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FOR MH CLASS 12 PREPARATION

Maharashtra Class 12 Syllabus 2027 Junior Software Developer (NSQF vocational)

EXAM	YEAR	TYPE
MH Class 12	2027	Syllabus

LEARNING OUTCOME BASED VOCATIONAL CURRICULUM

JOB ROLE:

Junior Software Developer

(QUALIFICATION PACK: Ref. Id. SSC/Q0508, NSQF Level 3)

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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Junior Software Developer

IT-ITeS Sector

March, 2020 (First Version)
August, 2022 (Revised Version)
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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 – Junior Software Developer**. 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 i s 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

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1. COURSE OVERVIEW

Course Title: Junior Software Developer

Individuals in this job are assigned one of the many entry level roles in the software industry including support and help desk, testing, user interaction design, maintenance, enhancement, development and documentation. They are responsible for assisting in performing the key activities and tasks involved in the assigned role. This job requires the individual to be flexible and operate under supervision for the area of work he/she is aligned to. The individual should have the necessary technical competency and be able to communicate effectively and work collaboratively. He/she should also have a willingness to learn and undertake a desk job entailing long hours.

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

- ✓ Apply effective oral and written communication skills to interact with people and 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 and abilities;
- ✓ Demonstrate the knowledge of the importance of green skills in meeting the challenges of sustainable development and environment protection;
- ✓ Manage the work to meet requirements;
- ✓ Maintain a healthy, safe and secure working environment
- ✓ Assist in performing software construction and software testing entry-level tasks in the IT
- ✓ Services industry
- ✓ Demonstrate basic computer operations
- ✓ Demonstrate to use operating system, browser, and internet,
- ✓ Demonstrate aptitude for analyzing information and making logical conclusions.
- ✓ Demonstrate knowledge of the foundational mathematical concepts in computing.
- ✓ Design algorithms to solve problems and convert them into code using the appropriate programming language constructs.
- ✓ Read and execute a test case and record the outcome in the appropriate.
- ✓ Demonstrate self and work management.
- ✓ Demonstrate working and communicating in team.
- ✓ Manage Health and Safety measures at workplace.
- ✓ Manage Data and Information.
- ✓ Apply new knowledge and skills in the workplace, under supervision and perform self development.

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 Grade XII.

COURSE DURATION: **Total : 600 hours**

Grade 11 : 300 hours

Grade 12 : 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 XI and XII opting for vocational subject along with general education subjects. The unit-wise distribution of hours and marks for **Grade XI** 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	Basic ICT Skills – III	20	
Unit 4	Entrepreneurial Skills – III	25	
Unit 5	Green Skills – III	15	
	Total Hours	**110**	**10**
Part B	**Vocational Skills**		
Unit 1	Software Construction Essentials	40	
Unit 2	Operating System and Computer Network	35	
Unit 3	Python Programming	60	
Unit 4	Data Structure	30	
	Total Hours	**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**

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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 & Practical 100**
Part A	**Employability Skills**		
Unit 1	Communication Skills – III	25	**10**
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 Hours	**110**	**10**
Part B	**Vocational Skills**		
Unit 1	Relational Database Management System – MySQL	45	**40**
Unit 2	Advanced Python Programming	60	
Unit 3	Software Engineering	40	
Unit 4	Emerging Trends and Social Impact	20	
	Total Hours	**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 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 Qes.)**

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

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		• 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 directions to others	• Asking for directions to place, • Giving directions for a place.	• Role-play on asking and giving directions, • Identifying symbols used for giving directions.	01
			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**

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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	• Tracking option • Manage option	• Group activity on performing track changes in LibreOffice	04

	change option in a word document	• Compare documents	Writer and Microsoft Word	
			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**

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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**

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GRADE XI, Part B: Vocational Skills

Unit No.	Unit Name	Duration in Hours
Unit 1	Software Construction Essentials	40
Unit 2	Operating System and Computer Network	35
Unit 3	Python Programming	60
Unit 4	Data Structure	30
	Total Duration	**165**

