

**BACHELOR OF INFORMATION AND COMMUNICATION  
TECHNOLOGY EDUCATION (BICTE)  
Curriculum**

# Third Semester



*[Handwritten Signature]*

## List of Course

Course title: Learning Psychology .....	1
Course Title: Web Technology .....	5
Course Title: 21st Century Skills.....	10
Course Title: Computer Architecture and Organization .....	14
Course Title: Data Structures and Algorithms.....	19
Course Title: Probability and Statistics.....	26



**Course title: Learning Psychology**

Course No.: Ed.432

Level: Bachelor.

Semester: Third

**Program: BICTE**

Nature of Course: Theoretical

Credit Hours: 3

Teaching Hours: 48

**1. Course description**

This course is designed to provide students with knowledge and understanding about learning theories and their application in teaching and learning. The course introduces different learning theories – behaviorism, cognitivism and constructivism. In addition, the course helps students to draw educational implications of different learning theories.

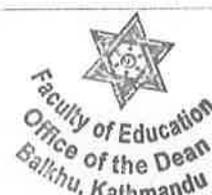
**2. General objectives**

The general objectives of this course are as follows:

- To help students develop understanding of the meaning and characteristics of learning from the lenses of empiricism and rationalism.
- To acquaint students with behaviorism and help them draw its educational implications.
- To develop students' understanding about cognitivism and help them draw its educational implications.
- To acquaint students with constructivism and enable them to draw its educational implications.
- To enable the students to critically discuss different learning theories, as well as to enable them to use these theories in classroom teaching.

**3. Specific Objectives and Contents**

Specific Objectives	Contents
<ul style="list-style-type: none"> <li>• Define the meaning of learning and discuss their characteristics.</li> <li>• Discuss the philosophical orientation of learning theories.</li> <li>• Define empiricism and discuss its link with behaviorism.</li> <li>• Discuss the characteristics of empiricism and behaviorism.</li> <li>• Discuss rationalism and link it with cognitivism.</li> </ul>	<b>Unit 1: Learning Psychology (5)</b> 1.1. Meaning, definition and characteristics of learning 1.2. Philosophical foundations of Learning Theories 1.2.1. Empiricism and behaviorism 1.2.2. Rationalism and cognitivism
<ul style="list-style-type: none"> <li>• Discuss the concept of behavioristic theories of learning.</li> <li>• Explain the Pavlovian conditioning and discuss its experiment on dog.</li> <li>• Describe the characteristics of Pavlovian</li> </ul>	<b>Unit 2: Behavioristic Theories (20)</b> <b>2.1 Introduction to Classical Conditioning (Pavlovian conditioning).</b>



<p>conditioning.</p> <ul style="list-style-type: none"> <li>• Draw the educational implications of Pavlovian conditioning.</li> <li>• Explain the Skinnerian conditioning and discuss its experiment on rat.</li> <li>• Define shaping and discuss the principle of shaping.</li> <li>• Mention the educational implications of operant conditioning.</li> <li>• Explain the Thorndike's theory of learning and discuss his experiment on cat.</li> <li>• Discuss the primary laws of learning.</li> <li>• Draw the educational implications of Thorndike's connectionism.</li> </ul>	<p>2.1.1 Basic process of conditioning and experiment on dog.</p> <p>2.1.2 Phenomena and characteristics of classical conditioning: extinction, spontaneous recovery, inhibition, and generalization.</p> <p>2.1.3 Educational implications of classical conditioning.</p> <p><b>2.2 Operant Conditioning (Skinnerian Conditioning).</b></p> <p>2.2.1 Basic process of operant conditioning and experiment on rat.</p> <p>2.2.2 Positive and negative reinforcement.</p> <p>2.2.3 Principle of shaping.</p> <p>2.2.4 Educational implications of operant conditioning.</p> <p><b>2.3 Connectionism (Thorndike's Theory of Learning).</b></p> <p>2.3.1 Basic process of conditioning (process of trial and error) and experiment on cat.</p> <p>2.3.2 Primary laws of learning: law of readiness, law of exercise and law of effect.</p> <p>2.3.3 Educational implications.</p> <p>2.4 Applications of integrated approaches to learning</p> <p>2.5 Addressing learning difficulties through different learning approaches.</p>
<ul style="list-style-type: none"> <li>• Define the concept of cognitive learning.</li> <li>• Explain insightful learning.</li> <li>• Discuss the characteristics of insightful learning.</li> <li>• Discuss the educational implications of insightful learning.</li> <li>• Explain the information processing theory.</li> <li>• Draw the educational implications of informational processing theory.</li> </ul>	<p><b>Unit 3: Cognitive Theories (15)</b></p> <p><b>3.1 Kohler's Insightful Learning</b></p> <p>3.1.1 Meaning and characteristics</p> <p>3.1.2 Experiment on chimpanzee</p> <p>3.1.3 Educational implications of Kohler's learning theory</p> <p><b>3.2 Information Processing Theory.</b></p> <p>3.2.1 Basic elements: Sensory register, short-term memory/store, long-term memory/store</p> <p>3.2.2 Educational implications of information processing theory.</p>

