Computer Science

Grade 9

Ministry of Education, Science and Technology
Curriculum Development Centre
Sanothimi, Bhaktapur

Computer Science
Grade 9

Credit Hour: 4 **Working Hours:128**

1.Introduction

This curriculum in computer science is a fundamental course for Grade 9-10. It aims to cultivate students' basic knowledge and skills on digital literacy, critical thinking and problem-solving, preparing them for future technological opportunities and challenges. Besides, the curriculum is intended to develop students' a foundational competency in the field of information and communication technology (ICT). Thus, the curriculum offers an exciting journey of exploration, establishing strong fundamental contents in computer science and information technology, and providing opportunities for gaining valuable technological insights. This curriculum is developed based on the National Curriculum Framework 2076.

This curriculum covers the essential content intended to develop fundamental knowledge, skill and attitude on computer science among students. The major content areas of this curriculum are computer system, computer network and communication, artificial intelligence (AI) and contemporary technology, digital citizenship and cyber security, internet and social media, web technology, multimedia, number system, database management system, block programming, programming concept (Python), and programming in Python. These contents are equally beneficial in bridging the contents for secondary level for Grade 11 and 12.

This curriculum has been structured in such a way that it includes competencies, learning outcomes, scope of sequence, learning facilitation process and student assessment. Student evaluation will be carried out by internal evaluation weighing 50 percentage and external evaluation 50 percentage. The curriculum is of 4 credit hour having 128 annual working hours. The overall assessment system is based on the provisions of the approved letter grading system.

2. Level wise competencies

On completion of the Grade 9 and 10, the students are expected to demonstrate the following competencies:

a. Explore knowledge about computer hardware and software components that are used in day-to-day life.
b. Develop skills for interactive and visually engaging block programming on block-based coding platforms.
c. Develop skills for designing and creating web pages using HTML and CSS, adhering to web standards and best practices.
d. Apply safe and secure online behaviors to surfing web systems and conceptualize security issues computer system.
e. Explore skills in simple problem-solving programmes to understand variables, data types, and control structures.
f. Explore knowledge about network protocols, standards, types, and components that make up computer networking.
g. Demonstrate SQL queries to create, manipulate, retrieve, and manage data within a database.
h. Develop programming code using a market-leading programming language to solve a variety of real-life problems.
i. Utilise libraries and packages for tasks like data visualisation, file handling, and developing creative projects in Python programmes.
j. Develop the skills for comprehensive understanding of contemporary technology trends, including artificial intelligence (AI) and their real-world applications.

2. Grade wise learning outcomes

On completion of grade 9, students will achieve the following learning outcomes.

S.N.	Area/Unit	Learning Outcome
1	**Computer System**	1.1 Describe the computer system and its components with a diagram. 1.2 Explore the application area of a computer system. 1.3 Demonstrate the major input devices of a computer system. 1.4 Explain the function and components of a computer system. 1.5 Describe the basic concept of the mother board and its bus structure. 1.6 Explain the concept of primary and secondary memory and its types and functions. 1.7 Explain the common storage devices used in computer systems and their comparison. 1.8 Demonstrate the major output devices: monitor, printer, and speaker. 1.9 Explain the peripheral devices and demonstrate the different ports in a computer system. 1.10 Define computer software and explain its types. 1.11 Describe the open and proprietary software concepts. 1.12 Compare the features of system software and application software. 1.13 Define the mobile software and web applications.
2	**Number System**	2.1 Discuss the number system and its application. 2.2 Calculate the binary number system 2.3 Demonstrate the conversion of the number system between binary, octal, and hexadecimal.

3	**Block Programming**	3.1 Describe concept of block programming and its purpose. 3.2 Demonstrate online or offline-based block programming and tools, their features, interfaces, and blocks. 3.3 Construct simple applications using block-based programming languages and components of the MIT Scratch programming tools. 3.4 Describe the concept of a micro bit and its applications. 3.5 Define the concepts of Arduino and UNO.

4	**Web Technology**	4.1 Describe the concept of web technology. 4.2 Define the web development life cycle. 4.3 Explain the concept of user interface (UI) and user experience (UX) in web design. 4.4 Explain HTML and its tags. 4.5 Demonstrate text formatting, an anchor, a list, a table, and an image tag on a web page. 4.6 Apply the form and div tags to the web page. 4.7 Describe CSS and its application. 4.8 Apply inline, internal, and external basic CSS to the web page.
5	**Internet and social media**	5.1 Describe concept of WWW, web browser, search engine and URL 5.2 Explain concept of remote login 5.3 Describe email and its uses 5.4 Describe the use of social media in different purpose in safety way 5.5 Demonstrate video online meeting using online virtual tools 5.6 Explain a blog and its features

