Learning Outcome Based Vocational Curriculum

JOB ROLE:

Artificial Intelligence Associate

(QP Code: NIE/SSC/Q1004, NSQF Level 4)

SECTOR: IT-ITeS

Grades XI and XII

PSS Central Institute Of Vocational Education
Shyamla Hills, Bhopal – 462 002, M.P., India
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Published by:

Joint Director

PSS Central Institute of Vocational Education, NCERT, Shyamla Hills, Bhopal

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 qualifications to open pathways of career progression for students. It is a part of Centrally Sponsored Scheme of Vocationalisation of Secondary and Higher Secondary Education (CSSVSHSE) launched by the Ministry of Education, Government of India in 2012. The PSS Central Institute of Vocational Education (PSSCIVE) is developing curricula under the project approved by the Project Approval Board (PAB) of *Rashtriya Madhyamik Shiksha Abhiyan* (RMSA). The main purpose of the competency based curricula is to bring about the improvement in teaching-learning process and working competences through learning outcomes embedded in the vocational subject.

It is a matter of great pleasure to introduce this learning outcome based curriculum as part of the vocational training packages for the job role of **IT-ITeS – Artificial Intelligence Associate**. The curriculum has been developed for the secondary students of vocational education and is aligned to the National Occupation Standards (NOSs) of a job role identified and approved under the National Skill Qualification Framework (NSQF).

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 needs. The teaching process is to be performed through the interactive sessions in classrooms, practical activities in laboratories and workshops, projects, field visits, and professional experiences.

The curriculum has been developed and reviewed by a group of experts and their contributions are greatly 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 Educational Research & Training

PREFACE

India today stands poised at a very exciting juncture in its saga. The potential for achieving inclusive growth are 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. The much-discussed demographic dividend will bring sustaining benefits only if this young workforce is skilled and its potential is channelized in the right direction.

In order to fulfill the growing aspirations of our youth and the demand of skilled human resource, the Ministry of Education (MoE), Government of India introduced the revised Centrally Sponsored Scheme of Vocationalisation of Secondary and Higher Secondary Education that aims to provide for the diversification of educational opportunities so as to enhance individual employability, reduce the mismatch between demand and supply of skilled manpower and provide an alternative for those pursuing higher education. For spearheading the scheme, the PSS Central Institute of Vocational Education (PSSCIVE) was entrusted the responsibility to develop learning outcome based curricula, student workbooks, teacher handbooks and e-learning materials for the job roles in various sectors, with growth potential for employment.

The PSSCIVE firmly believes that the vocationalisation of education in the nation need 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. The curriculum, therefore, aims at developing the desired professional, managerial and communication skills to fulfill the needs of the society and the world of work. In order to honor its commitment to the nation, the PSSSCIVE has initiated the work on developing learning outcome based curricula with the involvement of faculty members and leading experts in respective fields. It is being done through the concerted efforts of leading academicians, professionals, policy makers, partner institutions, Vocational Education and Training 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. Currently, the Institute is working on developing curricula and course-ware for over 100 job roles in various sectors.

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. We are grateful to MoE and NCERT for the financial support and cooperation in realising the objective of providing learning outcome based modular curricula and course-ware to the States and other stakeholders under the PAB (Project Approval Board) approved project of *Samagra Shiksha* of MoE.

Finally, for transforming the proposed curriculum design into a vibrant reality of implementation, all the institutions involved in the delivery system shall have to come together with a firm commitment and they should secure optimal community support. The success of this curriculum depends upon its effective implementation and it is expected that the managers of vocational education and training system, including subject teachers will make efforts to create better facilities, develop linkages with the world of work and foster a conducive environment as per the content of the curriculum document.

The PSSCIVE, Bhopal remains committed in bringing about reforms in the vocational education and training system through the learner-centric curricula and course-ware. We hope that this document will prove useful in turning out more competent Indian workforce for the 21st Century.

Deepak Paliwal

Joint Director

PSS Central Institute of Vocational Education

ACKNOWLEDGMENT

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* Rashtriya Madhyamik Shiksha Abhiyan (RMSA) and the officials of the Ministry of Education (MoE), Government of India for the financial support to the project for development of curricula.

We are grateful to the Director, NCERT for his support and guidance. We also acknowledge the contributions of our colleagues at the Technical Support Group of RMSA, MoE, RMSA Cell at the National Council of Educational Research and Training (NCERT), National Skill Development Agency (NSDA) and National Skill Development Corporation (NSDC) and Electronics Sector Skill Council of Indian (ESSCI) for their academic support and cooperation.

We are grateful to the expert contributors and Deepak D. Shudhalwar, Professor (CSE), PSSCIVE, for their earnest effort and contributions in the development of this learning outcome based curriculum. Their contributions are dully acknowledged.

The contributions made by Vinay Swarup Mehrotra, Professor and Head, Curriculum Development and Evaluation Centre (CDEC), Vipin Kumar Jain, Associate Professor and Head, Programme Planning and Monitoring Cell (PPMC) and Deepak Shudhalwar, Professor (CSE) and Head, ICT and Computer Centre, PSSCIVE in development of the curriculum for the employability skills are duly acknowledged.

We are also grateful to the Course Coordinator Deepak D. Shudhalwar, Professor (CSE), Head, ICT and Computer Centre, Department of Engineering and Technology, PSSCIVE, for bringing out this curriculum in the final form.

PSSCIVE Team

CONTENTS

1. COURSE OVERVIEW

The Artificial Intelligence (AI) Associate Qualification will cover the fundamentals of Python programming and libraries like Numpy and pandas used for data analysis. The course will also cover Visualization with Matplotlib. The course will lay stress on developing programming and analytical skills by providing practical exposure to the aspiring Python developers and analysts. The course will cover the concepts of Machine Learning and its algorithms. It will cover the methods and techniques to improve the performance and accuracy of various ML models

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

- Apply effective oral and written communication skills to interact with customers;
- Identify the principal components of a computer system;
- Demonstrate the basic skills of using computer;
- Demonstrate self-management skills;
- Demonstrate the ability to provide a self-analysis in context of entrepreneurial skills;
- Demonstrate the knowledge of the importance of green skills in meeting the challenges of sustainable development and environment protection;
- Install and configure the python IDE and learn about working on collaborative cloud interface required for programming.
- Learn about the concept of Data Science that relies on mathematical and statistical formulas to extract data and make sense of it.
- Learn about unstructured and raw data and how to convert that into meaningful form.
- Recognize Python Library Pandas which is the most widely used for Data Analysis/Data Science in machine learning tasks.
- Learn the concept of Machine Learning and its various categories and its application.

COURSE REQUIREMENTS: The learner should have basic knowledge of science.

COURSE LEVEL: This course can be taken up at Intermediate level in Grade XI and XII.

COURSE DURATION: **Total : 600 hours**

Grade XI : 300 hours

Grade XII : 300 hours

2. SCHEME OF UNITS AND ASSESSMENT

This course is a planned sequence of instructions consisting of Units meant for developing employ-ability and vocational competencies of students of Grade IX and X opting for vocational subject along with general education subjects. The unit-wise distribution of hours and marks for Grade IX is as follows :

Grade XI			
	Units	**No. of Hours for Theory and Practical 300**	**Max. Marks for Theory & Practical 100**
Part A	**Employability Skills**		
Unit 1	Communication Skills – III	25	**10**
Unit 2	Self-management Skills – III	25	
Unit 3	Information and Communication Technology Skills – III	20	
Unit 4	Entrepreneurial Skills – III	25	
Unit 5	Green Skills – III	15	
	Total	**110**	**10**
Part B	**Vocational Skills**		
Unit 1	Introduction to Artificial Intelligence (AI)	30	**30**
Unit 2	Basic Python Programming	45	
Unit 3	Data Literacy	30	
Unit 4	Mathematics for AI	30	
Unit 5	Introduction to Machine Learning	30	
	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	5
	Total	**15**	**15**
	Total	**300**	**100**

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

Grade XII			
	Units	**No. of Hours for Theory and Practical 300**	**Max. Marks for Theory and Practical 100**
Part A	**Employability Skills**		
Unit 1	Communication Skills – IV	25	**10**
Unit 2	Self-management Skills – IV	25	
Unit 3	Basic ICT Skills – IV	20	
Unit 4	Entrepreneurial Skills – IV	25	
Unit 5	Green Skills – IV	15	
	Total	**110**	**10**
Part B	**Vocational Skills**		
Unit 1	Machine Learning using Python	40	**40**
Unit 2	Data Science	30	
Unit 3	Data Analysis	30	
Unit 4	Neural Network	40	
Unit 5	AI Capstone Project	25	
	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	5
	Total	**15**	**15**
	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 the occupational 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 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 vocational teacher to the Head of the Institution.