Unit 1: Software Construction Essentials

Sn	Learning Outcome	Theory (20 Hours)	Practical (20 Hours)	40
1.	Describe computer system architecture	• Introduction to Computer, • Internal components of computer system, • Input devices – Keyboard, Mouse, Touchscreen, Scanner, Touchpad, Graphics tablet, • Output devices – Monitor, Speaker, Printer, Scanner, Camera, OMR, OCR, MICR, • Peripheral devices, • Storage devices – Hard Disk Drive, Solid-State Drives, Flash drive, Optical Disk, Cloud storage, • Capacity and cost of various storage devices	• Identify and name the various parts of computer system, • Draw the block diagram of computer system, • Identify and name the internal components of computer, • Observe the memory size in different computing device, • Identify and name the various input devices, • Identify and name the various output devices • Identify and name the various storage devices	08
2.	Describe data representation in computer	• Concept of data and Information, • Data representation in computer, • Units for measurement of data, • Coding systems – BCD, EBCDIC, ASCII, Unicode, • Number system – decimal, binary, octal, hexadecimal, • Number systems conversion, • Binary addition and subtraction	• Identify data types for the given data values, • Visualise the data using bar graph, pi chart and line graph, • List data measurement units, • Demonstrate to convert the number and character values into different coding system, • Demonstrate to convert the given number from one number system to other,	08
3.	Describe the basic concepts of Mathematics and Statistics	• Set theory, • Set operations, • Venn diagram, • Relations and functions, • Mathematical logic, • Group theory, • Boolean Algebra, • Statistical methods: mean, median, mode, standard deviation, variance;	• Demonstrate to perform various set operations and draw its Venn diagram, • Demonstrate the various logic operations using truth table, • Compute the adjacency matrix for the given graph, • State and prove laws of Boolean algebra, • Compute mean, median,	08

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		• Data visualization.	mode, standard deviation and variance for the given data, • Visualise the given data using graphs/charts.	
4.	Solve the problem using problem solving method	• Problem solving cycle – analyzing a problem, designing algorithm, implementation through coding, testing the solution, • Algorithms – need of algorithm in problem solving, characteristics of algorithm, • Representation of algorithm using flowchart, pseudo-code, • Alternative solution and efficiency of algorithm, • Flow of control – slection, iteration, repetition. • Coding, • Problem decomposition.	• Illustrate to write an algorithm using various examples such as to find the sauare of a number, swapping of variables, computation of factorial of a number, • Illustrate to write an flowchart using various examples such as swapping of variables, to find the largest of three numbers, generation of fibonacci series, • Illustrate to write the pseudocode using various examples, • Illustrate with with example Flow of control – slection, iteration, repetition.	08
5.	Describe programming language concepts	• Concept of a program, • Need of programming language for writing programs, • Types of programming language, • Syntax and semantics of the High-Level Languages, • Programming constructs, • Language translators – Compiler and Interpreter, • Programming approaches – procedural oriented and object oriented, • Selection of programming language, • Coding environment.	• Write the steps for solving a given problem, • List the types of programming languages, • Identify the syntax of semantics in programming language, • List the various programming constructs, • Differentiate between compiler and interpreter, • Differentiate between procedure oriented and object oriented languages, • List the criteria for selection of programming language, • Illustrate the various program coding environment tools.	08
			Total Duration in Hours	**40**

Unit 2: Operating System and Computer Network				
Sn	**Learning Outcome**	**Theory (15 Hours)**	**Practical (20 Hours)**	**35**
1.	Describe the basic concepts of operating system	• Concept of operating system, • Structure of operating system, • Functions of Operating System, • Types of Operating Systems, • Examples of Operating System, • Working with operating system.	• List the various functions performed by operating system, • Identify and name the operating system by observing its user interface, • Demonstrate to perform various tasks in operating system.	05