प्राथमिक पाठ्यक्रम कार्यालय  
कीर्तिपुर

Faculty of Education  
Office of the Dean  
Balkhu, Kathmandu

<ul style="list-style-type: none"> <li>• Conceptualize the meaning constructivism.</li> <li>• Explain the basic principles of individual constructivism.</li> <li>• Discuss the knowledge construction process of individual constructivism.</li> <li>• Explain the basic principles of social constructivism.</li> <li>• Discuss the knowledge construction process of social constructivism.</li> <li>• Draw the educational implications of social constructivism.</li> <li>• Compare and contrast between individual constructivism and social constructivism.</li> </ul>	<p><b>Unit 4: Constructivism (8)</b></p> <p>4.1 Individual constructivism (Piagetian constructivism)</p> <p>4.1.1 Basic principle and knowledge construction: scheme, adaptation-assimilation and accommodation, equilibrium.</p> <p>4.1.2 Classroom implications.</p> <p>4.2 Social constructivism (Vygotskian constructivism).</p> <p>5.2.1 Basic principle and knowledge construction: inter-psychological process and intra-psychological process; MKO, ZPD and scaffolding.</p> <p>5.2.2 Classroom implications.</p>
---	---

Note: The figures in the parentheses indicate approximate teaching hours for respective units.

## 5 Instructional Techniques

The instructional techniques for this course are divided into two groups. The first group consists of general instructional techniques applicable to most of the units. The second group consists of specific instructional techniques applicable to specific units.

### 5.1 General Instructional Techniques

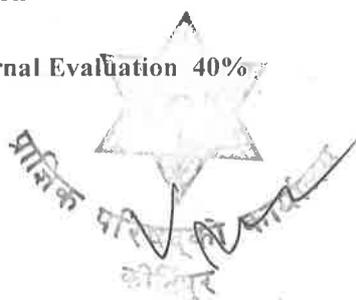
- Introductory presentation on each topic of the unit by the teacher
- Use of lecture, question answer, discussion, brainstorming and buzz sessions for the theoretical contents.

### 5.2 Specific Instructional Techniques

Unit	Suggested specific Instructional Techniques
I	<ul style="list-style-type: none"> <li>• Students are divided into gender disaggregated groups. Each group is assigned to prepare key aspects of empiricism and rationalism and their linkage with behaviorism and cognitivism. The students will present the group work in the class.</li> </ul>
II, III, IV	<ul style="list-style-type: none"> <li>• Students are divided into groups. The groups will visit a nearby school, observe a class and assess which learning theories teachers are using. Each group prepares a report and present in the class.</li> </ul>
V	<ul style="list-style-type: none"> <li>• Students work in pair and discuss what educational implications can be drawn from constructivism for classroom teaching in their subject areas.</li> </ul>

## 6 Evaluation

### 5.1 Internal Evaluation 40%



Faculty of Education  
Office of the Dean  
Balkhu, Kathmandu

Internal evaluation will be conducted by subject teacher based on following activities:

1) Attendance	5
2) Class participation	5
3) First assignment (Group work based on unit I, II, III & IV)	10
4) Second assignment (Pair work based on Unit V)	10
5) Third assignment (Written test: objectives and subjective)	10
Total	40

### 5.2 Final/Semester Evaluation 60%

Examination Division, office of the Dean, Faculty of Education will conduct final examination at the end of semester.