FIELD VISITS/ EDUCATIONAL TOUR

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 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 and make necessary arrangements for the visits. At least three field visits should be conducted in a year.

4. ASSESSMENT AND CERTIFICATION

Upon successful completion of the course by the candidate, the Central/ State Examination Board for Secondary Education and the respective Sector Skill Council will certify the competencies.

The National Skills 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. It should be closely linked to certification so that the individual and the employer could come to know the competencies acquired through the vocational subject or course. The assessment should be reliable, valid, flexible, convenient, cost effective and above all it should be fair and transparent. Standardized 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 of 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

It 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 group of experts of academicians, experts from existing vocational subject experts/teachers, and subject 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 blue print for the question paper may be as follows:

Duration: 3 hrs **Max. Mark: 30**

		No. of Questions			
	Typology of Question	**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, private an example, or solve a problem)	**0**	**2**	**1**	**07**
4.	High Order Thinking Skills – (Analysis & Synthesis – Classify, compare, contrast, or differentiate between different pieces of information; Organize 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 (20 Q)**

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 competency checklist should be developed as per the National Occupation Standards (NOSs) given in the Qualification Pack for the Job Role to bring about necessary consistency in the quality of assessment across different sectors and Institutions. The student has to demonstrate competency against the performance criteria defined in the National Occupation Standards and the assessment will indicate that they are 'competent', or are 'not yet competent'. 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 Councils should ensure that the assessors are provided with the training on the assessment of competencies.

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 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.

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. Field visits should be organised as part of the project work. Field visits can be followed by a small-group work/project work. When the class returns from the field visit, 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.

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.

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.

CONTINUOUS AND COMPREHENSIVE EVALUATION

Continuous and Comprehensive Evaluation (CCE) refers to a system of school-based evaluation of students that covers all aspects of student's development. In this scheme, the term `continuous' is meant to emphasize that evaluation of identified aspects of students `growth and development' is a continuous process rather than an event, built into the total teaching-learning process and spread over the entire span of academic session. The second term `comprehensive' means that the scheme attempts to cover both the scholastic and the co-scholastic aspects of students' growth and development. For details, the CCE manual of Central Board of Secondary Education (CBSE) or the guidelines issued by the State Boards on the procedure for CCE should be followed by the Institutions.

5. UNIT CONTENTS

GRADE XI, Part A: Employability Skills

Unit No.	Unit Name	Duration in Hours
Unit 1	Communication Skills – III	25
Unit 2	Self-management Skills – III	25
Unit 3	Basic ICT Skills – III	20
Unit 4	Entrepreneurial Skills – III	25
Unit 5	Green Skills – III	15
	Total	**110**

Unit 1: Communication Skills – III

Sn	Learning Outcome	Theory (10 Hours)	Practical (15 Hours)	25
1	Demonstrate knowledge of effective communication	• Introduction to communication • Importance of communication • Elements of communication • Perspectives in communication • Effective communication	• Role-play on the communication process, • Group discussion on the importance of communication and factors affecting perspectives in communication, • Classroom discussion on the 7Cs of effective communication (i.e. Clear, Concise, Concrete, Correct, Coherent, Courteous and Complete), • Chart making on elements of communication.	03
2	Demonstrate verbal communication	• Verbal communication • Public Speaking	• Role play of a phone conversation, • Group exercise on delivering a speech and practicing public speaking	02
3	Demonstrate non-verbal communication	• Importance of non-verbal communication, • Types of non-verbal communication, • Visual communication	• Role plays on non-verbal communication, • Group exercise and discussion on Do's and Don'ts to avoid body language mistakes, • Group activity on methods of communication.	02
4	Use correct pronounciation	• Pronounciation basics, • Speaking poperly, • Phonetics,	• Group excersises on pronouncing words,	01

		• Types of sounds		
5	Demonstratrate the knowledge eof assertive communication style	• Important communication styles, • Assertive communication, • Advantages of assertive communication, • Practicing assertive communication.	• Group discussion on communication styles, • Group discussion on observing and sharing communication styles.	02
6	Demonstrate the knowledge of saying no	• Steps for saying “No” • Connecting words (Conjuctions)	• Group discussion on how to respond, • Group discussion on how to say ‘No’	01
7	Identify and use parts of speech in writing	• Capitalisation, • Punctuation, • Basic parts of speech, • Supporting parts of speech	• Group exercises on identifying parts of speech, • Group activity on constructing sentences, • Group exercises on nouns.	02
8	Write sentences and paragraphs	• Parts of a sentence, • Types of object, • Types of sentences, • Paragraph	• Exercises on making sentences, • Activity on active and passive voice, • Assignment on writing different types of sentences.	01
9	Communicate with people	• Geetings, • Introducing self and others	• Role-play on formal and informal greetings, • Role-play on introducing someone, • Practice session and group discussion on greeting different people	01
10	Introduce yourself to others and write about oneself	• Talking about self, • Filling out a form to write about self	• Practicing self-introduction to write about self, • Filling up forms to write about self	01
11	Develop questioning skill	• Main types of questions, • Forming closed and open ended questions	• Exercise on asking different types of questions, • Group activity on framing open ended and close ended questions.	01
12	Communicate information about family to others	• Names of relatives, • Relations	• Practice taking about family, • Role-ply on talking about family members	01
13	Describe habits and routines	• Concept of habits and routines	• Group discussion on habits and routines, • Group activity on describing routines.	01
14	Ask or give	• Asking for directions to place,	• Role-play on asking and giving	01

	directions to others	• Giving directions for a place.	directions, • Identifying symbols used for giving directions.	
			Total Duration in Hours	**20**

Unit 2: Self-management Skills – III				
Sn	**Learning Outcome**	**Theory (10 Hours)**	**Practical (15 Hours)**	**25**
1.	Identify and analyze own strengths and weaknesses	• Knowing your self, • Identifying strengths and weaknesses, • Difference between interests and abilities.	• Activity on writing aims in life, • Prepare a worksheet on interests and abilities.	02
2.	Demonstrate personal grooming skills	• Guidelines for dressing and grooming,	• Role-play on dressing and grooming standards, • Self-reflection activity on dressing and grooming.	02
3.	Maintain personal hygiene	• Importance of personal hygiene • Three steps to personal hygiene • Essential steps of hand washing	• Role-play on personal hygiene, • Assignment on personal hygiene.	02
4.	Demonstrate the knowledge of working in a team and participating in group activities	• Describe the benefits of teamwork, • Working in a team.	• Assignment on working in a team, • Self-reflection on teamwork.	02
5	Descibe the importance of networking skills	• Benefits of networking skills, • Steps to build networking skills.	• Group exercise on networking in action, • Assignment on networking skills.	01
6	Describe the meaning and importance of self-motivation	• Self-motivation, • Types of motivation, • Qualities of self-motivation.	• Activity on staying motivated, • Assignment on reasons hindering motivation.	02
7	Set SMART goals	• Meaning of goals and purpose of goal-setting, • Setting SMART (Specific, Measureable, Attainable, Realistic and Timebound) goals	• Assignment on setting SMART goals, • Activity on developing long-term and short-term goals using SMART method.	02
8	Apply time management strategies and techniques	• Time management, • Steps for effective time management	• Preparing checklist of daily activities, • Preparing to-do-list.	02
			Total Duration in Hours	**15**

