtual or Physical), On-the- Job Training (OJT) and placement. These guidelines have been prepared with an aim to help and guide the States in engaging quality Vocational Teachers/Trainers in the schools. Various parameters that need to be looked into while engaging the Vocational Teachers/Trainers are mode and procedure of selection of Vocational Teachers/Trainers, Educational Qualifications, Industry Experience, and Certification/Accreditation. The State may engage Vocational Teachers/Trainers in schools approved under the component of Vocationalisation of Secondary and Higher Secondary Education under RMSA in the following ways:

- (i) directly as per the prescribed qualifications and industry experience suggested by the PSS Central Institute of Vocational Education (PSSCIVE), NCERT or the respective Sector Skill Council (SSC) OR (ii) through accredited Vocational Training Providers accredited under the National Quality Assurance Framework (NQAF*) approved by the National Skill Qualification Committee on 21.07.2016. If the State is engaging Vocational Teachers/Trainers through the Vocational Training Provider (VTP), it should ensure that VTP should have been accredited at NQAF Level 2 or higher.

** The National Quality Assurance Framework (NQAF) provides the benchmarks or quality criteria which the different organizations involved in education and training must meet in order to be accredited by competent bodies to provide government-funded education and training/skills activities. This is applicable to all organizations offering NSQF-compliant qualifications*

The educational qualifications required for being a Vocational Teacher/Trainer for a particular job role are clearly mentioned in the curriculum for the particular NSQF compliant job role. The State should ensure that teachers / trainers deployed in the schools have relevant technical competencies for the NSQF qualification being delivered. The Vocational Teachers/Trainers

preferably should be certified by the concerned Sector Skill Council for the particular Qualification Pack/Job role which he will be teaching. Copies of relevant certificates and/or record of experience of the teacher/trainer in the industry should be kept as record.

To ensure the quality of the Vocational Teachers/Trainers, the State should ensure that a standardized procedure for selection of Vocational Teachers/Trainers is followed. The selection procedure should consist of the following:

- i. Written test for the technical/domain specific knowledge related to the sector;
- ii. Interview for assessing the knowledge, interests and aptitude of trainer through a panel of experts from the field and state representatives; and
- iii. Practical test/mock test in classroom/workshop/laboratory. In case of appointment through VTPs, the selection may be done based on the above procedure by a committee having representatives of both the State Government and the VTP. The State should ensure that the Vocational Teachers/Trainers who are recruited should undergo induction training of 20 days for understanding the scheme, NSQF framework and Vocational Pedagogy before being deployed in the schools. The State should ensure that the existing trainers undergo in-service training of 5 days every year to make them aware of the relevant and new techniques/approaches in their sector and understand the latest trends and policy reforms in vocational education. The Head Master/Principal of the school where the scheme is being implemented should facilitate and ensure that the Vocational Teachers/Trainers:
 - a. Prepare session plans and deliver sessions which have a clear and relevant purpose and which engage the students;
 - b. Deliver education and training activities to students, based on the curriculum to achieve the learning outcomes;
 - c. Make effective use of learning aids and ICT tools during the classroom sessions;
 - d. Engage students in learning activities, which include a mix of different methodologies, such as project-based work, team work, practical and simulation-based learning experiences;
 - e. Work with the institution's management to organize skill demonstrations, site visits, on job trainings, and presentations for students in cooperation with industry, enterprises and other workplaces;
 - f. Identify the weaknesses of students and assist them in upgradation of competency;
 - g. Cater to different learning styles and level of ability of students;
 - h. Assess the learning needs and abilities, when working with students with different abilities
 - i. Identify any additional support the student may need and help to make special arrangements for that support;
 - j. Provide placement assistance

Assessment and evaluation of Vocational Teachers/Trainers is very critical for making them aware of their performance and for suggesting corrective actions. The States/UTs should ensure that the performance of the Vocational Teachers/Trainers is appraised annually. Performance based appraisal in relation to certain pre-established criteria and objectives should be done periodically to ensure the quality of the Vocational Teachers/Trainers. Following parameters may be considered during the appraisal process:

1. Participation in guidance and counselling activities conducted at Institutional, District and State level;
2. Adoption of innovative teaching and training methods;
3. Improvement in result of vocational students of Class X;
4. Continuous up gradation of knowledge and skills related to the vocational pedagogy, communication skills and vocational subject;
5. Membership of professional society at District, State, Regional, National and International level;
6. Development of teaching-learning materials in the subject area;
7. Efforts made in developing linkages with the Industry/Establishments;
8. Efforts made towards involving the local community in Vocational Education;
9. Publication of papers in National and International Journals;
10. Organization of activities for promotion of vocational subjects;
11. Involvement in placement of student's /student support services.

CAREER OPPORTUNITIES

Life Sciences is a sector which has huge career opportunities to different age group of people irrespective of gender, race and religion. Following career opportunities are available in this field. Students can make their career in any field based on their interest and suitability.

- Sales & Marketing
- Pharma covigilance
- Research & Development
- Bioinformatics
- Clinical Trial
- Manufacturing
- Biologist/ Biotechnologist
- Pharmacist
- Regulatory affair
- Clinical researcher
- Quality analyst/ assurance

CAREER PROGRESSION AND HIGHER EDUCATION

VERTICAL INTEGRATION OF THE COURSE