Objective type question (Multiple choice 10 x 1 points)	10
Short answer questions (6 questions with 2 OR x 5 points)	30
Long answer questions (2 questions with 1 OR x 10 points)	20
Total	60

### Recommended Books

Hergenhahn, B.R. & Olson, M. H. (1997). *An introduction to theories of learning*. NJ: Prentice Hall.  
(Unit: I, II, III, IV & V)

Hilgard, B.R. & Bower, G. H. (1975). *Theories of learning*. New Delhi: Prentice Hall. (Unit: I, II, III & IV)

Klein, S.B. (1996). *Learning: Principle and application*. NY: McGraw Hill, Inc. (Unit: I, II, III & IV)

### Reference Books

Chauhan, S. S. (2002). *Advanced educational psychology*. Vikas Publishing House Pvt. Ltd.

Dandekar, W.N. (2002). *Psychological foundation of education*. Macmillan India Limited.

Hill, W.F. (1975). *Learning: A Survey of psychological interpretation*. Great Britain: Lowe & Brydone.

Morgan C. T., King R..R., Weisz, J. R. & Schopler, J. (2004). *Introduction to psychology*. New Delhi: Tata McGraw Hill.

Woolfolk, A. (2004). *Educational psychology*. India: Pearson Publication.

प्राथमिक पाठ्यक्रम कार्यालय  
काठमाडौं

Faculty of Education  
Office of the Dean  
Balkhu, Kathmandu

**Course Title: Web Technology**

Course No.: ICT. Ed. 437

Level: Bachelor

Semester: Third

**Program: BICTE**

Nature of course: Theoretical + Practical

Credit Hour: 3 hours (2T+1P)

Teaching Hour: 80hours (32+48)

**1. Course Description**

The aim of the course is to help students gain knowledge in the basic concepts of web development and build skills to develop web based application using the web tools, scripting and server side language. The goal of course is to provide application developers easy and complete understanding design of web page and integrated with MySQL and PHP which are most popular open source technologies.

**2. General Objectives**

After the completion of this course, the students should be able to:-

- To gain an understanding of the theories and concepts underlying web development
- To gain the skill of HTML structures and functionality.
- To develop the web based application with client side control mechanism
- To build skill to mapping of web design structure to coding using CSS
- To develop web application with server site scripting language.

**3. Course Outlines:**

Specific Objectives	Contents	
<ul style="list-style-type: none"> <li>• Identify and explain different categories of HTML elements</li> <li>• Working with HTML tag for Text, List, Link, Table, Form and multimedia contents</li> </ul>	<b>Unit 1: Introduction to HTML</b> 1.1 Getting Started with a Simple Web Page 1.2 Block and Inline Elements 1.3 Presentation and Phrase Elements 1.4 Empty and Non-empty Elements 1.5 HTML character entities 1.6 HTML List, Table, Links (Internal and External) 1.7 Multimedia Contents (Image, Audio, Video and YouTube Player) 1.8 Form Elements (text, password, file, radio, checkbox, textarea, hidden, select option, button, date, email)	12
<ul style="list-style-type: none"> <li>• Identify and explain different CSS writing styles</li> <li>• Make use of CSS selectors to narrow down the element selection</li> <li>• Apply the CSS properties to design different HTML elements</li> <li>• Apply CSS properties to create simple page</li> </ul>	<b>Unit 2: Cascading Style Sheet</b> 2.1 How CSS fit with HTML page? 2.2 Inline, Internal and External CSS 2.3 CSS Selectors 2.4 CSS Properties for text, list, table, background, link formatting 2.5 Pseudo classes: before, after, first-line, first-letter, hover, focus, active 2.6 Custom list numbering using content property 2.7 CSS Box Model: margin, padding and border 2.8 Creating Layouts with display, position and float property 2.9 Fixed and Liquid design of the page	12