6	**Cyber Security and Digital Citizenship**	6.1 Describe the concept of cyber security and cybercrime. 6.2 Explore the prevention methods for cybercrime. 6.3 Describe the safe browsing techniques. 6.4 Define the concept of a digital citizen. 6.5 List good netiquette and online behaviours. 6.6 Clarify the concept of digital footprints, privacy, and data security issues in online
7	**Programming Concept (python)**	7.1 Define the concept of programming language. 7.2 Explain the compiler and interpreter. 7.3 Draw a basic flow chart and algorithm to understand the programming logic. 7.4 Explain the basic structure of a Python programme with data types and variables. 7.5 Describe the type of casting concept.
		7.6 Demonstrate the use of operators in Python, including arithmetic, relational, logical, and assignment operators. 7.7 Demonstrate the conditional statement in Python. 7.8 Demonstrate iteration on Python 7.9 Apply list and dictionary in programming. 7.10 Demonstrate string, numeric and mathematical functions in python.

3. Scope and sequence of contents

S.N.	Content area	Elaboration of contents	Working Hour (Theory (T) + Practical (P))
1	**Computer System**	1.1 Introduction to Computer Systems: 1.1.1 Definition and features of computer system 1.1.2 Application areas of computer systems. 1.1.3 Functions of a computer system: Input, Process, Output, Storage (IPOS) with Basic Block Diagram. 1.2 Input Devices: Overview of input devices: Mouse, Keyboard, Joystick, Microphone, Scanner, Webcam, Touchscreen, Touchpad. 1.3 Central Processing Unit (CPU)	**15+6**

		1.3.1 Function of the CPU 1.3.2 Components of the CPU: Control Unit, Arithmetic and Logic Unit, and Memory Unit. 1.4 Motherboard and Data Bus 1.4.1 Explanation of the motherboard's role in connecting components. 1.4.2 Understanding the data bus and its importance in data transfer. 1.5 Memory (Primary and Secondary) 1.5.1 Definition and function of memory 1.5.2 Units of memory measurement 1.5.3 Types of memory: primary and secondary memory and their comparison. 1.5.4 Example of primary memory: RAM, ROM, Cache, Register. 1.5.5 Example of secondary memory (Storage devices): Hard disk drive (HDD), Solid State Drive (SDD), Optical Discs (CD/DVD), Flash Memory 1.5.6 Function and characteristics of each type of memory. 1.6 Output Devices 1.6.1 Overview of output devices: 1.6.2 Display unit: LED and LCD Monitor, 1.6.3 Printer: Laser, Ink-jet, Dot-matrix and 3D Printer, 1.6.4 Overview of Ports: USB/Type C, HDMI, VGA, Ethernet, Audio port. 1.7 Computer Software 1.7.1 Concept and its types 1.7.2 Open sources and proprietary software 1.7.3 Compare features of System and Application software 1.7.4 Introduction to Mobile and Web Application **Practical Task** a. Demonstrate computer system and parts b. Demonstrate various input/output and storages devices. c. Use different ports to connect peripheral devices	

2	**Number System**	**Theory** 2.1 Concept of Number System: Definition of Number systems, Application of Number system conversion 2.2 Binary Calculation: Addition, Subtraction 2.3 Number Conversion 2.3.1 Decimal to Binary, Octal, Hexadecimal. 2.3.2 Binary, Octal, Hexadecimal to Decimal 2.3.3 Binary to Hexadecimal and vice versa **Practical Task** a. Demonstrate Calculation based on various numbers system mechanisms using suitable conversion tools (e.g. online tool or mobile app).	**6 + 1**
3	**Block Programming**	**Theory** 3.1 Concept of block programming 3.2 Introduction to Scratch: Features, Interface, Blocks 3.3 Components of Scratch: Control, Events, Motion, Operator, Variables and Sounds 3.4 Concept of Microbit: Micro Controller, Physical computing, sensors, LED Matrix 3.5 Concept of Arduino and UNO (universal Microcontroller coding) **Practical Task** a) Demonstrate the basic program MIT Scratch b) Create simple games using different components of Scratch c) Demonstrate online free coding simulation tools d) Show the working mechanism of Microbit and Arduino using an online simulator. **Project Work** a) Students prepare a simple game or story-telling based project with the guidance of the teacher applies control, events, operator, variables, and sound components of scratch and publish the project on Scratch.	**6 + 14**

4	**Web Technology**	**Theory** 4.1 Concepts of Web Technology 4.2 Concept of UI/UX: Concept of Wireframe, Wireframe Design 4.3 HTML: 4.3.1 Introduction to HTML 4.3.2 HTML Tag 4.3.3 Structure of HTML 4.3.4 Text Formatting Tag 4.3.5 Anchor, List, Table, image tag and their properties 4.3.6 Form and Div tag 4.4 CSS 4.4.1 Introduction to CSS 4.4.2 Embed CSS script in HTML 4.4.3 Types of CSS: Inline CSS, Internal CSS and External CSS **Practical Task** a) Develop simple webpage using notepad or similar tools including the features of html tags (basic and text formatting tags), lists, picture embedding, table and hyperlink. b) Demonstrate the use of inline and internal CSS (include it in basic text formatting tags) **Project Work** **a)** Develop your personal web page using suitable tools (e.g. Dreamweaver, Chrome DevTools or similar) , including <list>, <A>, <img>, <table>, <form>, html tags, and internal and inline CSS.	10 + 15

