LEARNING OUTCOME BASED VOCATIONAL CURRICULUM

JOB ROLE: KISAN DRONE OPERATOR

(QUALIFICATION PACK CODE: AGR/Q1006)

SECTOR: AGRICULTURE

Grades 11 and 12

PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION

(a constituent unit of NCERT, under Ministry of Education, Government of India)

Shyamla Hills, Bhopal- 462 002, M.P., India

http://www.psscive.ac.in

Gandhiji's Talisman

I will give you a talisman. Whenever you are in doubt or when the self becomes too much with you, apply the following test:

Recall the face of the poorest and the weakest man whom you may have seen and ask yourself if the step you contemplate is going to be of any use to him. Will he gain anything by it? Will it restore him to a control over his own life and destiny? In other words, will it lead to Swaraj for the hungry and spiritually starving millions?

Then you will find your doubts and your self melting away.

M K Gandhi

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Agriculture – Kisan Drone Operator

September, 2023

http://www.psscive.ac.in

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FOREWORD

The Pandit Sunderlal Sharma Central Institute of Vocational Education (PSSCIVE), a constituent of the National Council of Educational Research and Training (NCERT) is spearheading the efforts of developing learning outcome-based curricula and courseware aimed at integrating both vocational and general education to open pathways of career progression for students. The curriculum has been developed for the vocational education programme introduced under the Centrally Sponsored Scheme of *Samagra Shiksha* of the Ministry of Education (erstwhile, Ministry of Human Resource Development) and is aligned to the National Skill Qualification Framework (NSQF). The curricula for vocational courses are being developed under the project approved by the Project Approval Board (PAB) of '*Samagra Shiksha*', which is an overarching programme for the school education sector extending from pre-school to Grade 12.

It is a matter of great pleasure to introduce this learning outcome-based curriculum as part of the vocational education and training package for the job role/vocational subject of "Kisan Drone Operator". The curriculum has been developed for the secondary students of Grades 11 and 12 and is aligned to the National Occupation Standards (NOSs) for the job role. The curriculum aims to provide children with employability and vocational skills to support occupational mobility and lifelong learning. It will help them to acquire specific occupational skills that meet employers' immediate skill needs. The teaching-learning is to be done through interactive sessions in classrooms, practical activities in laboratories or workshops, projects, field visits, etc. and professional experience is to be provided through on-the-job training.

The curriculum has been developed and reviewed by a group of experts and their contributions are duly acknowledged. The utility of the curriculum will be adjudged by the qualitative improvement that it brings about in teaching-learning. The feedback and suggestions on the content by the teachers and other stakeholders will be of immense value to us in bringing about further improvement in this document.

DINESH PRASAD SAKLANI
Director
National Council of Education Research and Training

PREFACE

India today stands poised at a very exciting juncture in its saga. The potential for achieving inclusive growth is immense and the possibilities are equally exciting. The world is looking at us to deliver sustainable growth and progress. To meet the growing expectations, India will largely depend upon its young workforce. In order to fulfil the growing aspirations of our youth and the demand for skilled human resource, the Ministry of Education, Government of India introduced the revised Centrally Sponsored Scheme of Vocationalisation of School Education under *Samagra Shiksha*. For spearheading the scheme, the PSS Central Institute of Vocational Education (PSSCIVE) was entrusted with the responsibility to develop learning outcome- based curricula, student textbooks and e-learning materials for the job roles in various sectors.

The PSSCIVE firmly believes that the vocationalisation of education in the nation needs to be established on a strong footing of philosophical, cultural and sociological traditions and it should aptly address the needs and aspirations of the students besides meeting the skill demands of the industry. In order to honour its commitment to the nation, the PSSCIVE is developing learning outcome-based curricula with the involvement of faculty members and leading experts in the field. It is being done through the concerted efforts of leading academicians, professionals, policymakers, partner institutions, Vocational Education and Training (VET) experts, industry representatives, and teachers.

The expert group, through a series of consultations, working group meetings and use of reference materials develops a National curriculum. We extend our gratitude to all the contributors for selflessly sharing their precious knowledge, acclaimed expertise, and valuable time and positively responding to our request for development of curriculum.

The success of this curriculum depends upon its effective implementation, and it is expected that the managers of vocational education programme, vocational educators, vocational teachers/trainers, and other stakeholders will make earnest efforts to provide better facilities, develop linkages with the industry and foster a conducive learning environment for effectively transacting the curriculum and to achieve the learning outcomes as per the content of the curriculum document.

DEEPAK PALIWAL
Joint Director
PSS Central Institute of Vocational Education

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ACKNOWLEDGEMENTS

On behalf of the team at the PSS Central Institute of Vocational Education (PSSCIVE), we are grateful to the members of the Project Approval Board (PAB) of *Samagra Shiksha* and the officials of the Ministry of Education (MoE), Government of India for the financial support to the project for development of learning outcome-based curricula.

We are grateful to the Director, National Council of Educational Research and Training (NCERT) for his support and guidance. We also acknowledge the contributions of our colleagues at the NCERT, National Council for Vocational Education and Training (NCVET), National Skill Development Corporation (NSDC) and Agriculture Skill Council of India (ASCI) for their academic support and cooperation.

We are grateful to Prof. Vinay Swarup Mehrotra, Course Coordinator for his untiring efforts and contribution to the development of this learning outcome-based curriculum.

The contributions of the experts and the editorial support provided by Mrs. Shubha Misra, Assistant Professor in Education (Contractual), Mr. Sushant Ram Kamble, Assistant Professor (Contractual) in Education (Contractual) and Ms Akansha Dubey, Assistant Editor at PSSCIVE, are appreciated and acknowledged.

CONTENTS

1. COURSE OVERVIEW

COURSE TITLE: KISAN DRONE OPERATOR

Drones, which are fitted with sensors, cameras, and sprayers, are used in agriculture for increasing crop productivity, and at the same time reduce farmers' exposure to harmful chemicals, such as pesticides. They can used for spraying pesticides, and fertilizers, crop health monitoring, crop surveillance, crop inspection and monitoring, and yield measurement. Drone-based surveys increase crop yields while reducing time and costs.

A Kisan Drone Operator, who operates the drone in agriculture is responsible for operating and rendering the specific service using the drone. The individual operating the Kisan drone collects and analyses different types of data for enhancing productivity and profitability while ensuring sustainability and protection of the land resources. The Kisan Drone Operator training programme offers participants a comprehensive understanding and practical skills required to proficiently operate drones for agricultural applications.

Precision agriculture practices, which can help farmers, make better-informed decisions, have evolved significantly over recent years. Drone is a part of precision agriculture, wherein Global Positioning System (GPS) technology is used for crop monitoring and the uniform spray of crop nutrients and pesticides. Spraying through drones is beneficial for farmers for optimal usage of agriculture inputs, saving the effort and time and dependency on labour. Drone with suitable camera, like multi-spectral and hyper-spectral camera can be used for soil analysis. These advanced cameras capture images in multiple wavelengths beyond what the human eye can see. By utilizing geo and time tagging, these images can be processed and analyzed to gather valuable information about soil quality, composition, and health. Hyper-spectral imaging can identify specific wavelengths absorbed by water. This helps in mapping soil moisture content and drainage patterns. Certain minerals have unique spectral signatures. By analyzing these signatures, it's possible to estimate soil nutrient levels, helping farmers optimize fertilizer usage. Changes in soil composition due to erosion or degradation can be monitored over time. Comparing geo-tagged images allows for accurate tracking of these changes. With precise soil data, farmers can apply fertilizers, pesticides, and irrigation in specific amounts where and when they are needed, optimizing resources, which is also known as Variable Rate Application (VRA). Geo-tagged images can be integrated into Geographic Information System (GIS) for comprehensive spatial analysis. Time-tagged images over seasons or years provide insights into soil changes over time, crucial for agricultural planning.