layout		
<ul style="list-style-type: none"> <li>Integrate JavaScript within HTML documents</li> <li>Build interactive site components</li> <li>Make use of different JavaScript objects</li> <li>Demonstrate form validation concept</li> </ul>	<b>Unit 3: Client Side Programming with JavaScript</b> 3.1 How JavaScript fits into a web page? 3.2 JavaScript Basics: Variable, operators, 3.3 Understanding the Document Object Model (DOM) 3.4 Accessing HTML Elements with getElementById(), getElementsByClassName(), getElementsByTagName(), getElementsByTagName() 3.5 JavaScript objects: window, document, array, string, math, date 3.6 Writing scripts to handle events 3.7 Using JavaScript to validate user inputs	15
<ul style="list-style-type: none"> <li>Explain the basic concept of server side scripting</li> <li>Apply php variables, control statements</li> <li>Make use of functions and files</li> <li>Demonstrate to handle array, string, date data</li> </ul>	<b>Unit 4: Server Side Programming with PHP</b> 4.1 How PHP fits into a web page? 4.2 Variables and constants 4.3 Operators 4.4 Working with text and numbers 4.5 Making decisions with control statements (if, switch, loop) 4.6 Working with arrays, strings, datetime and files 4.7 Functions	10
<ul style="list-style-type: none"> <li>Design single and multipage web form to collect, store and disseminate data across web site</li> <li>Apply the storing function to save collected data in CSV file</li> </ul>	<b>Unit 5: Working with Web Form</b> 5.1 Creating simple web form 5.2 Creating multipage web form 5.3 Retrieving form data using post and get method 5.4 Storing form data to CSV file 5.5 Reading CSV file and displaying content as html table	12
<ul style="list-style-type: none"> <li>Identify and explain the use of database</li> <li>Demonstrate the basic database operations: CRUD</li> <li>Make use of session and cookie variables to remember web users</li> <li>Develop Bulk import facility in database for users to save time in data entry</li> <li>Reflecting database record into the CSV file for distribution</li> </ul>	<b>Unit 6: Database and PHP</b> 6.1 Introduction to database 6.2 Create, Retrieve, Update and Delete operation in database 6.3 Connecting to database through PHP mysqli_connect() 6.4 Executing Queries with mysqli_query() 6.5 Fetching data with mysqli_fetch_assoc() and mysqli_fetch_array() 6.6 Creating user registration and login feature 6.7 Remembering users with cookies and session 6.8 Converting database table to CSV file using fputcsv() 6.9 Reading CSV file and reflecting the contents in database	15

प्राथमिक परीक्षा कार्यालय  
कीर्तिपुर

Faculty of Education  
Office of the Dean  
Balkhu, Kathmandu

purpose		
• Assign dynamic web site project	<b>Unit 7: Project Work Assignment</b>	4

#### 4. Instructional Techniques

The instructional techniques for this course are divided into two groups. First group consists of general instructional techniques applicable to most of the units. The second group consists of specific instructional techniques applicable to particular units.

##### 4.1 General Techniques

Reading materials will be provided to students in each unit. Lecture, Discussion, use of multi-media projector, brain storming are used in all units.

##### 4.2 Specific Instructional Techniques

Demonstration is an essential instructional technique for all units in this course during teaching learning process. Specifically, demonstration with practical works will be specific instructional technique in this course. The details of suggested instructional techniques are presented below:

Units	Practical Activities
Unit 1: Introduction to HTML	<ul style="list-style-type: none"> <li>• Selection of HTML editors</li> <li>• Design Web page to describe web skeleton</li> <li>• Demonstrate Text formatting</li> <li>• Create list and insert image</li> <li>• Create hyper link</li> <li>• Create table</li> <li>• Create Form</li> <li>• Create page with multimedia contents</li> </ul>
Unit 2: Cascading Style Sheet	<ul style="list-style-type: none"> <li>• Use inline CSS</li> <li>• Use internal CSS</li> <li>• Use external CSS</li> <li>• Apply CSS selectors to select HTML elements</li> <li>• Design Text formatting</li> <li>• Create Fixed and Liquid page layouts</li> </ul>
Unit 3: Client Side Programming with JavaScript	<ul style="list-style-type: none"> <li>• Demonstrate data types and variables</li> <li>• Use function to accept the information</li> <li>• Demonstrate control structure</li> <li>• Apply JavaScript objects: array, string, date, window, document</li> <li>• Demonstrate events handling</li> <li>• Validation of form data</li> </ul>
Unit 4: Server Side Programming with PHP	<ul style="list-style-type: none"> <li>• Use PHP variables and constants</li> <li>• Create decision making programs using control statements</li> <li>• Demonstrate use of array functions, string functions, date functions and file handling functions</li> </ul>
Unit 5: Working with Web Form	<ul style="list-style-type: none"> <li>• Design and develop web forms to collect user data</li> <li>• Store the collected data in CSV file</li> <li>• Read CSV file and display data</li> </ul>