5	**Internet and social media**	**Theory** 5.1 Concept of WWW, Browser, Search engine, URL,	**6 + 6**
		5.2 Concept of remote login (such as Any Desk, team viewer), 5.3 Concept of protocols (HTTP, HTTPS), 5.4 Email and its uses 5.5 Appropriate usage of social media and safely accessing web sites 5.6 Introduction to Video conference tools (Zoom, Google Meet, MS Teams) and 5.7 Concept of blogs and its features **Practical Task** a) Demonstrate the mechanism of searching for different learning materials from the internet. b) Create a profile using social media like Facebook, YouTube, X etc. (if your age allowed) c) Create a virtual meeting using any application such as Zoom, Meet, Teams. d) Create personal web blog using suitable tools (e.g. blogspot or GitHub or similar)	

6	**Cyber Security and Digital Citizenship**	**Theory** 6.1 Concepts of Cybersecurity 6.2 Concept of Cybercrime 6.3 Prevention methods for cyber crime 6.4 Safe web browsing techniques 6.5 Concept of Digital Citizen 6.6 Concept of Netiquette and online behaviors 6.7 Concept of digital footprint and privacy in online **Practical Task** a) Demonstrate the use of antivirus b) Demonstrate the use of firewall (software or hardware) c) Apply safe browser techniques and list out your techniques d) Demonstrate the use and implementation of strong password in an online system or school application.	**6 + 4**

7	**Programming Concept (python)**	**Theory** 7.1 Introduction to programming languages 7.2 Types of programming languages 7.3 Programming tools: flowchart and algorithm 7.4 Introduction to coding, testing, and debugging 7.5 Compiler and interpreter 7.6 Introduction to python programming 7.7 Basic syntaxes 7.8 I/O statements and string formatting 7.9 Data types and variables 7.10 Concept of Type casting 7.11 Operators and expressions: Arithmetic, Relational, Logical, Assignment 7.12 Conditional statement (if, elseif, else) 7.13 Iteration (for and while) 7.14 List and Dictionary 7.15 Use library functions: String Functions (center, upper, lower, Len), Numeric and mathematical (sum, pow, round, abs, sqrt, Int) **Practical Task** 8 Download and install python 9 Setup IDE and customize interface. 10 Demonstrate the use of I/O statements. 11 Demonstrate the concept of constant, variable and data types. 12 Demonstrate the use of various operators. 13 Demonstrate the use of if, if else and elif. 14 Demonstrate the use of for loop 15 Demonstrate the use of while loop 16 Demonstrate the list Demonstrate the directory with relevant example.	**15 + 18**

		17 Demonstrate and use string functions and mathematical functions **Project work** a) Develop a simple real life project using Python programming and libraries such as calculators, mathematical operations, etc.	
Theory 64 hours +Practical 64 hours			

4. Possible teaching learning activities and evaluation process and methods Grade 9

S.N.	Unit/Area	Possible model learning activities (Methods, Techniques, Activities)	Evaluation techniques	Working hours
1	**Computer System**	• Engage students with visuals, animations, and interactive learning resources. • Demonstrate disassembling and reassembling computers to understand hardware components by the teacher. • Explore hardware and software in everyday devices and appliances. • More student engagement activities, tech-related topics, and discussion • Visit or observe a physical and virtual computer laboratory and its applications.	Quizzes and Tests Peer evaluation Presentation Rubrics Reflection Exit slip	**21**

2	**Number System**	• Demonstrate the manual conversion process hands-on. • Visual charts help students learn and convert number systems. • Student engagement and peer evaluation must be applied. • Use online tool conversion calculators for decimal, binary, octal, and hexadecimal numbers.	Quizzes and Tests Peer evaluation Presentation Assessment through google form	**7**
3	**Block Programming**	• Use the MIT Scratch and Jr Scratch from http://scratch.mit.edu/ • Encourage the students to develop any five simple games and share among the group. • Use and view (not coding) other project code and demo such as https://microbit.org/ • Document the game development process and block code to internal and practical evaluation • Student must develop game or story telling visual project using MIT Scratch and presentation in classroom.	Evaluation of develop game and logics Quizzes and tests Presentation Develop project	**20**
4	**Web**	• Visualise the web development life cycle.	Presentation of	**25**
	Technology	• Demonstrate the UI/UX wireframe concept. • Encourage the students to sketch UI/UX with manual or online tools. • Develop and present webpages using HTML tags. Develop and present webpages using CSS. Document the HTML tags and CSS script for internal and practical evaluation.	web pages Quiz and test Rubrics Demonstration Reflection	