Operating drones for agricultural purposes, especially involving chemical spraying, requires careful planning, adherence to regulations, and a good understanding of the technology involved. Safety and environmental concerns should always be a top priority.

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

- Describe the various components of drone;
- Register a drone with DGCA and follow their guidelines regarding registration and identification;

- Plan drone flights as per the rules and regulations of the Directorate General of Civil Aviation (DGCA) for drone operation;
- Use GPS for planning precise flight paths, especially for spraying operations;
- Calibrate the Global Positioning System (GPS) for accurate positioning;
- Operate a drone, equipped with GPS and tank for spraying chemicals and pesticides;
- Safely load chemicals/pesticides into the tank, following safety guidelines;
- Identify factors impacting drone flight such as environment, weather, and geography into planning and operations;
- Plan for scenarios where GPS signal is lost or adverse weather conditions or situations;
- Operate the spraying system judiciously based on GPS-guided patterns; and
- Identify emergency/abnormal conditions and avoid flying in adverse weather like heavy rain, strong winds, or low visibility.

COURSE REQUIREMENTS: The learner should be holding a 10th Grade pass certificate.

COURSE DURATION: 600 hrs

Grade 11: 300 hrs
Grade 12: 300 hrs

Total: 600 hrs

2. SCHEME OF UNITS AND ASSESSMENT

This course of "Kisan Drone Operator" is a planned sequence of instructions consisting of units meant for developing employability and vocational competencies of students of Grades 11 and 12 opting for vocational subject along with general education subjects. The unit-wise distribution of hours and marks for Grade 11 is as follows:

GRADE 11			
	Units	**No. of Hours for Theory and Practical = 300**	**Max. Marks for Theory and Practical = 100**
Part A	**Employability Skills**		
1.	Unit 1: Communication Skills – III	25	
2.	Unit 2: Self-management Skills – III	25	
3.	Unit 3: Information and Communication Technology Skills – III	20	
4.	Unit 4: Entrepreneurial Skills – III	25	
5.	Unit 5: Green Skills – III	15	
	Total	**110**	**10**
Part B	**Vocational Skills**		
6.	Unit 1: Introduction to Agriculture Practices	30	
7.	Unit 2: Introduction to Drones	50	
8.	Unit 3: Drone Operation	50	
9.	Unit 4: Flight Simulator Training	35	
	Total	**165**	**40**
Part C	**Practical Work**		
	Practical Examination	06	15
	Written Test	01	10
	Viva Voce	03	10
	Total	**10**	**35**
Part D	Project Work/Field Visit		
	Practical File/Student Portfolio	10	10
	Viva Voce	05	05
	Total	**15**	**15**
	Grand Total	**300**	**100**

The unit-wise distribution of hours and marks for Grade 12 is as follows:

GRADE 12			
	Units	**No. of Hours for Theory and Practical = 300**	**Max. Marks for Theory and Practical = 100**
Part A	**Employability Skills**		
1.	Unit 1: Communication Skills – IV	25	10
2.	Unit 2: Self-management Skills – IV	25	
3.	Unit 3: Information and Communication Technology Skills – IV	20	
4.	Unit 4: Entrepreneurial Skills – IV	25	
5.	Unit 5: Green Skills – IV	15	
	Total	**110**	**10**
Part B	**Vocational Skills**		40
6.	Unit 1: Drones in Agriculture	30	
7.	Unit 2: Operating Procedures for Use of Drone in Agriculture	70	
9.	Unit 3: Rules and Regulations for Drone Operation	45	
10.	Unit 4: Entrepreneurship Opportunities in Drone Technology	20	
	Total	**165**	**40**
Part C	**Practical Work**		
	Practical Examination	06	15
	Written Test	01	10
	Viva Voce	03	10
	Total	**10**	**35**
Part D	**Project Work/Field Visit**		
	Practical File/Student Portfolio	10	10
	Viva Voce	05	05
	Total	**15**	**15**
	Grand Total	**300**	**100**

3. TEACHING/TRAINING ACTIVITIES

The teaching and training activities have to be conducted in classroom, laboratory/ workshops and field visits. Students should be taken to field visits for interaction with experts and to expose them to the various tools, equipment, materials, procedures and operations in the workplace. Special emphasis should be laid on safety, health and hygiene during the training and field visits.

CLASSROOM ACTIVITIES

Classroom activities are an integral part of this course and interactive lecture sessions, followed by discussions should be conducted by trained vocational teachers. Vocational 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 impart knowledge, and training on skills and attitude to the students.

PRACTICAL WORK IN LABORATORY/WORKSHOP

Practical work may include, but should 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 specialised techniques. A training plan that includes tools, equipment, materials, skills and activities to be performed by the students, etc. should be submitted by the vocational teacher to the Head of the Institution.

FIELD VISITS

At least three field visits should be conducted in a year. In field visits, children will go outside the classroom to obtain specific information from experts or to make observations of the activities. A checklist of observations to be made by the students during the field visits should be developed by the Vocational Teacher for systematic collection of information by the students on the various aspects. Principals and Teachers should identify the different locations for field visits within a short distance from the school and make necessary arrangements for the visits.

4. ASSESSMENT AND CERTIFICATION

The National Skill Qualifications Framework (NSQF) is based on outcomes referenced to the National Occupation Standards (NOSs), rather than inputs. The NSQF level descriptors, which are the learning outcomes for each level, include the process, professional knowledge, professional skills, core skills and responsibility. The assessment is to be undertaken to verify that individuals have the knowledge and skills needed to perform a particular job and that the learning programme undertaken has delivered education at a given standard. The assessment should be reliable, valid, flexible, convenient, cost-effective and above all, it should be fair and transparent. Standardised assessment tools should be used for assessment of knowledge of students. Necessary arrangements should be made for using technology in assessment of students.

KNOWLEDGE ASSESSMENT (THEORY)

Knowledge Assessment should include two components; one-comprising internal assessment and second- an external examination, including theory examination to be conducted by the Board. The assessment tools shall contain components for testing the knowledge and application of knowledge. The knowledge test can be objective paper-based test or short structured questions, based on the content of the curriculum.

WRITTEN TEST allows candidates to demonstrate that they have the knowledge and understanding of a given topic. Theory question paper for the vocational subject should be prepared by the subject experts comprising a group of expert academicians, experts from existing vocational subject teachers, and subject matter experts from university/colleges or industry. The respective Sector Skill Council should be consulted by the Central/State Board for preparing the panel of experts for question paper setting and conducting the examinations. The blueprint for the question paper may be as follows:

Duration: 3 hrs **Maximum Marks: 40**

S. No.	Typology of Question	No. of Questions			
		Very Short Answer (1 mark)	Short Answer (2 Marks)	Long Answer (3 Marks)	Marks
1.	Remembering – (Knowledge-based simple recall questions, to know specific facts, terms, concepts, principles, or theories; identify, define or recite, information)	3	2	2	13
2.	Understanding – (Comprehension – to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase, or interpret information)	2	3	2	14
3.	Application– (Use abstract information in concrete situation, to apply knowledge to new situations: Use given content to interpret a situation, provide an example, or solve a problem)	0	2	1	07
4.	High Order Thinking Skills – (Analysis and Synthesis – classify, compare, contrast, or differentiate between different pieces of information; organise and/ or integrate unique pieces of information from a variety of sources)	0	2	0	04
5.	Evaluation – (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)	0	1	0	02
	Total	**5x1=5**	**10x2=20**	**5x3=15**	**40**

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, using a "competency checklist". The student has to demonstrate competency against the performance criteria. The assessors assessing the skills of the students should possess a current experience in the industry and should have undergone an effective training in assessment principles and practices. The Sector Skill Council should ensure that the assessors are provided with the training on the assessment of competencies.