प्रासिक  
कोलिपुर

Faculty of Education  
Office of the Dean  
Balkhu, Kathmandu

Unit 6: Database and PHP	<ul style="list-style-type: none"> <li>• Create a database connection</li> <li>• Insert, update, delete and retrieve data through PHP</li> <li>• Use session and cookie variable to memorize visitors</li> <li>• R/W CSV file from/to reflect database</li> </ul>
Unit 7: Project Work Assignment	<ul style="list-style-type: none"> <li>• Prepare and Involve students to design and develop web application using HTML, CSS, JavaScript, PHP and database.</li> </ul>

### 5. Evaluation

Evaluation of students' performance is divided into parts: Internal assessment (theory and practical and internal external examinations (theory and practical). The distribution of points is given below:

Internal Assessment Theory	Internal Assessment Practical	Semester Examination (Theoretical exam)	External Practical Exam/Viva	Total Points
25 Points	15 Points	40 Points	20 Points	100 Points

*Note: Students must pass separately in internal assessment, external practical exam and semester examination.*

#### 5.1 Internal Assessment (25 Points) of Theoretical Part

Internal assessment will be conducted by subject teacher based on following criteria:

Attendance and learning Activities	5 points
First assignment (Written assignment)	5 points
Second assignment (Project work with presentation)	10 points
Third assignment/written examination	5 point
<b>Total</b>	<b>25 points</b>

#### 5.2 Internal Assessment (15 Points) of practical part

Internal practical assessment will be conducted by subject teacher based on following criteria:

Attendance and learning Activities	5 points
Practical work/project work/lab work	10 points
<b>Total</b>	<b>15 points</b>

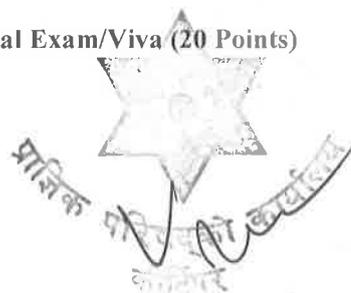
#### 5.3 Semester Final Examination (40 Points) theoretical part

Examination Division, Dean office will conduct final examination at the end of semester.

Objective question (Multiple choice questions 10 x 1 point)	10 Points
Subjective questions (6 questions x 5 marks with 'OR' two questions)	30 Points

<b>Total</b>	<b>40 points</b>
--------------	------------------

#### 5.4 Practical Exam/Viva (20 Points)



Faculty of Education  
Office of the Dean  
Balkhu, Kathmandu

Examination Division, Office of the Dean will appoint an external examiner (ICT teachers working another campus) for conducting practical examination

Items	Points
Evaluation of Record Book	4
Project work/practical work presentation/skill test	10
Viva	6
Total	20

**6. Recommended books and References materials (including relevant published articles in national and international journals)**

**Recommended Books:**

Kyrnin, J. & Meloni, J.C. (2019). *Sams teach yourself HTML, CSS and JavaScript All in One* (3<sup>rd</sup> Ed.). Pearson.

Nixon, R. (2021). *Learning PHP, MySQL & JavaScript: A Step-by-Step Guide to Creating Dynamic Websites* (6<sup>th</sup> Ed.). O' Really Media.

Sklar, D. (2004). *Learning PHP 5* (1<sup>st</sup> Ed.) O' Really Media.



**Course Title: 21st Century Skills**

Course No.: ICT. Ed. 438

Level: Bachelor.

Semester: Third

**Program: BICTE**

Nature of course: Theoretical

Credit Hour: 3 hours

Teaching Hour: 48 hours

**5. Course Description**

The aim of the course is to help students on 21st Century skills that today's students need to succeed in their careers during the Information Age. After the learn and practices of Critical thinking, Creativity, Collaboration, Communication, Media literacy, Flexibility, Leadership, cross-culture adaptation skills, the student will be able to develop and deepen their professional and general competences, to use innovative teaching tools and techniques as well as facilitate classroom.

**6. General Objectives**

After the completion of this course, the students should be able to:-

- To explore the different dimension of 21<sup>st</sup> century skills and practices.
- To able to demonstrate critical thinking and problem solving skill toward the new creation in classroom.
- To able establish the collaboration and communication teaching learning environment.
- To build skill to e-leadership and self-directed learn abilities.
- To explore the cross-culture practices on 21<sup>st</sup> CS and ready to cope up with learning environment.