5	**Internet and social media**	• • Demonstrate key terminology used in social media. show • the safe browsing of social media practices Conduct the • online meeting among students. Create a blog and post student ideas using tools such as Google Blogger.	Quizzes and Tests Peer evaluation Presentation Rubrics	**12**
6	**Digital Citizenship and Cyber Security**	• Present the cyber security practices and issues with some example and news from local preceptive. • Prepare posters for results of netiquette for students. • Create group work activities to share online safety and security practices in class.	Quizzes and Tests Peer evaluation Presentation mentoring	**10**
7	**Programming Concept (python)**	• Download and install the latest version of the Python program at https://www.python.org/downloads/. • Select and install any Python IDEs and code editors such as IDLE, Jupyter, Sublime Text, PyCharm, Visual Studio Code, or similar tools. • Use Python's interactive shell to demonstrate live coding, allowing students to experiment with code snippets and see immediate results. • Discuss the programming logic development tools and group work to develop a flowchart and algorithm. • Demonstrate each programming concept with syntax and code. • Document each programming code for internal and practical evaluation.	Quizzes and Tests Peer evaluation Presentation, Demo. Rubrics Rating Scale Observation form	**33**

5. Learning Facilitation process and methods

During the delivery process of computer science teaching in class 9 and 10, basically following approaches will be adopted;

- Project-Based Learning (PBL): introducing real-world computer science problems, encouraging students to investigate, plan, design, and complete small projects, providing a structured framework, regular check-ins, and peer reviews
- Implement practical coding labs, starting with simple exercises and gradually increasing complexity. Encourage experimentation, mistakes, and learning through trial and error, with guidance from teachers and problem-solving challenges.
- Collaborative group work involves students working on coding tasks, assigning roles, showcasing project outcomes through presentations, and evaluating individual and group contributions.
- Peer Mentorship: identifying experienced students, pairing them with less experienced ones, conducting code reviews, providing guidance, and promoting regular interactions
- Gamification and Coding Challenges: create coding challenges, contests, and competitions with rewards, incorporating gamification elements like leaderboards, badges, and achievements. Create coding clubs, encourage friendly competition, and provide students with opportunities to showcase their accomplishments.

6. Evaluation

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students, teachers and parents/guardians about how student learning is. Class tests, unit tests, oral question-answer, reflective writing, project work, practical works, home assignment etc, are some ways of formative evaluation.

There will be separate evaluation of theoretical and practical learning. Summative evaluation embraces theoretical examination, practical examination and evaluation of research work or innovative work. **(a) Internal Evaluation**

Internal evaluation covers 50 Percent weightage. Internal evaluation consists of (a) Practical Activities (Practical works and projects works) (35 Percent), (b) Marks from trimester examinations (10 Percent), and (c) Classroom participation (5 Percent). Practical work should be based on list of activities mentioned in this curriculum. Project works should be based on the mentioned lists or created by teachers. Mark distribution for internal evaluation (practical work and project work) will be as follows:

Note:

i. Practical examination will be conducted in the presence of teacher. Evaluation of practical and project work will focus both the product of work and skills competencies of student in using computer.
ii. Project work assessment is the internal assessment of reports and presentation of their project works either individually or group basis. In case of group presentation, every member of the group should submit a short reflection on the presented report in their own language. Records of project works must be attested by head teacher. iii. Two trimester test should be taken in a year. Each trimester test should be conducted in 50 full marks and convert to 10. For annual trimester test, it can be calculated the average of the two-trimester mark.

S.N.		Main activities	Activities in detail	Percent
1		Participation	• Participation in classroom attendance	2
			• Participation in homework, classwork, project works, practical works • Be very curious in learning, have a thorough frequent interaction in discussion, present own creative views and ideas in all activities, complete the entire task oneself	3
2	Practical and Project Work	Practical work	Conduction and presentation of practical work activities	20
			Record keeping of practical work activities	5
		Project work	Conduction and presentation of project work activities	5
			Record keeping of project work activities	5
3		**Trimester Test**		
		Trimester test	Trimester test should be based on grid	10
			Total	**50**

(b) External/Final Evaluation

External/Final evaluation of the students will be based on the written examination. It carries 50 percent of the total weightage. Questions for the external examination will be based on the specification grid developed by Curriculum Development Centre. Examination question paper will be developed using various levels of revised Bloom's taxonomy including remembering level, understanding level, application level and higher ability (analyzing, evaluating, and creating).

Remembering	Understanding	Applying	Higher Ability (analyzing, evaluating, creating)
15%	30%	30%	25%