Practical examination: Practical examination allows candidates to demonstrate the knowledge and understanding of performing a task. This will include the performance of tasks and viva voce. Teachers/Examiner will clearly define the tasks that candidates are required to perform during the practical examination. These tasks should align with the learning objectives of the course. Students are to be evaluated based on their skills, technique, accuracy, and overall performance.

For the practical exam, there should be a team of two evaluators – the subject teacher and the expert from the relevant industry certified by the Board or concerned Sector Skill Council. The same team of examiners will conduct the viva voce. They will assess the candidates' skills, adherence to industry standards, and efficiency in task execution. Special emphasis should be on assessment of the the candidate's ability to troubleshoot and solve problems related to the tasks. During the viva-voce, focus should be on assessment of candidate's communication skills and understanding of the subject.

Project Work: Project work is a great way to assess the practical skills on a certain period or timeline. Projects should simulate real-world scenarios, allowing students to solve problems or create something tangible using the skills and knowledge they've acquired. Projects should align with the curriculum's learning objectives, ensuring that students are applying relevant concepts and skills. Clear and detailed guidelines, including project objectives, evaluation criteria, and deadlines should be provided by the teachers/assessors. Rubrics, which would include aspects like content, creativity, organization, presentation, and adherence to deadlines, should be used by the Assessors to establish specific criteria for marking or grading.

Field visits can be followed by the submission of reports by the students, based on checklist. Teachers will develop a detailed checklist of items or questions students need to address during the visit. This could include specific observations, data collection, interviews, etc. Teachers will assess the reports based on the completeness of checklist items, depth of observations, analysis, and overall presentation. After the visit, teachers will also encourage students to reflect on their field experience, for example what students learned, how will they apply the knowledge gained through the field visit, etc.

Student Portfolio is a compilation of documents that supports the candidate's claim of competence. Documents may include reports, articles and photos of products prepared by students in relation to the unit of competency. Copies of certificates and awards received for academic achievements, extracurricular activities, or competitions may also be included in the portfolio. Student's portfolio may also include personal reflections of the students on their learning journey, challenges faced, and lessons learned.

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 vocational subject. Viva voce should also be conducted to obtain feedback on the student's experiences and learning during the project work/field visits.

5. UNIT CONTENTS

GRADE 11

Part A: Employability Skills

S. No.	Units	Duration (hrs)
1.	Communication Skills- III	25
2.	Self-management Skills – III	25
3.	Information and Communication Technology Skills - III	20
4.	Entrepreneurial Skills – III	25
5.	Green Skills – III	15
	Total	**110**

UNIT 1: COMMUNICATION SKILLS – III			
Learning Outcome	**Theory (10 hrs)**	**Practical (15 hrs)**	**Duration (25 hrs)**
1. Demonstrate knowledge of communication	1. Introduction to communication 2. Importance of communication 3. Elements of communication 4. Perspectives in communication 5. Effective communication	1. Role-play on the communication process 2. Group discussion on factors affecting perspectives in communication 3. Classroom discussion on the 7Cs (i.e. Clear, Concise, Concrete, Correct, Coherent, Courteous and Complete) of effective communication 4. Chart making on elements of communication	03
2. Demonstrate verbal communication	1. Verbal communication 2. Public speaking	1. Role-play of a phone conversation 2. Group exercise on	02

		delivering speech and practicing public speaking	
3. Demonstrate non-verbal communication	1. Importance of non-verbal communication 2. Types of non-verbal communication 3. Visual communication	1. Role-play on non-verbal communication 2. Group exercise and discussion on Do's and Don'ts to avoid body language mistakes 3. Group activity on methods of communication	02
4. Speak using correct pronunciation	1. Pronunciation basics 2. Speaking properly 3. Phonetics 4. Types of sounds	1. Group activities on practicing pronunciation	01
5. Apply an assertive communication style	1. Important communication styles 2. Assertive communication 3. Advantages of assertive communication 4. Practicing assertive communication	1. Group discussion on communication styles 2. Group discussion on observing and sharing communication styles	03
6. Demonstrate the knowledge of saying no	1. Steps for saying 'No' 2. Connecting words	1. Group discussion on how to respond 2. Group activity on saying 'No'	02
7. Identify and use parts of speech in writing	1. Capitalisation 2. Punctuation 3. Basic parts of speech 4. Supporting parts of speech	1. Group activity on identifying parts of speech 2. Writing a paragraph with punctuation marks 3. Group activity on constructing sentences 4. Group activity on identifying parts of speech	03
8. Write correct sentences and paragraphs	1. Parts of a sentence 2. Types of objects 3. Types of sentences 4. Paragraph	1. Activity on writing sentences 2. Activity on active and passive voice 3. Assignment on writing different types of sentences	02

9. Communicate with people	1. Greetings 2. Introducing self and others	1. Role-play on formal and informal greetings 2. Role-play on introducing someone 3. Practice and group discussion on how to greet different people	02
10. Introduce yourself to others and write about oneself	1. Talking about self 2. Filling a form	1. Practicing self-introduction and filling up forms 2. Practicing self-introduction to others	01
11. Develop questioning skill	1. Main types of questions 2. Forming closed and open-ended questions	1. Practice exercise on forming questions 2. Group activity on framing questions	01
12. Communicate information about family to others	1. Names of relatives 2. Relations	1. Practice talking about family 2. Role-play on talking about family members and relations	01
13. Describe habits and routines	1. Concept of habits and routines	1. Group discussion on habits and routines 2. Group activity on describing routines	01
14. Ask or give directions to others	1. Asking for directions 2. Using landmarks	1. Role-play on asking and giving directions 2. Identifying symbols used for giving directions	01
Total			**25**

UNIT 2: SELF-MANAGEMENT–III			
Learning Outcome	**Theory (10 hrs)**	**Practical (15 hrs)**	**Duration (25 hrs)**
1. Identify and analyse own strengths and weaknesses	1. Understanding self 2. Techniques for identifying strengths and weaknesses 3. Difference between interests and abilities	1. Activity on writing aims in life 2. Preparing a worksheet on interests and abilities	03
2. Demonstrate personal grooming skills	1. Guidelines for dressing and grooming 2. Preparing a personal grooming checklist	1. Role-play on dressing and grooming standards 2. Self-reflection activity on various aspects of personal grooming	04

3. Maintain personal hygiene	1. Importance of personal hygiene 2. Three steps to personal hygiene 3. Essential steps of hand washing	1. Role-play on personal hygiene 2. Assignment on personal hygiene	03
4. Demonstrate the knowledge of working in a team and participating in group activities	1. Describe the benefits of teamwork 2. Working in a team	1. Assignment on working in a team 2. Self-reflection on teamwork	03
5. Develop networking skills	1. Benefits of networking skills 2. Steps to build networking skills	1. Group exercise on networking in action 2. Assignment on networking skills	03
6. Describe the meaning and importance of self-motivation	1. Meaning of self-motivation 2. Types of motivation 3. Steps to building self-motivation	1. Activity on staying motivated 2. Assignment on reasons hindering motivation	03
7. Set goals	1. Meaning of goals and purpose of goal-setting 2. Setting SMART goals	1. Assignment on setting SMART goals 2. Activity on developing long-term and short-term goals using SMART method	03
8. Apply time management strategies and techniques	1. Meaning and importance of time management 2. Steps for effective time management	1. Checklist for making preparation for daily activities 2. Preparing To-do-list	03
Total			**25**