**7. Course Outlines:**

Specific Objectives	Contents	
<ul style="list-style-type: none"> <li>• Describe the concept of 21<sup>st</sup> CS skills.</li> <li>• Explain the 21<sup>st</sup> CS component of 4C, IMT and FLIPS.</li> <li>• Define the ATCs 21 CS Skills.</li> </ul>	<b>Unit I: Introduction to 21st CS</b> 1.9 Definition of 21st CS 1.10 Components of 21st CS: 4C, IMT, FLIPS 1.11 National Curriculum framework and 21st CS 1.12 ATC21s 21st Century Skills 1.13 Broad Outcomes of 21 <sup>st</sup> Century Skills	<b>8</b>
<ul style="list-style-type: none"> <li>• Explore the different levels arguments.</li> <li>• Apply the rational discussion into critical thinking process.</li> <li>• Demonstrate a critical thinking activity in classroom.</li> <li>• Explain a creativity and innovation.</li> <li>• Demonstrate the creative and innovative activities in classroom.</li> </ul>	<b>Unit II: Critical Thinking, Creativity and Innovation</b> 2.10 Concept of argument 2.11 Example of good vs bad argument 2.12 Rational discussion and reply rationally to an argument 2.13 Deductive arguments vs non-deductive arguments 2.14 Critical thinking activities in classroom 2.15 Concept of innovation and creativity 2.16 Creativity, innovation and learning 2.17 Classroom Activities of creativities and innovation 2.18 Classroom Activities on creativity and innovation	<b>12</b>



<ul style="list-style-type: none"> <li>• Explain basic component of communication.</li> <li>• Define the types of communication.</li> <li>• Explain the different mode of collaboration.</li> <li>• Explain the media literacy for learner</li> <li>• Demonstrate the application for create, publish, share learning materials</li> </ul>	<b>Unit III: Communication, collaboration and media literacy</b> 7.1 Component of Communication 7.2 Types of communication media 7.3 Concept of collaboration 7.4 Social media and collaboration practices 7.5 Classroom collaboration 7.6 Concept of media literacy for learner 7.7 Digital citizen and netiquettes 7.8 Application of create, publish, share audio, video materials. 7.9 Classroom activities on publishing students portfolios in online	12
<ul style="list-style-type: none"> <li>• Define the 21<sup>st</sup> Century e-Leadership.</li> <li>• Describe the flexibility and adaptability in learning environment.</li> <li>• Explain the self-direct learner characteristics</li> </ul>	<b>Unit IV: e-Leadership and Responsibility</b> 4.8 Concept of e-leaderships in education 4.9 Characteristics of 21 <sup>st</sup> Century leadership 4.10 Learning flexibility and adaptability 4.11 Self-directed leader 4.12 Self-director learning classroom activities 4.13 Classroom activities on 21 <sup>st</sup> Century leadership	6
<ul style="list-style-type: none"> <li>• Define the social and cross-culture learning environment.</li> <li>• Explore the ethical issues in cross-culture learning environment.</li> </ul>	<b>Unit V: Social and Cross-Cultural Interaction</b> 5.1 Concept of digital culture and global villages 5.2 Ethical issues of cross culture interaction 5.3 Privacy and freedom of expression in digital world 5.4 Cultural difference and Privacy 5.5 Classroom Activities on ethical issues, privacy and freedom of expression on online behaviours.	6
<ul style="list-style-type: none"> <li>• Analyze the practices of 21<sup>st</sup> CS skills in education system.</li> </ul>	<b>Unit VI: CASE Study on critical thinking, creativity and innovation and collaboration practices in classroom using digital technology.</b>	4

## 7 Instructional Techniques

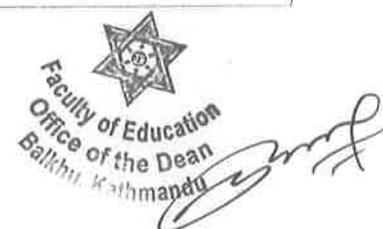
The instructional techniques for this course are divided into two groups. The first group consists of general instructional techniques applicable to most of the units. The second group consists of specific instructional techniques applicable to specific units.

### 7.1 General Instructional Techniques

- Introductory presentation on each topic of the unit by the teacher
- Use of lecture, question answer, discussion, brainstorming and buzz sessions for the theoretical contents.