Unit 3: Information and Communication Technology Skills – III				
Sn	**Learning Outcome**	**Theory (08 Hours)**	**Practical (12 Hours)**	**20**
1.	Create a document on the word processor	• Introduction to ICT, • Advantages of using a word processor, • Working with LibreOffice Writer	• Group activity on demonstration and practice of the following: • Creating a new document • Typing text • Saving the text • Opening and saving file in Microsoft word/Libre Office Writer	02
2.	Identify icons on the toolbar	• Standard user interface of LibreOffice Writer • Status bar, • Menu bar, • Tool bar • Making text bold	• Group activity on using basic user interface of LibreOffice Writer, • Group activity on working with Microsoft Word.	02
3.	Save, close, open and print document	• Saving a document, • Closing a document, • Opening an existing document, • Printing a document	• Group activity on perform ing the functions for saving, closing and printing documents in LibreOffice Writer, • Group activity on performing the functions to save, close and print documents.	02
4.	Format text in a document	• Changeing style and size of text • Aligning text, • Cutting, Copying, Pasting text, • Find and replace	• Group activity on formatting text in LibreOffice Writer, • Group activity on formatting text in Microsoft Word	02
5.	Check spelling and grammar in a word document	• Starting s spell checker, • Short-cut menu for spell checker, • Autocorrect spelling.	• Group activity on checking spellings and grammer using LibreOffice Writer, • Group activity on checking spellings and grammer using Microsoft Word	02
6.	Insert lists, tables, pictures, and shapes in a word document	• Inserting bullet list, number list in document, • Inserting Tables in document, • Inserting Pictures in document, • Inserting Shapes in document,	• Practical exercise of inserting lists and tables in LibreOffice Writer	03
7.	Insert header, footer and page number in a word document	• Inserting header, • Inserting footer, • Inserting page number, • Inserting page count	• Practical exercise of inserting header, footer and page numbers in LibreOffice Writer and Microsoft Word.	03

8.	Make changes by using the track change option in a word document	• Tracking option • Manage option • Compare documents	• Group activity on performing track changes in LibreOffice Writer and Microsoft Word	04
			Total Duration in Hours	**20**

Unit 4: Entrepreneurial Skills – III				
Sn	**Learning Outcome**	**Theory (10 Hours)**	**Practical (15 Hours)**	**25**
1.	Differentiate between different kinds of businesses	• Introduction to entrepreneurship • Types of business activities – manufacturing, trading and service.	• Role play on different kind of business around us.	03
2.	Describe the significance of entrepreneurial values	• Values of an Entrepreneur, • Case study on qualities of an entrepreneur.	• Role play on qualities of an entrepreneur	03
3.	Describe the attitudinal changes required to become an entrepreneur	• Difference between the attitude of entrepreneur and employee.	• Interviewing employees and entrepreneurs.	03
4.	Describe the importance of thinking like an entrepreneur	• Problems of entrepreneurs • Problem-solving, • Thinking like an entrepreneur to solve problems.	• Group activity on identifying and solving problems	04
5.	Generate business ideas	• The business cycle, • Principles of idea creation, • Generating a business idea, • Case studies.	• Group activity to create business ideas.	04
6.	Describe customer needs and importance of conducting a customer survey	• Understanding customer needs • Conducting a customer survey	• Group activity to conduct a customer survey	04
7.	Create a business plan	• Importance of business planning, • Preparing a business plan, • Principles to follow for growing a business, • Case studies	• Group activity on developing a business plan	04
			Total Duration in Hours	**25**

Unit 5: Green Skills – III				
Sn	**Learning Outcome**	**Theory (07 Hours)**	**Practical (08 Hours)**	**15**
1.	Describe the importance of the main sector of the green economy	• Important sectors of the green economy- Artriculture, Energy resources, Constructioin, Fisheries, Forestry, Tourism, Transport, Water Mamagement, Waste Mamagement, Manufacturing, Industry.	• Group discussion on sectors of green economy, • Poster making on various sectors for promoting green economy	06
2.	Describe the policies for the green economy	• Policies for a green economy	• Group discussion on initiatives for promoting the green economy, • Writing an essay or short note on initiatives for promoting the green economy.	03
3.	Describe the major green sector/area and the role of various stakeholders in the green economy	• Stakeholders in the green economy	• Group discussion on the role of stakeholders in green economy, • Making solar bulbs.	03
4.	Identify the role of government and private agencies in the green economy	• Role of the government in promoting a green economy, • Role of private agencies in promoting green economy.	• Group discussion on the role of government and private agencies in promoting a green economy. • Preparing posters on green sectors.	03
			Total Duration in Hours	**15**

GRADE XI, Part B: Vocational Skills

Unit No.	Unit Name	Duration in Hours
Unit 1	Introduction to AI	30
Unit 2	Python Programming	45
Unit 3	Data Literacy	30
Unit 4	Maths for AI	30
Unit 5	Machine Learning	30
	Total Duration	**165**

Unit 1	**Introduction to AI**	**Duration in Hours**	**30**
Session/ Learning Outcomes	**Theory Topics**	**Practical Activities**	**Hrs**
Session 1. Introduction to AI: Concept, History and Evolution **LO.** Describe the Concept, History and Evolution of AI	• Introduction to Artificial Intelligence(AI), • History and Evolution of AI, • Need of AI in school education, • Application of AI in daily, • Role and Responsibilities of AI Associate personnel, • Knowledge and Skills required for AI Associate, • Framework of AI Associate – Google Dialogflow, IBM Watson Assistnat, Amaxon Alexa skills kit, • Future scope of AI Associate,	• Identify AI technology used in smartphone, • Identify and list use of AI in daily life, • Illustrate AI technolgy used in industry and business, • List the Role and Responsibilities of AI Associate, • Identify and list the knowledge and skills required for AI Associate, • List the avaliable framework of AI Associate, • List the areas for future scope of AI Associate	8
Session 2. Types of AI **LO.** Describe the types of AI	• Types of AI: ANI, AGI, ASI, • Examples of types of AI, • Branches of AI: NLP, CV, Robotics, Expert Systems, • Various terms used in AI, • Ethics and Bias in AI, • AI Myths vs. Reality.	• List the differentiating point in different types of AI, • List the Branches of AI, • List the terms used in AI, • Illustrate to implement the Ethics and Bias in AI, • Differentiate AI Myths vs. Reality.	8
Session 3. Domains of AI **LO.** Describle the various domains of AI.	• Introduction to AI Tools and Platforms, • AI Tools for various	• List the various AI Tools used in various applications, • List the domains and	14

	applications, • Domains and Branches of AI, • NLP – Concept, Evolution, Applications, How NLP is related to AI, Examples of NLP, • CV – Concept, Evolution, Applications, How CV is related to AI, Examples of CV, • Robotics – Concept, Evolution, Applications, How Robotics is related to AI, Examples of Robotics, • Expert Systems – Concept, Evolution, Applications, How Expert Systems is related to AI, Examples of Expert Systems, • Examples of AI Platforms used for various applications.	Branches of AI, • Illustrate an example with case study of NLP in real life, • Illustrate an example with case study of CV in real life, • Illustrate an example with case study of Robotics in real life, • Illustrate an example with case study of Expert Systems in real life, • List the various AI Platforms and their applications applications in real life, • List the programming languages used to build AI applications with justification.	
		Total Duration in Hours	**30**