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2.	Describe the concept of computer networks	• Basic concepts of networking, • Types of network – LAN, PAN, MAN, WAN, • Network devices – Modem, Ethernet Card, RJ45 connector, Repeater, Hub, Switch, Router, Gateway. • Network Topology – Bus, Ring, Star, Mesh, Tree • Computer Network Architecture – Peer to peer network and Client-server network, • Basics of MAC and IP Address, • Useful network commands.	• Identify the types of network and draw its labeled diagram, • Identify and list the network devices and their applications, • Identify and name types of network topology, • Identify the architecture of network, • Draw the diagram of client server network, • Fetch MAC and IP address of the system using OS commands • Illustrate to find the MAC address and IP address of computing device.	10
3.	Describe the transmission media and network protocols	• Wireless Transmission Media – Radio Waves, Microwave, Infrared, • Wireless Technologies – Bluetooth, Wi Fi, WLAN, • Mobile Telecommunication Technologies, • Computer network models – OSI Model, TCP/IP Model, • Layers of OSI Model and TCP/IP Model, • Network Protocol – Need for Protocol, Categorization • Examples of protocol, HTTP, FTP, IP, PPP, SMTP, POP.	• Demonstrate the use of wireless devices in a network, • List the various wireless transmission media, • List the various wireless technologies, • Illustrate the features of HTTP and HTTPS protocol, • Demonstrate the use of protocol in email application, • Demonstrate the use of FTP protocol to transfer files.	10
4.	Describe the features of network security	• Threats and prevention, • Concept of Network security, • Types of Cyber attacks, • Malware attacks– Virus, Worms, Ransomware, Trojan, Spyware, Adware, Key-loggers, Spam • Antivirus software, • Network security attacks – Denial of Service (DoS), Buffer Overflows, Ping Attacks, SYN Flood, DNS Amplification, Back Door, Spoofing Attack, TCP/IP Hijacking, Man In The Middle Attacks, • Wireless attacks – Data Emanation, Jamming, Bluetooth Vulnerabilities, Near-Field Communication, Evil Twin, Packet Sniffing and Eavesdropping, Replay Attacks (Wireless), WPS attacks, WAP2 attacks, • Firewall and its types,	• Identify and list various threats • List the preventive processes to tackle threats, • Clean your computer using antivirus or defender, • List the various network security attacks and ways to prevent these attacks, • Identify the various firewall operations, • Identify and list the security issues and threats in Email communication.	10

		• Cookies and threats due to cookies, • Hackers and Crackers – White hats: Ethical hacker, Black hats: Crackers, Grey hats • Security Issues and Threats in Email communication		
			Total Duration in Hours	**35**

Unit 3: Python Programming				
Sn	**Learning Outcome**	**Theory (12 Hours)**	**Practical (18 Hours)**	**60**
1.	Code and execute simple programs in Python	• Features of Python programming, • Working with Python interpreter, • Python in interactive mode and script mode, • Structure of a program, debugging-errors, • Identifiers, keywords, constants, variables, • Types of operators, precedence of operators, • Data types, mutable and immutable data types, • Statements, expressions, evaluation and comments, • Input and output statements, • Data type conversion, debugging.	• Install the python compiler (binaries) • List the various components of python interface, • Draw the diagram of structure of python program, • Write, compile and execute a simple program in python, • Write the rules for identifiers, constants and variables, • Write, compile and execute simple programs in python that uses constants, variables, operators and I/O statements • Write, compile and execute programs for data type conversion in python.	10
2.	Code and execute programs using control structures in Python	• Control structures: Sequence, selection (decision) and repetition (iteration) • Selection: if, if-else, and nested if statement, indentation • Repetition: for, while, and nested loops, break, continue;	• Write, compile and execute programs using sequence selection and repetition, • Write, compile and execute programs using if, if-else, and nested if statement, • Write, compile and execute programs using for, while, and nested loops, break, continue.	10
3.	Code and execute programs using functions in Python	• Introduction to functions, need of functions • User defined functions: passing arguments to a function, returning values from functions, scope of variables, • Standard library: using built-in functions, importing modules-math, random, statistics, creating and importing user defined module	• Write, compile and execute programs using functions, • Write, compile and execute programs using user defined functions, • Write, compile and execute programs by passing arguments to a function and returning values from functions, • Write, compile and execute programs by using built-in functions,	10