UNIT 3: INFORMATION AND COMMUNICATION TECHNOLOGY-III			
Learning Outcome	**Theory (08 hrs)**	**Practical (12 hrs)**	**Duration (20 hrs)**
1. Create a document on the word processor	1. Introduction to ICT 2. Advantages of using a word processor 3. Work with Libre Office Writer	1. Group activity on demonstration and practice of the following: • Creating a new document • Typing text • Saving the text • Opening and saving files on Microsoft Word/Libre Office Writer	02

2. Identify icons on the toolbar	1. Status bar 2. Menu bar 3. Icons on the Menu bar 4. Multiple ways to perform a function	1. Group activity on using basic user interface of Libre Office writer 2. Group activity on working with Microsoft Word	02
3. Save, close, open and print document	1. Save a word document 2. Close 3. Open an existing document 4. Print	1. Group activity on performing the functions for saving, closing and printing documents in Libre Office Writer 2. Group activity on performing the functions for saving, closing and printing documents in Microsoft Word	02
4. Format text in a word document	1. Change style and size of text 2. Align text 3. Cut, Copy, Paste 4. Find and replace	1. Group activity on formatting text in Libre Office Writer 2. Group activity on formatting text in Microsoft Word	02
5. Check spelling and grammar in a word document	1. Use of spell checker 2. Autocorrect	1. Group activity on checking spellings and grammar using Libre Office Writer 2. Group activity on checking spellings and grammar using Microsoft Word	02
6. Insert lists, tables, pictures, and shapes in a word document	1. Insert bullet list 2. Number list 3. Tables 4. Pictures 5. Shapes	1. Practical exercise of inserting lists and tables using Libre Office Writer	03
7. Insert header, footer and page number in a word document	1. Insert header 2. Insert footer 3. Insert page number 4. Page count	1. Practical exercise of inserting header, footer and page numbers in Libre Office Writer 2. Practical exercise of inserting header, footer and page numbers in Microsoft Word	03
8. Make changes by using the track	1. Tracking option 2. Manage option	1. Group activity on performing track changes	04

change option in a word document	3. Compare documents	in Libre Office Writer 2. Group activity on performing track changes in Microsoft Word	
Total			**20**

UNIT 4: ENTREPRENEURIAL SKILLS – III			
Learning Outcome	**Theory (10 hrs)**	**Practical (15 hrs)**	**Duration (25 hrs)**
1. Differentiate between different kinds of businesses	1. Introduction to entrepreneurship 2. Types of business activities	1. Role-play on different kinds of businesses around us	03
2. Describe the significance of entrepreneurial values	1. Meaning of value 2. Values of an Entrepreneur 3. Case study on qualities of an entrepreneur	1. Role-play on qualities of an entrepreneur	03
3. Demonstrate the attitudinal changes required to become an entrepreneur	1. Difference between the attitude of entrepreneur and employee	1. Interviewing employees and entrepreneurs	03
4. Develop thinking skills like an entrepreneur	1. Problems of entrepreneurs 2. Problem-solving 3. Ways to think like an entrepreneur	1. Group activity on identifying and solving problems	04
5. Generate business ideas	1. Principles of idea creation 2. Generating a business idea 3. Case studies	1. Group activity to create business ideas	04
6. Describe customer needs and the importance of conducting a customer survey	1. Understanding customer needs 2. Conducting a customer survey	1. Group activity to conduct a customer survey	04

7. Create a business plan	1. Importance of business planning 2. Preparing a business plan 3. Principles to follow for growing a business 4. Case studies	1. Group activity on developing a business plan	04
Total			**25**

UNIT 5: GREEN SKILLS – III			
Learning Outcome	**Theory (07 hrs)**	**Practical (08 hrs)**	**Duration (15 hrs)**
1. Describe the importance of the main sector of the green economy	1. Meaning of ecosystem, food chain and sustainable development 2. Main sectors of the green economy- E-waste management, green transportation, renewal energy, green construction, and water management	1. Group discussion on sectors of green economy 2. Preparing posters on various sectors for promoting green economy	06
2. Describe the main recommendations of policies for the green economy	1. Policies for a green economy	1. Group discussion on initiatives for promoting the green economy 2. Writing an essay or a short note on the important initiatives for promoting green economy	03
3. Describe the major green sectors/ areas and the role of various stakeholders in the green economy	1. Stakeholders in the green economy	1. Group discussion on the role of stakeholders in the green economy 2. Making solar bulbs	03
4. Identify the role of government and private agencies in the green economy	1. Role of the government in promoting a green economy 2. Role of private agencies in promoting green economy	1. Group discussion on the role of Government and Private Agencies in promoting a green economy. 2. Preparing posters on green sectors	03
Total			**15**

Part B–Vocational Skills

S.No.	Units	Duration (hrs)
1.	Introduction to Agriculture Practices	30
2.	Introduction to Drones	50
3.	Drone Operation	50
4.	Flight Simulator Training	35
	Total	**165**

UNIT 1: INTRODUCTION TO AGRICULTURE PRACTICES			
Learning Outcome	**Theory (15 hrs)**	**Practical (15 hrs)**	**Duration (30 hrs)**
1. Describe agriculture practices	1. Agriculture practices - land preparation, sowing and planting, fertililizer application, irrigation, plant protection, harvesting, threshing, and storage.	1. Visit agricultural farms for studying agriculture practices. This includes understanding the type of crops grown, agricultural techniques used, and any unique practices employed by the farm. Students should observe various agricultural practices, such as planting, irrigation, pest control, and harvesting and take notes and photographs to document their observations and to include the same in portfolio. 2. Visit *Krishi Vigyan Kendras* (KVKs) and agricultural research centers for hands-on experience related to relevant data on various aspects, such as types of crops, soil conditions, weather patterns, and any other factors that influence agricultural practices.	8

2. Describe the Precision agriculture	1. Concepts and applications of precision agriculture. 2. Difference between traditional and precision agriculture. 3. Applications of precision agriculture- data collection and analysis, crop monitoring and management (sensors and imaging, geographic information system, big data analytics), Variable Rate Technology (precision planting, precision irrigation system, fertilizer application), GPS (Global Positioning System) technology in mapping, crop monitoring, livestock management, and farm machinery and equipment optimisation.	1. Case studies on precision farming for exploring and understanding real-world examples of successful precision agriculture implementation. 2. Preparing posters on applications and benefits of precision agriculture.	10

3. Describe the various components of precision agriculture	1. Components of precision agriculture – Global Positioning System and Geographic Information System (GIS), Remote Sensing, Variable Rate Technology (VRT), sensors and monitoring devices, automated equipment and machinery, data analytics and decision support systems, farm management software, communication and connectivity, and education and training)	1. Visit agricultural where precision agriculture technologies are actively used. Observe equipment like GPS-guided tractors, drones, and sensors in action. Engage with farmers and technicians to understand their experiences and challenges with precision agriculture. Understand the concept of variable rate planting and operate equipment that adjusts seed rates based on soil conditions. 2. Hands-on experience on setting up and using various sensors for soil moisture, temperature, and nutrient levels. 3. Familiarize with GPS devices and auto-steering systems in tractors. 4. Practice flying drones equipped with cameras for aerial imaging of fields. 5. Group discussion on advantages and disadvantages of precision agriculture 6. Divide students into groups and assign them specific fields (virtual or real). Have them create precision farming plans based on collected data. 7. Facilitate internships or short-term placements with precision agriculture companies or agriculture farms to provide real-world work experience to students.	12
Total			**30**