Unit 2	**Python Programming**	**Duration in Hours**	**45**
Session/ Learning Outcomes	**Theory Topics**	**Practical Activities**	**Hrs**
Session 1. Programming Basics **LO 1.** Develop problem solving and logical reasoning skills	• Problem solving and logical reasoning, • Problem decomposition • Concept of coding, • Programming as a tool for problem solving, • Programming prerequisite – Algorithm, Flowchart, • Alternative solution and efficiency of algorithm • Examples of algorithm and flowcharts.	• Illustrate the conept of problem soving and logical reasoning, • Illustrate the concept of problem decomposition, • Illustrate the concept of algorithm and flowchart with examples, • Demonstrate the problem solving approch through algorithm and flowchart for few problems.	4
Session 2. Introduction to Python and Programming Basics **LO1.** Describe the importance of Python Programming.	• Python – History, Features, Advantages, Applications, Installation and setup, • Python coding – Interactive Mode and Script Mode,	• Illustrate the process of program execution in Python, • Install, set up the environment and run Python. • Write, compile, execute,	4

LO2. Write and run basic Python programs.	• Coding in Python IDLE, • Crating a new file in Python, • Structure of Python program, • Writing and executing Python scripts • Syntax, indentation, and comments, • Procedure to compile and execute a program in Python	debug and test simple code in Python, • Print a welcome message • Write your first "Hello, World!" program • Use input and output functions • Practice the coding and debugging in IDE.	
Session 3. Variables and Data Types **LO1.** Declare and use variables and different data types correctly.	• Python Keywords and Identifiers with examples, • Variables – Rules for Variables, examples of valid and invalid variables, using variables in Python code, • Data Types – Numbers, Sequence, Set, None, Mapping, • Classification of data types – mutable and immutable, • Input and output statements, • Python programs on variables and data types.	• Identify the keywords and identifiers in Python, • List the examples of Keywords and Identifiers in Python, • Code and execute simple programs using variables and data types, • Calculate the area of a circle • Create a basic interest calculator, • Convert temperature between Celsius and Fahrenheit.	4
Session 4. Operators and Expressions **LO.** Perform operations using arithmetic and logical operators	• Operators – Arithmetic, relational, logical, assignment, Identity, membership, • Casting, string, Boolean, • Expression, • Presedence of operators in evaluation of expression, • Type conversion – Explicit and Implicit conversion, • Python programs on operators and expression	• Illustrate to evaluate the expression using various types of operators, • Determine the sequence of execution based on operator precedence, • Code and execute program to perform operations using various types of operators	4
Session 5. Conditional Statements **LO1.** Control program execution using conditions and loops **LO2.** Apply decision-making	• Condtional satements – if, elif, else, • Syntax and examples of if...else statement, • Syntax and examples of if...elif statement,	• Write and test Python programs demonstrating the use of if, elif, else statements, • Examples – Grading system, voting eligibility checker.	4

logic	• Syntax and examples of if...elif ...else statement, • Structural pattern matching, • Example to use structural pattern matching,		
Session 6. Loops **LO1.** Control program execution using loops **LO2.** Perform repeated tasks using loops	• Loops in Python – for loop, while loop, • for loop – syntax, examples, • Range function in for loop, • Examples using for loop, • while loop – syntax, examples, • break and continue statement, • Nested loops, • Examples using while loop.	• Write and test Python programs using for loop in Python to demonstrate its use, • Write and test Python programs using while loop in Python to demonstrate its use,	4
Session 7. Functions and Modules **LO1.** Manipulate strings using Python methods **LO2.** Organize code with functions and reusable modules	• Functions in Python, • Advantages of functions, • Types of functions – Built in, User defined functions, • Creating user defined functions, • Arguments and parameters in function, • Variable number of arguments, • Functions returning values, • Flow of execution of function, • Scope of variable – global and local variable, • Standard library – Built in functions, Module, Built-in modules, math, random	Write and test Python code to • Perform basic operations using built-in modules. • Illustrate the scope of gloabal and local variable in function, • Illustrate the use of standard library – Built in functions, Module, Built-in modules, math, random, • Calculate factorial, • Create a module for string utilities, • Use math and random modules in a game	4
Session 8. Data Structures - Lists, Tuples and Dictionaries **LO1.** Use built-in collections to store and manipulate data **LO2.** Store and access data using lists, tuples and dictionaries	• Data Strucure – Lists, tuples, dictionaries, sets; indexing, slicing, • List operations, slicing, looping through lists, immutability of tuples, • Creating and accessing dictionaries, basic methods • Sample Python programs	Write and test Python code to • Create a simple to-do list using a list, • Count word frequencies in a string, • Store marks of students, find average, • Build a contact list using	4

	using List, Tuples, Dictionaries	dictionaries, • Word frequency counter, contact list with dictionaries.	
Session 9. File Handling **LO.** Read from and write to files using Python.	• Opening, reading, writing, and closing files • File modes: r, w, a, r+ • Handling file exceptions	Write and test Python code to • Write user input to a file, • Read a text file and count lines and words, • Build a basic log file generator	3
Session 10. Exception Handling **LO.** Handle runtime errors using try-except blocks.	• Input validation, file error handling, • Types of errors and exceptions • try, except, else, and finally, • Raising custom exceptions.	Write and test Python code to • Create a robust user input form with validation, • Handle division by zero and file-not-found errors	3
Session 11. External Libraries **LO.** Install and use third-party Python libraries.	• pip and PyPI • Popular packages like requests, datetime, os, re	Write and test Python code to • Make API call using requests, • Parse and format dates using datetime, • Perform regex search and replac	3
Session 12. Object-Oriented Programming **LO.** Use classes and objects to model real-world entities.	• Classes and objects, • Constructors and destructors, • Inheritance, encapsulation, and polymorphism	Write and test Python code to • Create a class for managing a student record, • Inherit a class for different types of bank accounts, • Build a basic product inventory system	4
		Total Duration in Hours	**45**

Unit 3	**Data Literacy**	**Duration in Hours**	**30**
Session/ Learning Outcomes	**Theory Topics**	**Practical Activities**	**Hrs**
Session 1. Role of Data in Society **LO1.** Explain the importance of data in modern society. **LO2.** Identify examples of data use in business, health,	• Introduction to Data and Information, • Data in the Digital Economy, • Ethical Considerations and Bias in Data Use.	• Identify data types for the given data values, • Group discussion on the impact of data in real-world events, • Identify and critique	5

education, and government.		examples of data misuse.	
Session 2. Types and Sources of Data **LO1.** Distinguish between qualitative and quantitative data. **LO2.** Recognize primary vs. secondary data sources.	• Structured vs. Unstructured data, • Quntitative and Qualitative data, • Numerical, categorical, ordinal, textual data, • Data Collection Methods, • Open Data and Big Data Concepts.	• Analyze different datasets and classify their types, • Identify the category of data values for the given set of values, • Identify the characteristics of data from given data set, • Identify the missing values in the given data set, • Explore open data portals.	5
Session 3. Data Quality and Data Cleaning **LO1.** Assess the quality of a dataset. **LO2.** Perform basic data cleaning techniques.	• Dimensions of Data Quality (accuracy, completeness, consistency), • Data Cleaning Techniques, • Common Data Errors • Missing values, deletion, outlier, data inconsistancy,	• Clean a messy dataset using Excel or Google Sheets, • Identify and handle missing or inconsistent values, • Perform basic data validation checks	5
Session 4. Statistics for Data Analysis **LO1.** Use basic statistics to describe data. **LO2.** Interpret visualizations and statistical summaries.	• Descriptive Statistics – mean, median, mode, range, • Data Visualization Principles, • Introduction to Inferential Statistics.	• Generate charts (bar, pie, histogram) from sample data • Use tools like Excel, Google Sheets, or Tableau, • Interpret statistical summaries from reports.	5
Session 5. Data Visualisation **LO1.** Present data findings to a non-technical audience. **LO2.** Create clear and accurate data visualizations.	• Data Storytelling, • Choosing the Right Chart, • Avoiding Misleading Visualizations	• Create a short data story presentation, • Redesign a poor-quality chart, • Practice interpreting visualizations in small groups.	5
Session 6. Ethics in Data Collection **LO1.** Describe data privacy and security issues **LO2.** Recognize ethical considerations in data usage.	• Data Protection Laws, • Ethical Issues in Data Collection and Use, • Informed Consent and Anonymization.	• Evaluate a data ethics case study, • Simulate an ethical decision-making process around data use, • Create a checklist for ethical data handling.	5
		Total Duration in Hours	**30**