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4.	Code and execute python programs using Strings	• Strings: initializing strings and accessing strings, • String operations, • Built-in functions for string manipulation, • String traversal, • String as argument to function	• Write, compile and execute the programs by using built in functions for strings, • Write, compile and execute the programs by using built in functions for String operations, • Write, compile and execute the programs by using built in functions for string traversal, and manipulation, • Write, compile and execute the programs by using built in functions for String as argument to function	10
5.	Code and execute python programs using List	• List, list operations – creating, initializing, traversing and manipulating lists, list methods, • Built-in functions, nested lists, list as argument to a function	• Write, compile and execute the programs in python for operations – creating, initializing, traversing and manipulating lists, • Write, compile and execute the programs in python for built-in functions for list, • Write, compile and execute the programs in python for nested lists, • Write, compile and execute the programs in python for list as argument to a function	10
6.	Code and execute python programs using Tuples and Dictionary	• Tuples: Creating, initializing, accessing elements, tuple assignment, • Operations on tuples, • Tuple methods and built-in functions, nested tuples. • Dictionary: concept of key-value pair, mutability, creating, initializing, traversing, updating and deleting elements; • Dictionary methods and built-in functions.	• Write, compile and execute the program for creating, initializing, accessing elements and tuple assignment, • Write, compile and execute the program for performing operations on tuples, • Write, compile and execute the program for built-in functions, • Write, compile and execute the program for nested tuples, • Write, compile and execute the program for creating, initializing, traversing, updating and deleting elements from a dictionary; • Write, compile and execute the program by using built-in functions for operations on dictionary.	10
			Total Duration in Hours	**60**

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Unit 4: Data Structure				
Sn	**Learning Outcome**	**Theory (15 Hours)**	**Practical (20 Hours)**	**30**
1.	Describe the concepts of data structure	• Introduction to data structure • Basic terminology – Primitive and Group data items, Entities • Elementary data organisation – Field, Record, File, • Need of Data Structures, • Classification of Data Structure- Linear and Non-Linear, • Operations on data structure – Traversing, Insertion, Deletion, Searching, Sorting, Merging.	• Give the examples of Primitive data items, Group data items, Entities, • Give the examples of Field, Record, File • List the various linear data structures, • List the various non-linear data structures, • List the various operations performed on data structure.	04
2.	Describe Linear Data Strucures and its Algorithms	• Linear Data Structure – Array, Stack, Que, Linked List, • Array – Memory represention, • Algorithms of operations on Array – Traversal, Insertion, Deletion, Searching, Linear and Binary search • Stack – Memory represention, • Creation of stack using array, • Algorithms of operations on stack – Push, Pop, • Queue – Representation of queue using Array, • Algorithms of operations on Queue – Insertion, Deletion, • D Queue and Priority Queue, • Linked Lists – Memory represention, Types, • Algorithms of operations on Linked List – Traversal, Insertion, Deletion.	• Draw the diagram to represent array in memory, • Write a algorithm for traversing a linear array, for insertion of element in a linear array, for deleting an element in array, for binary search, • Write a algorithm for inserting element in stack (Push), and deleting an element from stack (Pop), • Write a algorithm for inserting element in Queue, and deleting an element from Queue, • Write a algorithm for traversal of linked list, inserting element in Linked List, and deleting an element from Linked List.	14
3.	Describe Non-Linear Data Strucures and its Algorithms	• Non- Linear Data Strucures – Trees and Graph, • Tree and Binary Tree – Memory Representation, • Algorithms for Traversing of Binary Tree – Pre- order, post order and in order, • Concept of Graph, • Terminologies related to Graph, • Types of Graph – undirected, cyclic and directed Graph, • Representation of Graph, • Operations of Graph,	• Write a algorithm for Pre-order (NLR) traversing of binary tree, • Write a algorithm for Pre-order (LNR) traversing of binary tree, • Write a algorithm for Post-order (LRN) traversing of binary tree, • Give an example of Graph, • Draw a diagram of Graph showing edges and vertices • Draw a diagram of linked representation of Graph,	12
			Total Duration in Hours	**30**