UNIT 2: INTRODUCTION TO DRONES			
Learning Outcome	**Theory (20 hrs)**	**Practical (30 hrs)**	**Duration (50 hrs)**
1. Identify different types of drones	1. Introduction to drones 2. Classification of drones: (i) based on propellers (fixed wing drones, single rotor drones, multirotor drones, quadcopters, hexacopters, octocopters, and hybrid drones) ; (ii) based on weight; (iii) based on range (close-range, short-range, mid-range); (iv) based on power: (battery powered, fuel cell-powered, gasoline/petrol-powered , solar-powered and hybrid-powered drones).	1. Visit to the drone laboratory to identify different type of drones, such as quadcopters, hexacopters, fixed-wing drones, and hybrid models. Explain their unique features and use. 2. Make drones out of various locally available materials, such as wood, thermocol, plastic, fibre, etc. 3. Conduct live demonstrations of various drones, showcasing their flight capabilities, maneuverability, and payload capacities. Study the internal and external components of drones, including motors, propellers, flight controllers, GPS modules, cameras, and sensors.	20
2. Describe basic components of a drone	1. Basic components of a drone: frame, motors, propellers, fight controller battery, electronic speed controllers, radio transmitter and receiver, sensors, on-board camera/gimbal, propeller guards and landing gear.	1. Visit to the drone technology lab to observe basic components and their functions. 2. Demonstrate drone components like frame, battery, flight controllers, sensors, motors and propellers in the laboratory. 3. Draw schematic diagram showing different components of the drone.	12

3. Demonstrate knowledge of Drone Rules 2021	1. Unmanned Aircraft System Rules (UAS Rules), 2021, notified by the Central Government on August 25, 2021. (i) Terms, Regulations and Organisations related to UAVs or Drones (ii) Certificate of airworthiness (iii) Controlled airspace (iv) Digital sky platform (v) Geo-fencing (vi) Prototype drone (vii) Unmanned aircraft system traffic management system (viii) Unique identification number of drone (ix) Classification of zones as per the Drone Rules 2021 – red, yellow and green. 2. Drone Certification 3. Remote Pilot Licensing	1. Organise lecture sessions on Unmanned Aircraft System rules and regulation for drones. 2. Slide presentation and poster preparation on the UAS rules and regulations for drones. 3. Discuss the evolution of drone regulations, including key incidents or developments that led to specific rules. 4. Study real-world incidents involving drones, examining what went wrong and how these incidents shaped or reinforced UAS regulations. 5. Conduct a workshop where students simulate a scenario involving drone regulations. They can play roles as drone operators, regulators, and law enforcement officers, learning about decision-making processes. 6. Visit drone research facilities, manufacturing units, or drone pilot training centers to understand how these entities adhere to regulations in their operation. 7. Use drone flight simulators to teach students about different flight scenarios while adhering to regulations.	18
Total			**50**

UNIT 3: DRONE OPERATION			
Learning Outcome	**Theory (25 hrs)**	**Practical (25 hrs)**	**Duration (50 hrs)**
1. Describe the principles of aerodynamics	1. Principles of aerodynamics: weight, lift, thrust, and drag 2. Three axes of flight: roll, pitch, and yaw 3. Other important terms in the operation of drone: throttle, hovering and control surfaces	1. Visit to drone technology lab to study the principles of aerodynamics. 2. Visit the drone technology lab and study the three axes of flight.	10
2. Demonstrate the operation of fixed-wing drone	1. Types of fixed-wing drones: monoplanes, biplanes, triplanes, quadra planes, and multiplanes. 2. Operation of fixed-wing drone: takeoff, lift and control, control surfaces, ailerons, elevator, rudder, and navigation and control. 3. Advantages and disadvantages of fixed-wing drone.	1. Visit to drone technology lab to study the details of fixed-wing drone. 2. Group discussion on advantages and disadvantages of fixed- wing drone.	20
3. Demonstrate the operation for multirotor drone	1. Operation of multirotor drone - Lift and thrust, pitch, roll, and yaw, flight control, stability and flight modes. 2. Advantages of multirotor drone- vertical takeoff and landing, hovering capability, maneuverability, stability, simplicity in design and maintenance, precise positioning, versatility, and ease of transportation and	1. Visit to drone technology lab to study the details of multirotor drone for understanding the principles of aerodynamics. 2. Group discussion on specialized drones used in agriculture, surveying, search and rescue, aerial photography, and environmental monitoring. Explain how these drones are customized for specific applications.	20

	accessibility. 3. Disadvantages of multirotor drone- limited flight time, reduced speed and efficiency, payload capacity, noise level, flight efficiency, complex flight modes, battery limitations, and vulnerability in extreme conditions.	3. Write a paragraph on applications and operation of multirotor drones. 4. Group discussion on advantages and disadvantages of multirotor drone.	
Total			**50**

UNIT 4: FLIGHT SIMULATOR TRAINING			
Learning Outcome	**Theory (15 hrs)**	**Practical (20 hrs)**	**Duration (35 hrs)**
1. Introduction to flight simulator training	1. Flight simulator training: virtual environment, flight dynamics and realistic controls, training and skill development, scenario-based training, risk-free training, and performance analysis and feedback 2. Drone flight simulator- types of simulator (software-based simulators, hardware-integrated simulators, full-scale simulators, Virtual Reality Simulators (VRS), and Augmented Reality Simulators (ARS)) 3. Emergency scenarios: emergency procedures, cross-country navigation, instrument approaches, weather conditions, aircraft system simulations, crosswind landings, and flight scenario simulations	1. Allow students to practice flying drones using flight simulators. 2. Demonstrate skills of hand-eye coordination in simulator-based training. 3. Demonstrate skills of flying, disorientation, recovery training, autonomous flight planning. 4. Use drone flight simulators to teach students about different flight scenarios while adhering to regulations.	15

2. Demonstrate the operation of drone on flight simulator	1. Flight simulator: launching the simulator, selecting drone model and environment, takeoff preparation, performing pre-flight checks, takeoff, basic flight maneuvers, different flying modes, landing the drone, post-flight analysis. 2. Reasons to use a drone flight simulator: skill development, risk-free training, cost savings, scenario-based training, weather and environment simulation, and equipment familiarization.	1. Visit to a drone laboratory for demonstration of safe drone flying on simulator. 2. Observe and share flight experience with wind effects, ground effects, simulated crashes. 3. Perform practical flying with instructor on a drone simulator.	20
Total			**35**

GRADE 12

Part A: Employability Skills

S. No.	Units	Duration (hrs)
1.	Communication Skills- IV	25
2.	Self-management Skills – IV	25
3.	Information and Communication Technology Skills – IV	20
4.	Entrepreneurial Skills – IV	25
5.	Green Skills – IV	15
	Total	**110**

UNIT 1: COMMUNICATION SKILLS – IV

Learning Outcome	Theory (10 hrs)	Practical (15 hrs)	Duration (25 hrs)
1. Demonstrate active listening skills	1. Active listening - listening skill, stages of active listening 2. Overcoming barriers to active listening	1. Group discussion on factors affecting active listening 2. Preparing posters of steps for active listening 3. Role-play on negative effects of not listening actively	10