Unit 4	**Mathematic for AI**	**Duration in Hours**	**30**
Session/ Learning Outcomes	**Theory Topics**	**Practical Activities**	**Hrs**
Session 1. Linear Algebra Concepts Used in AI **LO1.** Represent data and operations using vectors and matrices. **LO2.** Perform basic matrix operations and understand their relevance to AI models.	• Linear Algebra Basics – Vectors, Matrices, Tensors, • Matrix Multiplication and Transposition, • Eigenvalues and Eigenvectors, • Linear Transformations	• Use NumPy to perform vector and matrix operations, • Visualize geometric transformations using Python, • Apply matrix multiplication in a feedforward neural network.	5
Session 2. Calculus for Optimization **LO1.** Explain the role of derivatives and gradients in AI algorithms. **LO2.** Apply differentiation to optimize functions (e.g., in training models)	• Limits and Derivatives. • Gradient and Partial Derivatives, • Gradient Descent Optimization • Chain Rule and Backpropagation.	• Compute derivatives of simple cost functions by hand, • Implement gradient descent in Python to minimize a loss function, • Visualize cost function surfaces and gradients using Matplotlib.	5
Session 3. Probability and Statistics in AI **LO1.** Apply probability rules to model uncertainty in AI. **LO2**. Use statistical methods to analyze data distributions and model outputs.	• Basic Probability Theory (conditional probability, Bayes' theorem), • Central tendency – Mean, Mode, Median, • Dispersion – Range, Variance, Standard Deviation, • Probability, • Random Variables and Distributions, • Expectation, Variance, and Covariance, • Statistical Inference	• Simulate probabilistic experiments using Python, • Compute Mean, Median and Mode for the given data set, • Fit and plot probability distributions using real datasets, • Use Bayesian reasoning in classification tasks (e.g., Naïve Bayes)	5
Session 4. Discrete Mathematics for AI **LO1**. Apply logic and set theory in defining AI algorithms. **LO2**. Use graphs to represent and solve problems in AI	• Propositional Logic and Predicate Logic, • Sets and Functions, • Graph Theory (nodes, edges, adjacency matrices), • Combinatorics and Recursion	• Model logic gates and logical expressions, • Solve graph search problems (e.g., DFS, BFS) using networkx in Python, • Construct decision trees and analyze combinatorial paths	5
Session 5. Optimization Techniques for AI Model	• Convex Functions and Convex Optimization,	• Solve a linear programming problem using SciPy,	5

Training **LO1.** Formulate optimization problems and solve them with appropriate methods. **LO2**. Describe constraints and objective functions in AI.	• Linear Programming, • Constrained vs. Unconstrained Optimization, • Lagrange Multipliers	• Visualize convex vs. non-convex functions, • Tune hyperparameters in machine learning using grid search	
Session 6. Intuition for Mathematical Thinking in AI Contexts **LO1**. Interpret mathematical formulations of AI algorithms. **LO1**. Connect mathematical tools to specific AI applications..	• Mathematical Modeling for AI Systems, • Function Approximation, • Loss Functions and Regularization, • Norms and Distance Measures	• Derive the cost function for linear regression and implement it, • Compare L1 and L2 regularization using Python models, • Analyze decision boundaries using different norms	5
		Total Duration in Hours	**30**

Unit 5	**Machine Learning**	**Duration in Hours**	**30**
Session/ Learning Outcomes	**Theory Topics**	**Practical Activities**	**Hrs**
Session 1. Introduction to Machine Learning (ML) **LO1.** Describe the Machine Learning and it's use	• Definition of Machine Learning, • Importance of Machine Learning, • Difference between AI and ML, • Applications of Machine Learning in various industries, • Workflow of Machine Learning, • Real-life examples of ML (e.g., recommendations, voice assistants)	• Draw the workflow of ML, • Watch demos of ML in action (YouTube, Google Translate) • Draw the workflow of Machine Learning, • Group activity: List daily life examples where ML is used, • Class discussion: How is ML different from traditional programming?	5
Session 2. Types of Machine Learning **LO1.** Identify different types of ML: Supervised, Unsupervised, and Reinforcement Learning	• Types of Machine Learning – Supervised, Un-Supervised, Reinforcement, • Supervised Learning: Learning from labeled data, Classification and Regression • Unsupervised Learning: Finding patterns in unlabeled data, Clustering,	• Draw the diagram to illustrate the types of Machine Learning, • Illustrate the examples of Supervised Leaning, un-Supervised Leaning, reinforcement learning, • Use visual examples (e.g., fruit classification for	5

	• Reinforcement Learning: Learning through rewards	supervised learning), • Online simulation tools (e.g., Teachable Machine by Google), • Interactive quiz to identify ML types from examples	
Session 3. Supervised Learning – Classification & Regression **LO1**. Understand basic ML tasks like classification and regression.	• Classification: Grouping data into categories (e.g., spam detection), • Regression: Predicting continuous values (e.g., house prices)	• Teachable Machine: Train a model to recognize poses or sounds, • Use spreadsheet-based examples to manually classify data (e.g., cat vs. dog images using basic features), • Graph plotting of data to show regression (height vs. weight)	5
Session 4. Data in Machine Learning **LO1**. Describe the importance of data in ML and how it is used for training.	• Features and Labels, • Training and Testing Data, • Importance of clean and sufficient data	• Use sample CSV files to explore data (in Excel or Google Sheets), • Label simple data manually, • Create a mini-project: Collect data (e.g., weather and mood) and visualize it	5
Session 5. Ethics and Responsibility in AI/ML **LO1**. Recognize the ethical use of AI and ML in real life.	• Bias of Data in ML, • Importance of clean data, • Fairness, Transparency and explainability. • Privacy and Data Security.	• Demonstrate the imporatance of clean data in getting the accuracy in results, • Watch a short documentary or news clip on AI bias.	5
Session 6. Hands-On ML Without Code (Using Tools) **LO1.** Train and test a basic ML model using no-code tools	• Concept of training a model and testing accuracy, • Input features and outputs, • Prediction and feedback loop • Introduction to ML tools, • Teachable Machine, (https://teachablemachine.withgoogle.com/) • Google Colab (for visual demos)	• Train a model to recognize images or sounds, • Hands-on with a pre-built model using Python (no-code/low-code example), • Train your own image classifier using Teachable Machine, • Sample code to build a basic linear regression, • Visual worksheet: Label the ML pipeline with arrows.	5
		Total Duration in Hours	**30**

GRADE XII, Part A: Employability Skills

Unit No.	Unit Name	Duration (Hrs.)
Unit 1	Communication Skills – IV	25
Unit 2	Self-management Skills – IV	25
Unit 3	Basic ICT Skills – IV	20
Unit 4	Entrepreneurial Skills – IV	25
Unit 5	Green Skills – IV	15
	Total Hours	**110**

Unit 1: Communication Skills – IV

Sn	Learning Outcome	Theory (10 Hours)	Practical (15 Hours)	25
1.	Demonstrate active listening skills	• Active listening -listening skill and stages of active listening, • Overcoming barriers to active listening.	• Group discussion on the factors affecting active listening, • Preparing posters of steps for active listening, • Role-play on negative effects of not listening actively.	08
2.	Identify the parts of speech	• Parts of speech – using capitals, punctuation, basic parts of speech, supporting parts of speech, • Supporting parts of speech.	• Group practice on identifying parts of speech. • Group practice on constructing sentences.	08

3.	Write sentences	• Writing simple sentence,
		• Writing complex sentence,
		• Types of object,
		• Types of sentences
		  • Active and Passive sentences,
		  • Statement/Declarative sentence,
		  • Question/Interrogative sentence,
		  • Emotion/Reaction or Exclamatory sentence,
		  • Order or Imperative sentence.
			• Group work on writing sentences and paragraphs,
			• Group work on practicing writing sentences in active or passive voice,
			• Group activity on writing different types of sentences (i.e., declarative, exclamatory, interrogative and imperative)
				09