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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	• Role Play on avoiding stressful situation, • Activity on listing negative situations and ways to turn it	09

		maintain positive attitude, • Stress and stress management - ways to manage stress	positive.	
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	05

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			of an entrepreneur.	
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 management, goal setting, efficiency, managing quality.	• 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" • Group activity on listing stress and methods to deal with it like Yoga, deep breathing exercise.	05
			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

Sn	Units	Duration in Hours
Unit 1	Relational Database Management System - MySQL	45
Unit 2	Advanced Python Programming	60
Unit 3	Software Engineering	40
Unit 4	Emerging Trends and Social Impact	20
	Total Duration	**165**

Unit 1: Relational Database Management System – MySQL				
Sn	**Learning Outcome**	**Theory (15 Hours)**	**Practical (30 Hours)**	**45**
1.	Describe the database management concepts	• Introduction to database systems, • File system and its limitations • Database management systems (DBMS), • Limitations, advantages and disadvantages of DBMS, • Comparison of DBMS with File System, • Concepts in DBMS, • Relational data model, • Keys in Relational database – Candidate key, Primary key, Composite Primary Key, Foreign Key	• List the requirement of database system, • List and compare the the various DBMS • List the uses of DBMS in real life, • Prepare the database table of real life examples – relatives, friends, classmates, telephone, • Identify the fields and records in the database table, • Identify the primary key and other keys in the database table,	10
2.	Describe Structured Query Language	• Structured Query Language (SQL) • Installing RDBMS package (MySQL), • Data Types and Constraints in MySQL • Types of SQL – DDL, DML, DQL, TCL, DCL • Data Definition Language (DDL) commands, • Data Manipulation Language (DML) commands, • Data Query Language (DQL) commands, • Data Control Language (DCL) commands, • Transaction Control Language (TCL) commands.	• List and identify different data types in SQL, • List and identify various constraints in data table, • Use DDL commands to create Database, Table, View, • Use Alter command to modify table structure, • Use Drop and Truncate command on Table, • Use DML commands to insert data records in Table, • Use Update and Delete command to modify the data records, • Use DCL command Select to retrieve data records, • Use DCL command Grant and Revoke to authorise and withdraw privileges for data operation,	20

			• Use TCL command Commit to save, Rollback and SavePoint command to undo the data transaction in Table	
3.	Use functions in SQL	• SQL functions - Single Row Functions and Aggregate functions, • Single Row Functions – Math Functions, String Functions, Date and Time Functions, • Aggregate Functions • GROUP BY clause in SQL • Operations on Relations – Union, Intersect, Minus, Cartesian Product • Using two relations in a query - JOIN on two tables,	• List the various Single Row Functions and Aggregate functions, • Demonstrate to use math functions, • Demonstrate to use string functions, • Demonstrate to use Date and Time functions, • Demonstrate to use Aggregate functions in SQL • Demonstrate to join two tables in SQL	15
			Total Duration in Hours	**45**

Unit 2: Advanced Python Programming				
Sn	**Learning Outcome**	**Theory (20 Hours)**	**Practical (40 Hours)**	**60**
1.	Implement data structures Stack and Queue in Python	• Application of Stack, • Implementation of PUSH and POP operations on Stack using Python program. • Implementation of operations on Queue using Python program.	• Write a Python program for PUSH and POP operations on Stack, • Write a Python program to perform operations on Queue.	04
2.	Handle Exception and in Python	• Exception Handling – syntax errors, exceptions, need of exception handling, • User-defined exceptions, • Raising exceptions, • Need for Exception Handling • Handling exceptions, • Catching exceptions, • Try - except – else clause, • Try - finally clause, • Recovering and continuing with finally, built-in exception classes.	• Write, compile and execute the programs in python to handle exceptions, • Write, compile and execute the programs in python by using Try - except – else clause, • Write, compile and execute the programs in python by using Try - finally clause, • Write, compile and execute the programs in python by using built-in exception classes.	08
3.	Use File handling in Python	• Concept of File. • Types of File – text file and binary file, • File handling – open and close files, • Reading and writing text files, • Reading and writing binary files, • File access modes,	• Write, compile and execute the programs in python to create a text file and binary file, • Write, compile and execute the programs in python to read the contents of existing file and to write the new contents in the text file,	08