2. Identify the parts of speech	1. Parts of speech – using capitals, punctuation, basic parts of speech, supporting parts of speech	1. Group practice on identifying parts of speech 2. Group practice on constructing sentences	10
3. Write sentences	1. Writing skills to the following: • Simple sentences • Complex sentences • Types of objects 2. Types of sentences : - Active and passive sentences - Statement/ Declarative sentences - Question/ Interrogative sentences - Emotion/ Reaction or Exclamatory sentence - Order or Imperative sentences 3. Paragraph writing	1. Group work on writing sentences and paragraphs 2. Group work on practicing writing sentences in active or passive voice 3. Group work on writing different types of sentences (i.e., declarative, exclamatory, interrogative and imperative).	05
Total			**25**

UNIT 2: SELF-MANAGEMENT SKILLS – IV			
Learning Outcome	**Theory (10 hrs)**	**Practical (15 hrs)**	**Duration (25 hrs)**
1. Describe the various factors influencing motivation and positive attitude	1. Motivation and positive attitude 2. Intrinsic and extrinsic motivation 3. Positive attitude – ways to maintain positive attitude 4. Stress and stress management - ways to manage stress	1. Role-play on avoiding stressful situations 2. Activity on listing negative situations and ways to turn it into positive	10

2. Describe how to become result oriented	1. How to become result oriented? 2. Goal setting – examples of result-oriented goals	1. Group activity on listing aim in life	05
3. Describe the importance of self-awareness and the basic personality traits, types and disorders	1. Steps towards self-awareness 2. Personality and basic personality traits 3. Common personality disorders- • Suspicious • Emotional and impulsive • Anxious 4. Steps to overcome personality disorders	1. Group discussion on self-awareness	10
Total			**25**

UNIT 3: INFORMATION AND COMMUNICATION TECHNOLOGY SKILLS-IV			
Learning Outcome	**Theory (06 hrs)**	**Practical (14 hrs)**	**Duration (20 hrs)**
1. Identify the components of a spreadsheet application	1. Getting started with spreadsheet - types of a spreadsheet, steps to start Libre Office Calc., components of a worksheet	1. Group activity on identifying components of spreadsheet in Libre Office Calc.	02
2. Perform basic operation in a spreadsheet	1. Opening workbook and entering data – types of data, steps to enter data, editing and deleting data in a cell 2. Selecting multiple cells 3. Saving the spreadsheet in various formats 4. Closing the spreadsheet 5. Opening the Spreadsheet 6. Printing the	1. Group activity on working with data on Libre Office Calc.	03

	spreadsheet		
3. Demonstrate the knowledge of working with data and formatting text	1. Using a spreadsheet for addition – adding value directly, adding by using cell address, using a mouse to select values in a formula, using sum function, copying and moving formula 2. Need to format cell and content 3. Changing text style and font size 4. Align text in a cell 5. Highlight text	1. Group activity on formatting a spreadsheet in Libre Office Calc. 2. Group activity on performing basic calculations in Libre Office Calc.	02
4. Demonstrate the knowledge of using advanced features in spreadsheet	1. Sorting data 2. Filtering data 3. Protecting spreadsheet with password	1. Group activity on sorting data in Libre Office Calc.	03
5. Make use of the software used for making slide presentations	1. Presentation software available 2. Steps to start Libre Office Impress 3. Adding text to a presentation	1. Group practice on working with Libre Office Impress tools	02
6. Demonstrate the knowledge to open, close and save slide presentations	1. Open, Close, Save and Print a slide presentation	1. Group activity on saving, closing and opening a presentation in Libre Office Impress	01
7. Demonstrate the operation related to slides and texts in the presentation	1. Working with slides and text in a presentation- adding slides to a presentation, deleting slides, adding and formatting text, highlighting text, aligning text, changing text colour	1. Group practice on working with font styles in Libre Office Impress	04
8. Demonstrate the use of advanced features in a	1. Advanced features used in a presentation	1. Group activity on changing slide layout on Libre Office Impress	03

presentation	2. Inserting shapes in the presentation 3. Inserting clipart and images in a presentation 4. Changing slide layout		
Total			**20**

UNIT 4: ENTREPRENEURIAL SKILLS-IV			
Learning Outcome	**Theory (10 hrs)**	**Practical (15 hrs)**	**Duration (25 hrs)**
1. Describe the concept of entrepreneurship and the types and roles and functions entrepreneur	1. Entrepreneurship and entrepreneur 2. Characteristics of entrepreneurship 3. Entrepreneurship-art and science 4. Qualities of a successful entrepreneur 5. Types of entrepreneurs 6. Roles and functions of an entrepreneur 7. What motivates an entrepreneur 8. Identifying opportunities and risk-taking 9. Startups	1. Group discussion on the topic "An entrepreneur is not born but created" 2. Conducting a classroom quiz on various aspects of entrepreneurship	10
2. Identify the barriers to entrepreneurship	1. Barriers to entrepreneurship 2. Environmental barriers 3. No or faulty business plan 4. Personal barriers	1. Group discussion about "What we fear about entrepreneurship?" 2. Activity on taking an interview of an entrepreneur	05
3. Identify the attitude that make an entrepreneur successful	1. Entrepreneurial attitude	1. Group activity on identifying entrepreneurial attitude.	05
4. Demonstrate the knowledge of entrepreneurial attitude and competencies	1. Entrepreneurial competencies 2. Decisiveness 3. Initiative 4. Interpersonal skills-	1. Playing games, such as "Who am I". 2. Group discussion on business ideas 3. Group practice on "Best	05

	positive attitude, stress management 5. Perseverance 6. Organisational skills - time management, goal setting, efficiency, managing quality.	out of Waste" 4. Group discussion on the topic of "Let's grow together" 5. Group activity on listing stress and methods to deal with it like yoga, deep breathing exercises, etc. 6. Group activity on time management	
Total			**25**

UNIT 5: GREEN SKILLS-IV			
Learning Outcome	**Theory (05 hrs)**	**Practical (10 hrs)**	**Duration (15 hrs)**
1. Identify the benefits of the green jobs	1. Green jobs 2. Benefits of green jobs 3. Green jobs in different sectors: • Agriculture • Transportation • Water conservation • Solar and wind energy • Eco-tourism • Building and construction • Solid waste management • Appropriate technology	1. Group discussion on the importance of green job.	08
2. State the importance of green jobs	1. Importance of green jobs in: • Limiting greenhouse gas emissions • Minimising waste and pollution • Protecting and restoring ecosystems • Adapting to the effects of climate change	1. Preparing posters on green jobs. 2. Group activity on tree plantation.	07
Total			**15**

Part B–Vocational Skills

S. No.	Units	Duration (hrs)
1.	Drones in Agriculture	30
2.	Operating Procedures for Use of Drone in Agriculture	70
3.	Rules and Regulations for Drone Operation	45
4.	Entrepreneurship Opportunities in Drone Technology	20
Total		**165**