			Total Duration in Hours	**25**

Unit 2: Self-management Skills – IV

Sn	Learning Outcome	Theory (10 Hours)	Practical (15 Hours)	25
1.	Describe the various factors influencing motivation and positive attitude	• Motivation and positive attitude, • Intrinsic and extrinsic motivation • Positive attitude – ways to maintain positive attitude, • Stress and stress management - ways to manage stress	• Role Play on avoiding stressful situation, • Activity on listing negative situations and ways to turn it positive.	09

2.	Demonstrate the knowledge of becoming oriented	• Becoming result oriented, • Goal setting – examples of result-oriented goals.	• Group activity on listing sim in life.	08

3.	Describe the importance of self-awareness and the basic personality traits, types and disorders	• Steps towards self-awareness,
		• Personality and basic personality traits,
		• Common personality disorders-
		  • Suspicious,
		  • Emotional and impulsive,
		  • Anxious,
		• Steps to overcome personality disorders
			• Group discussion on self awareness.	08

			Total Duration in Hours	**25**

Unit 3: Information and Communication Technology Skills – IV				
Sn	**Learning Outcome**	**Theory (06 Hours)**	**Practical (14 Hours)**	**20**
1.	Identify the components of a spreadsheet application	• Getting started with spreadsheet – types of a spreadsheet, components of a worksheet, • Steps tp start LibreOffice Calc, • Components of worksheet	• Group activity on identifying components of spreadsheet in LibreOffice Calc	02
2.	Perform basic operations in a spreadsheet	• Opening workbook and entering data – types of data, steps to enter data, editing and deleting data in a cell, • Selecting multiple cells, • Saving the spreadsheet in various formats, • Closing the spreadsheet, • Opening the spreadsheet, • Printing the spreadsheet.	• Group activity on working with data on LibreOffice Calc	03
3.	Demonstrate the knowledge of working with data and formatting text	• 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, • Need to format cell and content, • Changing text style and font size, • Aligning text in a cell, • Highlighting text.	• Group activity on formatting a spreadsheet in LibreOffice Calc • Group activity on performing basic calculations in LibreOffice Calc.	02
4.	Demonstrate the knowledge of using advanced features in spreadsheet	• Sorting data, • Filtering data, • Protecting spreadsheet with password	• Group activity on sorting data in LibreOffice Calc	03
5.	Make use of the software used for making slide presentations	• Steps to start LibreOffice Impress, • Adding text to a slide presentation	• Group practice on working with LibreOffice Impress tools	02

6.	Demonstrate the knowledge to open, close and save slide presentations	• Open, Close, Save and Print a slide presentation	• Group activity on saving, closing and opening a presentation in LibreOffice Impress	01
7.	Demonstrate the operations related to slides and texts in the presentation	• 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	• Group practice on working with font styles and types in LibreOffice Impress.	04
8.	Demonstrate the use of advanced features in a presentation	• Advanced features used in the presentation, • Inserting shapes in the presentation, • Inserting clipart and images in the presentation, • Changing slide layout.	• Group activity on changing slide layout in LibreOffice Impress.	03
			Total Duration in Hours	**20**

Unit 4: Entrepreneurial Skills – IV				
Sn	**Learning Outcome**	**Theory (10 Hours)**	**Practical (15 Hours)**	**25**
1.	Describe the concept of entrepreneurship and the types and roles and functions entrepreneur	• Entrepreneurship and entrepreneur, • Characteristics of entrepreneurship, • Entrepreneurship-art and science, • Qualities of a successful entrepreneur, • Types of entrepreneurs, • Roles and functions of an entrepreneur, • What motivates an entrepreneur? • Identifying opportunities and risk-taking, • Startups.	• Group discussion on the topic “An entrepreneur is not born but created”. • Conducting a classroom quiz on various aspects of entrepreneurship. •	10
2.	Identify the barriers to entrepreneurship	• Barriers to entrepreneurship, • Environmental barriers, • Faulty business plan, • Personal barriers	• Group discussion about “What we fear about entrepreneurship” • Activity on taking an interview of an entrepreneur.	05
3.	Identify the attitude that make entrepreneur successful	• Entrepreneurial attitude.	• Group activity on identifying entrepreneurial attitude.	05
4.	Demonstrate the knowledge of entrepreneurial attitude and competencies	• Entrepreneurial competencies • Decisiveness, • Initiative • Interpersonal skills-positive attitude, stress management • Perseverance • Organisational skills- time	• Playing games, such as “Who am I”. • Brainstorming a business ideas • Group practice on “Best out of Waste” • Group discussion on the topic of “Let’s grow together”	05

		management, goal setting, efficiency, managing quality.	• Group activity on listing stress and methods to deal with it like Yoga, deep breathing exercise.	
			Total Duration in Hours	**25**

Unit 5: Green Skills – IV				
Sn	**Learning Outcome**	**Theory (05 Hours)**	**Practical (10 Hours)**	**15**

1.	Identify the benefits of the green jobs	• Green jobs
		• Benefits of green jobs
		• Green jobs in different sectors:
		  • Agriculture
		  • Transportation
		  • Water conservation
		  • Solar and wind energy
		  • Eco-tourism
		  • Building and construction
		  • Solid waste management
		  • Appropriate technology
			• Group discussion on the importance of green job,
			•
				08

2	State the importance of green jobs	• Importance of green jobs in
		  • Limiting greenhouse gas emissions,
		  • Minimizing waste and pollution,
		  • Protecting and restoring ecosystems,
		  • Adapting to the effects of climate change
			• Preparing posters on green jobs,
			• Group activity on tree plantation.
				07

			Total Duration in Hours	**15**

GRADE XII, Part B: Vocational Skills

Unit No.	Unit Name	Duration in Hours
Unit 1	Machine Learning using Python	40
Unit 2	Data Science	30
Unit 3	Data Analysis	30
Unit 4	Neural Network	40
Unit 5	AI Project	25
	Total Duration	**165**

Unit 1	**Machine Learning using Python**	**Duration in Hours**	**40**
Session/ Learning Outcomes	**Theory Topics**	**Practical Activities**	**Hrs**
Session 1. Introduction to Machine Learning (ML) **LO**. Describe the Machine Learning and it's use	• Introduction to ML, • AI vs. ML vs. Deep Learning, • ML workflow, • Importance of ML, • Applications of ML in various industries, • Real-life examples of ML (e.g., voice assistants)	• Draw the workflow of Machine Learning, • Group activity: List daily life examples where ML is used, • Class discussion: How is ML different from traditional programming? • Explore ML applications in real-life (Netflix, Amazon)	5
Session 2. Types of Machine Learning **LO.** Identify different types of ML: Supervised, Unsupervised, and Reinforcement Learning	• Types of Machine Learning – Supervised, Un-Supervised, Reinforcement, • Supervised Learning: Learning from labeled data, Classification and Regression • Unsupervised Learning: Finding patterns in unlabeled data, Clustering, • Reinforcement Learning: Learning through rewards	• Draw the diagram to illustrate the types of ML, • Illustrate the examples of Supervised Leaning, un-Supervised Leaning, reinforcement learning, • Use visual examples (e.g., fruit classification for supervised learning), • Online simulation tools (e.g., Teachable Machine), • Interactive quiz to identify ML types from examples	5
Session 3. Python Tools for Machine Learning **LO.** Set up and use Python libraries for ML.	• Introduction to scikit-learn, pandas, NumPy, and matplotlib, • Data loading, exploration, and visualization	• Install scikit-learn and import basic datasets (e.g., iris, digits), • Use .head(), .describe(), .plot() to explore data	5