### 7.2 Specific Instructional Techniques

Unit	Suggested specific Instructional Techniques
I	<ul style="list-style-type: none"> <li>• Students are divided into gender disaggregated groups. Each group is assigned to prepare key aspects 4C, IMT, FLIPS 21<sup>st</sup> CS skills. The students will present the</li> </ul>



	group work in the class.
II, III, IV, V	<ul style="list-style-type: none"> <li>Students are divided into groups. The groups will visit a nearby school, observe a class and assess which 21<sup>st</sup> CS Skills teachers are using. Each group prepares a report and present in the class.</li> </ul>
VI	<ul style="list-style-type: none"> <li>Students work in pair and discuss different case study about 21<sup>st</sup> CS and drawn the educational implications from 21<sup>st</sup> CS for classroom teaching in their computer science areas.</li> </ul>

## 8 Evaluation

### 5.2 Internal Evaluation 40%

Internal evaluation will be conducted by subject teacher based on following activities:

6) Attendance	5
7) Class participation	5
8) First assignment (Group work based on unit I, II, III, IV, V)	10
9) Second assignment (Pair work based on Unit VI)	10
10) Third assignment (Written test: objectives and subjective)	10
Total	40

### 5.2 Final/Semester Evaluation 60%

Examination Division, office of the Dean, Faculty of Education will conduct final examination at the end of semester.

Objective type question (Multiple choice 10 x 1pnts)	10
Short answer questions with two OR option (6 questions x 5 points)	30
Long answer questions with one OR option (2 questions x 10 points)	20
Total	60

## 7. Recommended books and References materials (including relevant published articles in national and international journals)

### Recommended books:

21st Century Skills : A Handbook, Central Board of Education, Delhi, 2020

### References materials:

Walter Sinnott Armstrong and Robert Fogelin, Understanding Arguments: An Introduction to Informal Logic. 8th Ed. Wadsworth Cengage Learning.

Bellanca, J. A. (Ed.). (2015). *Deeper learning: Beyond 21st century skills*. Solution Tree Press.



Lamri, J. (2019). *The 21st century skills: How soft skills can make all the difference in the digital era.*



**Course Title: Computer Architecture and Organization****Program: BICTE**

Course No. : ICT. Ed. 439

Nature of course: Theoretical + Practical

Level: Bachelor.

Credit Hour: 3 hours (2T+1P)

Semester: Third

Teaching Hour: 64 hours (32+32)

**1. Course Description**

This course is an introduction to Computer Architecture and its Organization. It covers topics in physical design of the computer (i.e. computer organization). This course discusses the basic structure of a digital computer and deals with the detail study of data representation in computer system, Register transfer language and microoperations, and organization of the Control unit, the Arithmetic and Logic unit, the Memory unit and the I/O unit.

**2. General Objectives**

The general objectives of this course are as follows:

- To provide the students with the knowledge of data representation, register transfer language and microoperations
- To provide the organization and designing concept of computer system including processor, computer arithmetic, memory organization and I/O organization.
- To discuss in detail, the operation of the arithmetic unit including the algorithm to add, subtract and multiply signed magnitude data and signed 2's complement data.
- To study the multiprocessors and pipelining.
- To study the different ways of communicating with I/O devices and standard I/O interfaces

**3. Course Outlines:**

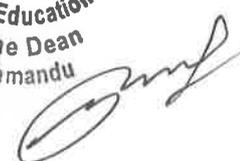
Specific Objectives	Contents	LH
<ul style="list-style-type: none"> <li>• Explain different data types representation</li> <li>• Define the requirement of complement numbers</li> </ul>	<p><b>Unit 1: Data Representation</b></p> <p>1.1 Data Types 1.2 Complements 1.3 Fixed Point Representation 1.4 Floating Point Representation</p> <p><b>Practical Works</b> <b>1.1 Computer Program:</b> Write program to visualize the representation of complement numbers, integers, floating point numbers and character data, overflow detection while adding integers.</p>	4
<ul style="list-style-type: none"> <li>• Explain register transfer language</li> <li>• Apply different microoperations to perform specific task</li> </ul>	<p><b>Unit 2: Register Transfer and Microoperations</b></p> <p>2.1 Register and Register Transfer Language 2.2 Bus and Memory Transfers 2.3 Arithmetic, Logic and Shift Micro-operations 2.4 Arithmetic Logic Shift Unit</p>	8