UNIT 1: DRONES IN AGRICULTURE

Learning Outcome	Theory (15 hrs)	Practical (15 hrs)	Duration (30 hrs)
1. Describe the principles of crop Production and management	1. Principles of crop production: (crop selection, soil management, seed selection and quality, Irrigation management, nutrient management, pest and disease management, weed control, crop rotation and diversification, harvest and post-harvest management)	1. Visit to an agricultural farm for studying the various crop production techniques in agriculture. Understand the varieties, growth stages, and planting methods for each crop. Study planting methods, like direct seeding, transplanting, and seedling preparation. Understand the factors influencing the choice of planting method. Study different irrigation systems in use, including drip irrigation, sprinklers, and furrow irrigation. Observe how pests and diseases are managed, including the use of pesticides, natural predators, and disease-resistant crop varieties. Take detailed notes, sketch diagrams, and record observations during the visit. 2. Invite agricultural experts or farmers for guest lectures to provide insights and answer questions.	10

2. Describe the applications of drones in agriculture	1. Drones used in agriculture – fixed-wing drones (ideal for large-scale crop monitoring, mapping, and surveying), multirotor drones (used for crop scouting, pest and disease detection, and precise spraying of fertilizers or pesticides), Helicopter drones (suited for specialized tasks such as vineyard inspection, orchard monitoring, and terrain mapping due to their ability to maneuver in tight spaces), single-rotor drones (used for tasks requiring more endurance, such as large-scale aerial mapping and monitoring of vast agricultural landscapes). 2. Working principles of drones used in agriculture. 3. Role of drones in revolutionizing the agriculture industry. 4. Applications of sensors in drones (primary and secondary sensors). 5. Advantages of agriculture drones (efficient crop monitoring, precise crop management, improved yield, cost saving, time efficiency, improved safety, and environmental sustainability). 6. Limitations of agriculture drone (dependence on weather conditions, cost, legal and regulatory	1. Identify different type of drones used in agriculture. 2. Provide information about careers in drone technology, including roles in drone manufacturing, software development, aerial mapping, and research. 3. Organise question and answer session with drone experts and researchers. Students can ask questions related to drone technology, applications, and career opportunities. 4. Conduct a workshop where students can assemble and disassemble basic drone components. This hands-on activity enhances their understanding of the internal workings of drones. Ask students to write reports summarizing what they learned during the visit. Include details about the types of drones, their applications, and any interesting facts or experiences.	20

	issues, data processing, limited battery life and limited payload capacity).		
Total			**30**

UNIT 2: OPERATING PROCEDURE FOR USE OF DRONE IN AGRICULTURE			
Learning Outcome	**Theory (35 hrs)**	**Practical (35 hrs)**	**Duration (70 hrs)**
1. Describe procedure for applying pesticides using drones	1. Parameters affecting selection of drone (purpose, payload capacity, flight time, range, sensor quality, etc.). 2. Precautions and pre-requisites for drone-based pesticide application (pre-application, during application and post-application). 3. Critical parameters to be considered for drone-based pesticide application. 4. Drift management-critical operational parameters. 5. Safeguarding the non-targets. 6. Registration requirement of pesticides for drone application. 7. Spray monitoring form .	1. Prepare the drone for spraying of pesticides in agriculture field 2. Create Informative posters on steps for pesticides application using drone. 3. Group activity on spraying of pesticides 4. Hands-on training on drone flying and its control. 5. Demonstration on use of drones for pesticide application in the field by an authorized or recognised Remote Pilot Training Organization (RPTO).	25
2. Demonstrate the use of drones in soil and crop nutrient management	1. Plant Nutrient Management – assessment of nutrient deficiencies using NDVI (Normalized Difference Vegetation Index) mapping. 2. Spraying of soil/crop nutrients 3. Drone, sensors, data	1. Visit to agricultural field to observe the application of crop nutrients. 2. Discussion on how NDVI (Normalized Difference Vegetation Index) mapping helps in identifying areas with low vegetation vigour,	25

	processing software and soil nutrient spraying system 4. Feasibility of sustainable adoption of drone 5. Standard Operating Procedures (SOPs) for use of drone, mapping of soil nutrients and application of nutrients crops- procedures for use and application of crop nutrients, good agricultural practices, solid (granular/ powder) crop nutrient application using drones and procedures for application of liquid crop nutrients using drone.	indicating nutrient deficiencies and how this information guides targeted nutrient application. 3. Group activity on spraying of crop nutrients in the field. 4. Demonstration of application of drones for nutrient application in the field from an authorized or recognized Remote Pilot Training Organization (RPTO).	
3. Describe pre-requisites for using drones to reduce drift and air pollution	1. Before application 2. During application 3. Post application	1. Visit agriculture field to practice different standards using drones to reduce drift and air pollution.	10
4. Describe the Precautions during drone operation	1. Pre-flight inspection and precautions. 2. Post-flight inspection and precautions.	1. Demonstrate fault finding of drone.	10
Total			**70**

UNIT 3: RULES AND REGULATIONS FOR DRONE OPERATION			
Learning Outcome	**Theory (20 hrs)**	**Practical (25 hrs)**	**Duration (45 hrs)**
1. Describe the basic maintenance of drone	1. Maintenance of drone and its accessories 2. Equipment maintenance	1. Practical lessons in lab: repair, maintenance and documentation 2. Practice emergency procedures for breakdown during operation 3. Presentation on maintenance tips for Kisan Drone Operators.	20

2. Describe drone handling procedures in case of emergencies	1. Drone emergency and handling procedures – emergencies due to loss of link, loss of power, during fly away, loss of GPS, due to collision, etc.	1. Practice on emergency procedures during loss of link, loss of power, etc. 2. Study of failsafe feature that triggers an automatic return to the home point when connection is lost. 3. Practice emergency procedures for fly away, loss of GPS, collision, etc. 4. Join online forums or local drone pilot communities where you can discuss emergency scenarios with experienced pilots. Learn from their experiences.	10
3. Describe the regulations of Directorate General of Civil Aviation and safety guidelines for drone operation	1. Directorate General of Civil Aviation (DGCA)safety regulations 2. Airport Traffic Control (ATC) operations – (communicating with ATC including position and altitude reporting) 3. Drone registration 4. Drone operation (airspace map, interactive maps, requirement of prior permission, mandatory pre-flight verification of zonal restrictions, dynamic nature of zoning, temporary red zone, access to data) 5. Remote pilot certificate (procedure for obtaining remote pilot license, validity, exemption) 6. Insurance of drone, such as liability insurance, hull	1. Group discussion on safety rules to be followed during drone operation in the field, including specific flight planning, no flight zones procedures for specific drone flights, data collection and management 2. Group discussion on the requirements for obtaining Remote Pilot Certificate and the procedure to be followed for the same. 3. Group discussion on drone Insurance. Discuss different types of coverage, such as liability insurance, hull insurance (covering damage to the drone), payload coverage (for cameras or other	15

	insurance (covering damage to the drone), payload coverage (for cameras or other equipment), and non-owned drone coverage (for drones not owned by the insured but operated by them).	equipment), and non-owned drone coverage (for drones not owned by the insured but operated by them). Discuss how insurance mitigates financial risks associated with drone accidents, damages, or third-party liabilities. Discuss how the drone's value, specifications, and usage affect insurance premiums.	
Total			**45**

UNIT 4: ENTREPRENEURSHIP OPPORTUNITIES IN DRONE TECHNOLOGY			
Learning Outcome	**Theory (15 hrs)**	**Practical (05 hrs)**	**Duration (20 hrs)**
1. Identify business and entrepreneurship opportunities in drone technology	1. Business and entrepreneurship opportunities related to drone (aerial and video photography, mapping, surveying and GIS services, delivery and logistics, agriculture, environmental monitoring, security and surveillance, entertainment and recreation, etc.) 2. Qualities of an entrepreneur	1. Prepare charts showing business and entrepreneurship opportunities related to drones. 2. Lectures/presentations by entrepreneurs on their experiences and success stories related to drone business.	05
2. Describe the business plan	1. Business plan (business concept, target market, market research, service portfolio – drone service to be provided, sales strategy, pricing structure, regulatory compliance	1. Develop a business plan for a service related to drone operation 2. Lectures/presentations by entrepreneurs on their experiences.	15

	procedures, licensing, insurance procedure, equipment and technology to be used, operational plan, physical and human resources required, online presence, revenue model (project-based fees, annual maintenance contract, etc.) and financial aspects.		
Total			**20**

6. ORGANISATION OF FIELD VISITS

In an academic year, at least three field visits should be organised for the students to expose them to agricultural practices and to learn about drone operations. The following aspects are to be covered during the field visits:

1. Understanding Agricultural Practices:

a) **Crop Types:** Students will learn about different types of crops, their growth stages, and specific needs.

b) **Crop Health:** Students will understand how to identify healthy crops from diseased or stressed ones.

c) **Soil Analysis:** Students will learn about soil types, fertility, and the importance of soil health for crop growth.