Session 4. Supervised Learning – Classification **LO.** Train and evaluate a classification model.	• Classification: Grouping data into categories (e.g., spam detection), • Example: Predicting flowers (Iris dataset), • Train-test split, accuracy	• Load the Iris dataset and train a K-Nearest Neighbors (KNN) model, • Predict flower type and measure accuracy using accuracy_score • Teachable Machine: Train a model to recognize poses or sounds.	5
Session 5. Supervised Learning – Regression **LO.** Use regression to make numeric predictions.	• Regression: Predicting continuous values (e.g., house prices), • Example: Predicting student scores or house prices, • Concept of line of best fit.	• Graph plotting of data to show regression (e.g., height vs. weight), • Use LinearRegression to predict scores from study hours, • Plot regression line using Matplotlib.	5
Session 6. Unsupervised Learning – Clustering **LO.** Apply basic clustering techniques.	• Clustering: K-Means, Hierarchical, • Dimensionality Reduction : PCA, • K-Means algorithm, • Applications: customer segmentation, grouping data	• Cluster data using Kmeans, • Reduce dimensions using PCA, • Visualize clusters and PCA results, • Use K-Means on sample data (e.g., customer spending), • Visualize clusters using scatter plots	5
Session 7. Model Evaluation and Metrics **LO.** Evaluate model performance using standard metrics.	• Accuracy, precision, recall, confusion matrix (basics), • Overfitting vs. Underfitting, • Cross-validation (K-Fold), • Hyperparameter tuning: Grid Search, Random Search, • Bias-Vaiance tradeoff, • Train/Test split using train_test_split()	• Calculate accuracy and confusion matrix for classification models, • Perform K-Fold cross-validation, • Implement GridSearchCV and cross_val_score, • Compare models before and after tuning, • Interpret evaluation results in simple terms.	5
Session 8. Ethics and Responsibility in AI/ML **LO.** Recognize the ethical use of AI and ML in real life.	• Bias of Data in ML, • Importance of clean data, • Transparency and explainability. • Privacy and Data Security,	• Demonstrate the imporatance of clean data in getting the accuracy in results, • Watch a short documentary	5

	• Fairness and Transparency	or news clip on AI bias, • Group discussion or debate: "Should AI decide who gets a job?"	
		Total Duration in Hours	**40**

Unit 2	**Data Science**	**Duration in Hours**	**30**
Session/ Learning Outcomes	**Theory Topics**	**Practical Activities**	**Hrs**
Session 1. Introduction to Data Science **LO1.** Describe the role and importance of Data Science in various industries.	• Introduction to data science, • Career opportunities in Data Science • Use of data in daily life, • Real-world applications (healthcare, retail, finance, etc.) • Python libraries for data sciece – NumPy, Pandas, Maplotlib • Installation of NumPy, Pandas, Maplotlib	• Watch and summarize a video on how businesses use data • Prepare a chart of industries using data science and the type of data they use • List the Python libraries used for data sciece, • Demonstrate to install NumPy, Pandas, Maplotlib in Python, • Discuss examples: how Netflix recommends shows, or how Google Maps predicts traffic,	5
Session 2. Introduction to NumPy **LO1.** Use NumPy arrays for efficient numerical operations.	• Concept of arrays, • Creating arrays, slicing using NumPy, • Arrays vs lists, • Array data types, • Array dimesions – 1D, 2D, 3D, • Array properties – shape, size, dimensions, • Array manipulation – Resizing, Reshaping, Joining, Splitting.	• Create NumPy arrays and perform arithmetic operations, • Calculate mean and standard deviation using NumPy, • Create 1D, 2D, 3D array using NumPy, • Assign values to the array elements. • Create an array of student marks NumPy, • Calculate average, highest, and lowest marks,	5
Session 3. Data Handling with Pandas **LO1.** Load and manipulate tabular data using Pandas.	• Introduction to Pandas, • Series and DataFrame, • Reading CSV files, • Selecting rows/columns,	• Load a student dataset and display top 5 rows • Filter students who scored above 80 in Science	5

	filtering data, • Accessing a dataframe in pandas, • Columns and rows, • Reading data from files,		
Session 4. Data Cleaning and Preprocessing **LO1.** Clean and prepare data for analysis.	• Handling missing values, • Fixing incorrect data. • Removing duplicates, • Dropping/renaming columns, • Data type conversion	• Use Pandas to fill missing values with mean, • Remove duplicate rows from a dataset	5
Session 5. Data Visualization using Matplotlib and Seaborn **LO1.** Create plots to represent data visually.	• Line plots, bar charts, histograms, pie charts, • X and Y axes • Labels and titles • Introduction to Seaborn for attractive plots	• Plot bar chart of subject-wise student scores, • Plot a line graph of daily temperatures, • Use Seaborn to show correlation heatmap of marks	5
Session 6. Basic Statistical Analysis **LO1.** Perform statistical analysis using Python libraries. **LO2.** Analyze patterns and trends in data	• Mean, median, mode, standard deviation, • Maximum and minimum, • Count and frequency, • Correlation and basic interpretation, • Time series basics, • Data trends and comparison.	• Analyze sales data: Find most sold items,average daily sales, • Calculate descriptive statistics on a dataset, • Find correlation between two subjects' scores, • Plot and compare school attendance across months or exam scores by subject.	5
		Total Duration in Hours	**30**

Unit 3	**Data Analysis**	**Duration in Hours**	**30**
Session/ Learning Outcomes	**Theory Topics**	**Practical Activities**	**Hrs**
Session 1. Introduction to Data Analysis **LO1.** Describe the data analysis process and the role of Python.	• Types of data – Qualitative and Quantitative, Structured vs unstructured data, • Data formats: CSV, Excel, JSON. • Stages: data collection, cleaning, exploration, visualization, and conclusion, • Real world examples	• Discuss a real-life data-driven decision (e.g., YouTube recommendations), • Install Jupyter Notebook and write a "Hello Data" program • Discuss how data is used in business, sports, education	5

Session 2. Data Handling **LO1.** Load, explore, and manipulate data using Pandas.	• Python for data analysis – simplicity, libraries, community • Pandas: Series vs. DataFrame, • Importing CSV files using pd.read_csv(), • Basic DataFrame operations: .head(), .info(), .describe()	• Load a sample dataset (e.g., student_scores.csv), • Display first 10 records, data types, and summary stats.	5
Session 3. Data Cleaning and Preparation **LO1.** Clean and preprocess data using Python.	• Identifying and handling missing values, • Removing duplicates, • Renaming and dropping columns	• Use df.dropna(), df.fillna(), df.duplicated() on a sample dataset, • Remove irrelevant columns and standardize data types.	5
Session 4. Exploratory Data Analysis (EDA) **LO1.** Explore and summarize data to find patterns and insights.	• Filtering rows based on conditions, • Sorting and grouping data, • Aggregation functions: .sum(), .mean(), .groupby()	• Group student scores by subject and calculate average, • Filter students who scored above 80 in any subject	5
Session 5. Data Visualization using Python **LO1.** Visualize data using Python libraries.	• Matplotlib basics: line, bar, histogram, pie chart, • Seaborn for styled visualizations (e.g., sns.barplot(), sns.heatmap()), • Importance of visuals in analysis.	• Create a bar chart of students' subject-wise scores, • Plot a correlation heatmap using Seaborn	5
Session 6. Basic Statistical Analysis **LO1.** Apply statistical measures to analyze data patterns.	• Mean, median, mode, standard deviation, • Maximum and minimum, • Count and frequency, • Correlation and basic interpretation.	• Calculate statistics for a dataset using Pandas and NumPy, • Find and interpret correlation between Math and Science scores	5
		Total Duration in Hours	**30**

Unit 4	**Neural Network**	**Duration in Hours**	**40**
Session/ Learning Outcomes	**Theory Topics**	**Practical Activities**	**Hrs**
Session 1. Introduction to Neural Network **LO**. Describe the basic concept and use of Neural	• Concept of Neural Network, • Applications in real life (e.g., face recognition, spam detection) • Biological vs Artificial	• Illustrate a simple diagram comparing brain neurons and artificial neurons, • Draw a neural network with 1 hidden layer manually,	5