		• Setting offsets in a file, • Creating and traversing a text file, • The Pickle module, • File handling using Pickle module.	• Write, compile and execute the programs in python to read the contents of existing file and to write the new contents in the binary file,	
4.	Handle Exception and File in Python	• Exception Handling – syntax errors, exceptions, need of exception handling, • User-defined exceptions, • Raising exceptions, • Handling exceptions, • Catching exceptions, • Try - except – else clause, • Try - finally clause, • Recovering and continuing with finally, built-in exception classes.	• Write, compile and execute the programs in python to handle exceptions, • Write, compile and execute the programs in python by using Try - except – else clause, • Write, compile and execute the programs in python by using Try - finally clause, • Write, compile and execute the programs in python by using built-in exception classes.	08
5.	Create and use NumPy Array in Python	• Concept of NumPy array, • Creating NumPy array, • Dimensions in Arrays, • Checking Dimensions of Array, • NumPy Arrays Vs Python Lists, • Accessing Array Elements, • Data Types in NumPy, • Creating Arrays With a Defined Data Type, • Converting Data Type on Existing Arrays, • NumPy Array Reshaping, • NumPy Array Slicing.	• Demonstrate to install and import NumPy, • Write Python code to create NumPy using array function, • Write Python code to create NumPy using tuple, • Write Python code to check the dimensions of array, • Write Python code to check data type of array, • Write Python code to reshape array, • Write Python code to slice the elements of array.	08
6.	Use Pandas and Series in Python	• Concept of Pandas and Series, • Installation of Pandas, • Series, • Creation of Series using list and dictionary, • Creation of series with Scalar value, • Series Object Attributes, • head() and tail () Function, • Vector Operations and Arithmetic Operations on series, • Relational Operations on series, • Difference between NumPy array and Series data objects.	• Write a program to create a series to display its different attributes, • Write a program for slicing series, • Write a python code to modify/update a data series, • Write a python code to modify / update index of a data series, • Write a program to illustrate vector and arithmetic operations on series, • Write a program to illustrate realational operations on series,	08
7.	Demonstrate Graphical Representation using MatpotLib	• MATPLOTLIB Library, • Installing and importing Matplotlib, • Basics of Simple Plotting, • Creating Line chart,	• Write a program to create Line Graph with the help of two given List, • Write a python code for creating a line chart with	08

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		• Creating bar chart • Creating multiple bar chart, • Creating horizontal bar chart, • Creating pie chart, • Chart Anatomy and Saving Graph.	different line colour, • Write a program to create bar chart, • Write a program to create multiple bar chart, horizontal bar chart, • Write a program to create pie chart.	
8.	Establish database connectivity with MySQL	• Introduction to database connectivity in programming, • Frontend and backend interface, • Creating database connectivity application, • MySQL and Other SQL databases, • Installing MySQL Connector/Python, • Establishing a connection With MySQL Server, • Creating database and table, • Showing the database and table, • Retriving and displaying records from table, • Deleting data from the table, • Updating data of the table.	• Demonstrate to installing MySQL connector in Python, • Write Python code to connect MySQL database, • Write Python code to create database in MySQL and display all database name, • Write a python code to create table in database and show the created table, • Write a python code to insert data in table, • Write a python code to display data from table using select command, • Write a python code to delete data from table using delete command, • Write a python code to delete data from table using delete command.	08
			Total Duration in Hours	**60**