2. Agricultural Use Cases:

a) **Precision Agriculture:** Students will learn how drones enable precise application of water, fertilizers, and pesticides, optimizing resource use.

b) **Crop Monitoring:** Understand how drones can monitor crop health, growth patterns, and yield estimation.

c) **Pest Detection:** Explore methods to identify and monitor pests and diseases using drone-collected data.

3. Introduction to Drone Technology:

a) **Drone Components:** Students will understand the basic components of a drone, including the frame, motors, propellers, and sensors.

b) **Flight Operations**: Students will learn how to plan drone flights, including takeoff, landing, and emergency procedures.

c) **Safety Protocols:** Students will how to follow safety measures such as no-fly zones, altitude limits, and avoiding obstacles.

4. Data Collection and Sensors:

a) **Remote Sensing:** Students will understand how sensors on drones capture data in various wavelengths (visible, infrared, thermal) for agricultural analysis.

b) **Data Interpretation:** Students will learn how to interpret data related to plant health, soil moisture, and pest infestation.

5. Mapping and Surveying:

a) **GIS Mapping:** Students will explore Geographic Information Systems (GIS) and how mapping with drones contributes to precision agriculture.

b) **Surveying Techniques**: Students will understand how drones can create 3D models and topographic maps for agricultural landscapes.

6. Regulations and Compliance:

a) **Regulations and Compliance:** Students will about DGCA regulations and guidelines for drone operations in agriculture.

b) **Permits and Licenses:** Students will understand the process of obtaining permits and licenses for agricultural drone operations.

7. Practical Training:

a) **Flight Simulations:** Students will use drone flight simulators to practice flight operations and maneuvering without the risk of damaging actual drones.

b) **Hands-on Flying:** Students will learn to fly drones under supervision, allowing them to apply theoretical knowledge in real-world settings.

8. Data Analysis and Reporting:

a) **Data Processing Tools**: Students will be introduced to software tools for processing and analyzing drone-collected data, such as GIS software and agricultural analytics platforms.

b) **Report Generation:** Students will learn how to generate comprehensive reports based on the collected data, including actionable insights for farmers.

7. LIST OF EQUIPMENT AND MATERIAL

The drone laboratory aims in nurturing young talents by bringing in multirotor and fixed-wing drone development and real-world flight-testing experiences at the school level courses as well as working on societal-application based projects.

The tools, equipment and material 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.

A simulator may be procured for training and regular field visits should be organised to provide opportunities to the students/trainees for observation and hands-on practice.

S.No.	List of equipment, tools and material	Quantity	Estimated Cost (Rs)
I.	**Drones**		
1.	Commercial drone, Wifi Headless Mod FPV RC Quadcopter 0.3MP Camera 2.4GHz 6-axis 360 Degree Eversion RTF – Black	1	25000
II.	**Custom-made drones**		
2.	Hexacopter with 1080 HD camera, transmitter and receiver with autopilot, 7 inch ground display and control unit and GPS	1	25000
3.	Plastic Hexacopter with Propulsion Kit (Motor + ESC +Propeller + Flight Controller + Frame + TX-RX Fly sky FSi6 + Power module + Belt)	1	28000
4.	Quadcopter drone Combo with Pix hawk Kit for beginner (Motor + ESC +Propeller + Flight Controller + Frame + TX-RX Fly sky FSi6 + Power module + Belt)	4	80000
5.	Micro Quadcopter kit	1	25000
6.	Fixed Wing UAV with 2.4 GHz, Digital Six Channel Transmitter with HD Camera	1	25000
III.	**Tools**		
7.	Thrust Measuring Stand	1	5000
8.	Magnetic Propeller Balancer	3	22500
9.	Digital Calliper	3	27000
10.	Anemometer	1	2000
11.	Laser Tachometer	1	1800
12.	Multi-meter	2	5250
13.	Electronic Hanging Balance	1	3000
14.	Magnetic Tray	1	1000
15.	Soldering Kits – Basic and Battery powered	1	3200
16.	Hand Driller Kit	1	1500
17.	Glue Gun	2	1400
18.	Cutting Mat	1	1500
19.	Allen Key Set	1	2000
20.	Knife Set	1	2700
21.	Screw Driver Set	1	1000
22.	Plier Set	1	5000
23.	Hammers	1	600
24.	Hacksaw	1	800
IV.	**Propulsion Units**		
25.	Motor	1	7000
26.	Electronic Speed Controller	1	4000
27.	LiPo Battery	1	9000
28.	Battery Charger	1	1000
29.	LiPo Battery Checker	1	1000

30.	Propellers	4 set	2800
V.	**Controllers**		
31.	Arducopter Flight Controller with GPS	1	3000
32.	Ardino Uno Micro Controller	1	1500
VI.	**Sensors**		
33.	Ultrasonic Sensor (upto 400 cm)	1	1000
34.	Inertia Measurement Unit	1	20000
35.	Inertial Sensors	1	25000
36.	Distance and Gesture Sensor Module	1	1500
37.	Raspberry Pi Kit	1	3000
38.	Humidity and Temperature Sensor	5	6000
39.	Gas Sensor	1	3000
40.	433 MHz Telemetry	1	6300
VII.	**Accessories**		
41.	Foldable Air Frame – Aluminium & Glass Fibre	10 kg	5000
42.	RC Flight Simulator	1	30000
43.	Furniture's Storage Cabinets (open and shuttered) for Lab setup	1	100000
44.	Lab Safety/Emergency Booth	1	5000
	Total		**9,08,400**

8. VOCATIONAL 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
Undergraduate Degree in any Science Discipline, with specialisation in Electronics/Aeronautical Engineering/Mechanical Engineering/Mechatronics/Drone Technology from a recognized Institute /University Or B.Voc. (Bachelor of Vocations) degree, with specialisation in Electronics/ Aeronautical Engineering/ Mechanical Engineering/Mechatronics/Drone Technology from a recognised Institute /University	Effective communication skills (oral and written) Basic computing skills.	18-37 years - as on Jan. 01 (mention year). Age relaxation to be provided as per Government 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, 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 Education under *Samagra Shiksha* 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 Skills 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 organisations 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:

1. Written test for the technical/domain specific knowledge related to the sector;
2. Interview for assessing the knowledge, interests and aptitude of trainer through a panel of experts from the field and state representatives; and
3. 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; and
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 Grade 10 or Grade 12;
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. Organisation of activities for promotion of vocational subjects; and
11. Involvement in placement of student's/student support services.

9. LIST OF CONTRIBUTORS

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