Network	Neurons, • Working of Neural Network	• Visualize how changing weights affects predictions using an interactive tool or Python demo	
Session 2. Neurons and Activation Functions **LO**. Describe how artificial neurons work and the role of activation functions.	• Structure of a Neural Network, • Layers of Neural Network – Input Layer, Hidden Layer, Output Layer, • Neurons, weights, bias, • Activation functions: ReLU, sigmoid, softmax, • Types of Neural Network	• Use NumPy to implement a simple neuron (manual weights and bias), • Plot sigmoid and ReLU functions using Matplotlib	5
Session 3. Applications of Neural Network **LO.** Illustrate the applications of Neural Network	• Applications of Neural Network, • Object detection using ANN, • Image segmentation using ANN • Classification using ANN, • Speech to Text using ANN, • Machine Translation using ANN	• Demonstratre to detect object using Scratch script, • Demonstratre to convert speech to text using Scratch, • Demonstratre the image segmentation using Scratch.	5
Session 4. Introduction to Python Libraries for Neural Networks **LO.** Set up Python tools to build neural networks.	• Installing and using TensorFlow/Keras, • Difference between low-level (NumPy) and high-level (Keras) APIs	• Install TensorFlow using pip or Anaconda, • Run a basic Keras example to classify digits (MNIST)	5
Session 5. Training the Neural Network **LO.** Train and test a Neural Network	• Training data vs testing data, • Epochs, loss, accuracy • activation functions – ReLU, Sigmoid, Tanh,	• Split dataset (80/20), train a model, evaluate with test set, • Plot activation function using matplotlib,	5
Session 6. Data Preparation for Neural Networks **LO.** Prepare data for neural network training.	• Normalization and reshaping, • One-hot encoding for classification.	• Normalize image data (divide by 255), • Use to_categorical() to convert labels.	5
Session 7. Model Evaluation and Prediction **LO.** Evaluate model performance and make predictions.	• Accuracy, loss, confusion matrix (basic), • Overfitting and underfitting (conceptual)	• Use .evaluate() and .predict() functions in Keras, • Display predicted vs actual labels.	5
Session 8. Building a basic Neural Network for classification	• Layers: Dense (fully connected), • Loss functions and optimizers (e.g., categorical	• Train a model end-to-end (load data, preprocess, train, test), • Visualize predictions using	5

LO. Build and train a simple Neural Network for classification	crossentropy, SGD), • Training and evaluation steps, • Binary classification example (e.g., pass/fail), • Introduction to TensorFlow/ Keras, • Model performance - Accuracy, precision, recall, confusion matrix , • Overfitting and underfitting.	Matplotlib, • Use Keras to build a Neural Network to classify students who passed or failed based on scores, • Train a model with and without dropout and observe the performance difference	
		Total Duration in Hours	**40**

Unit 5	**AI Captione Project**	**Duration in Hours**	**25**
Session/ Learning Outcomes	**Theory Topics**	**Practical Activities**	**Hrs**
Session 1. AI Project Cycle framework. **LO.** Identify the AI Project Cycle framework.	• Introduction to AI Project Cycle, • Problem Scoping, • Data Acquisition, • Data Exploration, • Modeling, • Evaluation, • Deployment	• Activity: Brainstorm around the theme provided and set a goal for the AI project, • Activity: To set actions around the goal, • Activity: Data and Analysis, • Brainstorming solutions for the problem statement	5
Session 2. Captione Project in Python **LO.** Develop a project in Python	• Practical design of project	• Practical development of project	20
		Total Duration in Hours	**25**

6. ORGANISATION OF FIELD VISITS and OJT

In a year, at least 3 field visits/educational tours should be organised for the students to expose them to the activities in the workplace. During summer or winter vacation, students can undergo one week on-the-job training in nearby industry or work place. Visit a Software Development Company and observe the following: Location, Site, Computer systems and peripheral devices, Software, Software Development Process, Coding and Testing Tools, Documentation Process, Software Maintenance. During the visit, students should obtain the following information from the organisation:

- Computer System, parts and peripherals.
- Specifications of various parts of computer system.
- Role and Responsibilities of AI Associate.
- Software requirement and installation for AI system.
- Coding, debugging, testing, implementation and maintenance.
- Storage devices and storage capacity of various storage devices.

7. LIST OF EQUIPMENT AND MATERIALS

The equipment / materials listed below are required to conduct effective hands-on learning sessions while delivering the curriculum to students. The list below consists of minimal configuration required to execute the curriculum and create social impact real time solutions/ projects. The quantities mentioned here are recommended for a batch of 30 students keeping the human-machine ratio as 1:1. An exhaustive list may be compiled by the teacher(s) teaching the subject.

List of Tools and Equipment

Sn	Tool/ Equipment	Specifications	Quantity
1	Student Chair	Revolving chair	30
2	Student Table	Computer Table	30
3	Desktop computers	Desktop computer with latest specifications, Camera, Headphone with Wifi/internet connectivity	30
4	Printer	Laser Printer	1
5	Software	Operating System: Linux/Windows with Anti-Virus Activated Productivity Suite: Any (Google+ Suite recommended) Anaconda Navigator Distribution (https://bit.ly/AI-installation-guide) Installed with software: Python, NumPy, Pandas, Matplotlib, Seaborn, Scikit-Learn Conceptual installations (https://bit.ly/AI-installation-guide) Intel Open VINO tools	

NOTE: In keeping with the spirit of Recycle, Upcycle and Reuse, it is recommended to make use of any equipment/ devices/ accessories from the existing inventory in school.

Classroom Aids

Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Pin-up Board, Projector, Laptop

8. TEACHER'S/TRAINER'S QUALIFICATION

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:

Qualifications	Age Limit
Essential : Bachelor's degree in Engineering/ Technology (IT/CS/AI/Data Science) **OR** Master's degree in Sciece M.Sc. (CS/IT) **OR** MCA **OR** NIELIT "B" Level Certificate. ***Desirable:*** Certified to TOT for the job role: NIE/SSC/Q1004 "Artificial Intelligence Associate" or equivalent with Minimum accepted score is 80%. ***Experience:*** 2 years of work experience in Industry/ Training.	18-37 years (as on Jan. 01 (year)) Age relaxation to be provided as per Govt. rules

Note – The qualifications for vocational teachers mentioned above is suggestive and not prescriptive. The States/ UTs can make modifications in the qualifications for appointment of vocational teachers/ trainers as per their requirement through a committe appointed by the competent authority in the State/ UT Directorate/ Department of School Education.

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 and Higher Secondary Education under RMSA in following ways:

1. 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**
2. 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 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:

- Prepare session plans and deliver sessions which have a clear and relevant purpose and which engage the students;
- Deliver education and training activities to students, based on the curriculum to achieve the learning outcomes;
- Make effective use of learning aids and ICT tools during the classroom sessions;

- 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;
- Work with the institution's management to organise skill demonstrations, site visits, on-job trainings, and presentations for students in cooperation with industry, enterprises and other workplaces;
- Identify the weaknesses of students and assist them in up-gradation of competency;
- Cater to different learning styles and level of ability of students;
- Assess the learning needs and abilities, when working with students with different abilities
- Identify any additional support the student may need and help to make special arrangements for that support;
- 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:

- Participation in guidance and counseling activities conducted at Institutional, District and State level;
- Adoption of innovative teaching and training methods;
- Improvement in result of vocational students of Class X or Class XII;
- Continuous up-gradation of knowledge and skills related to the vocational pedagogy, communication skills and vocational subject;
- Membership of professional society at District, State, Regional, National and International level;
- Development of teaching-learning materials in the subject area;
- Efforts made in developing linkages with the Industry/Establishments;
- Efforts made towards involving the local community in Vocational Education
- Publication of papers in National and International Journals;
- Organisation of activities for promotion of vocational subjects;
- Involvement in placement of students/student support services.

9. LIST OF CONTRIBUTORS

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