Unit 3: Software Engineering				
Sn	**Learning Outcome**	**Theory (15 Hours)**	**Practical (25 Hours)**	**40**
1.	Describe the concepts of software engineering	• Software engineering – concept and definition, • Need and importance of software engineering, • Software development life cycle (SDLC) phases, • Software development methodologies, • SDLC models – Waterfall model, V-model, Incremental model, Spiral model, Prototyping model, Agile model, • Selection of SDLC models.	• Draw a diagram of phases of software life cycle • Prepare the sample software requirement specification document of a given case study.	10
2.	Describe the software development process	• Detail look at the phase of software development life cycle • Requirement analysis, • System analaysis,	• Prepare the sample test use cases for a given case study.	10

		• Sytem Design, • System Development, • System Testing, • System Impementation, • System Testing, • System Maintenance		
3.	Implement minor software project using python	• Minor projects such as financial system, college management system, library management system to be implemented by using Python.	• Develop minor project based on SRS for a given case study using python. • Document the given project and prepare the project report	20
			Total Duration in Hours	**40**

Unit 4: Emerging Trends and Social Impact				
Sn	**Learning Outcome**	**Theory (10 Hours)**	**Practical (10 Hours)**	**20**
1.	Describe Emerging Trends and new Technologies	• New Technology Trends and Emerging Technologies, • Artificial Intelligence (AI), • Machine Learning, • Computer Vision, • Expert Systems, • Natural Language Processing, • Generative-AI and ChatGpt, • Immersive Experiences – AR, VR, • Internet of Things (IoT), • Big Data, • Data Analytics, • Cloud Computing, • Block Chain, • Virtual Lab,	• List the various commercial platform available for cloud services, • Demonstrate to use of cloud services for storing of data on commercial platform, • Demonstrate to use virtual lab from the various websites,	10
2.	Describe the Societal Impact of Technology	• Digital footprints, • Digital society and netizen - Net Etiquettes, Communication Etiquettes, • Social Media Etiquettes, • Data protection, • Intellectual Property Right (IPR) – Copyright, Patent, Trademark, • Violation of IPR – Plagiarism, Copyright Infringement, Trademark Infringement, • Public Access and Open Source Software, • Cyber Security, • Cyber Crime, • IT Act of India 2000 and IT Amendment Act 2008.	• Demonstrate to practice Net Etiquettes, Communication Etiquettes, and Social Media Etiquettes, • Illustrate the data protection, • Practice IPR and follow the copyrigh rules to use the material from internet, • List and practice to use open source software, • Create awareness about cyber security and cyber crimes, • Practice the IT act of India while internet searching.	10
			Total Duration in Hours	**20**

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:

1. Computer System, parts and peripherals.
2. Specifications of various parts of computer system.
3. Types of computers.
4. Types of printers.
5. Types of scanners.
6. Storage devices and storage capacity of various storage devices.
7. Comparison of various parts based on cost.
8. Software Development Process – Software Requirement Specifications, Analysis, Designing, Coding, Debugging, Testing, Implementation and Maintenance.
9. Programming languages and RDBMS,
10. Software Testing Tools and equipment required.
11. Software Development Work environment,
12. Any other relevant information

7. LIST OF EQUIPMENT AND MATERIALS

The list given below is suggestive and an exhaustive list should be prepared by the vocational teacher. 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.

Classroom Aids	Equipment	Software
• Whiteboard and Markers • Chart paper and sketch pens • LCD Projector and Laptop for presentations	• PCs/Laptops • Internet with Wi-Fi (Min 2 Mbps Dedicated)	• Operating System – Windows and Linux, • Python IDLE, RDBMS MySQL • Ms Office or LibreOffice

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:

Qualification	Minimum Competencies	Age Limit
Essential : Bachelor of Engineering / Technology in Computer Science / Information Technology **OR** Master of Computer Application (MCA) **OR** Master of Science (Computer Science/IT) **OR** NIELIT "B" Level Certificate.	The candidate should have a minimum of 1 year of work experience in the same job role. S/He should be able to communicate in English and local language. S/He should have knowledge of equipment, tools, material, Safety, Health&Hygiene.	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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विद्ययाऽमृतमश्नुते

एन सी ई आर टी
NCERT

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(A constituent unit of National Council of Educational Research and Training, under Ministry of Education, Government of India)