<ul style="list-style-type: none"> <li>• Explain instruction codes</li> <li>• Describe instruction format and instruction cycle</li> <li>• Design component organization in basic computer.</li> </ul>	<p><b>Unit 3: Basic Computer Organization and Design</b></p> <ol style="list-style-type: none"> <li>4. Instruction Codes</li> <li>5. Computer Registers</li> <li>6. Computer Instructions</li> <li>7. Timing and Control</li> <li>8. Instruction Cycle</li> <li>9. Input Output and Interrupt</li> </ol> <p><u>Practical Works</u></p> <p><b>3.1 Circuit Design:</b> Design of Basic Computer</p> <p><b>3.2 Computer Program:</b> Write program to illustrate fetch, decode and execute instructions.</p>	8
<ul style="list-style-type: none"> <li>• Describe control memory and its usage</li> <li>• Apply address sequencing concept</li> <li>• Identify microinstruction format</li> </ul>	<p><b>Unit 4: Microprogrammed Control</b></p> <ol style="list-style-type: none"> <li>4.1 Control Memory</li> <li>4.2 Address Sequencing</li> <li>4.3 Computer Configuration</li> <li>4.4 Microinstruction Format</li> </ol>	6
<ul style="list-style-type: none"> <li>• Explain different CPU organizations</li> <li>• Describe the requirement of different instruction formats</li> <li>• Understand and apply addressing modes</li> </ul>	<p><b>Unit 5: Central Processing Unit</b></p> <ol style="list-style-type: none"> <li>5.1 CPU Organizations</li> <li>5.2 Instruction Formats</li> <li>5.3 Addressing Modes</li> </ol> <p><u>Practical Works</u></p> <p><b>5.1 Computer Program:</b> Write program to illustrate the use of different addressing modes.</p>	6
<ul style="list-style-type: none"> <li>• Define different types of computers</li> <li>• Explain pipelining</li> <li>• Utilizing different types of pipelining to improve performance</li> <li>• Understand pipeline hazards and suggest their solutions</li> </ul>	<p><b>Unit 6: Pipelining</b></p> <ol style="list-style-type: none"> <li>6.1 Parallel Processing, Flynn's Classification of Computers</li> <li>6.2 Pipelining</li> <li>6.3 Arithmetic Pipeline</li> <li>6.4 Instruction Pipeline</li> <li>6.5 Pipeline Hazards and their Solutions</li> <li>6.6 Array and Vector Processing</li> </ol> <p><u>Practical Works</u></p> <p><b>6.1 Case Study:</b> Available array and vector processors and their application domain</p> <p><b>6.2 Computer Program:</b> write program which simulates instruction pipeline and arithmetic pipeline.</p>	8
<ul style="list-style-type: none"> <li>• Demonstrate the addition and subtraction of signed magnitude data and signed 2's complement data</li> <li>• Trace Multiplication algorithms to multiply signed magnitude and signed 2's complement</li> </ul>	<p><b>Unit 7: Computer Arithmetic</b></p> <ol style="list-style-type: none"> <li>7.1 Addition and Subtraction of Signed Magnitude Data</li> <li>7.2 Addition and Subtraction of Signed 2's Complement Data</li> <li>7.3 Multiplication of Signed Magnitude Data</li> <li>7.4 Multiplication of Signed 2's Complement Data</li> </ol>	8

श्रीशक्ति  
कार्यालय  
काठमाडौं

Faculty of Education  
Office of the Dean  
Balkhu, Kathmandu



data.	<b>Practical Works</b> <b>7.1 Computer Program:</b> Implement all algorithms learned in this chapter in high level language.	
<ul style="list-style-type: none"> <li>Explain I/O interface, async. data transfer, modes of transfer</li> <li>Demonstrate interrupt handling and DMA transfer</li> <li>Identify the need of IOP</li> </ul>	<b>Unit 8: Input and Output Organization</b> 8.1 I/O Interface 8.2 Asynchronous Data Transfer 8.3 Modes of Transfer 8.4 Priority Interrupt 8.5 Direct Memory Access 8.6 I/O Processor  <b>Practical Works</b> <b>8.1 Case Study:</b> USB (universal serial bus)	6
<ul style="list-style-type: none"> <li>Describe the concept of memory hierarchy</li> <li>Explain associative memory organization and cache mapping techniques</li> </ul>	<b>Unit 9: Memory Organization</b> 9.1 Memory Hierarchy 9.2 Main Memory 9.3 Associative Memory 9.4 Cache Memory  <b>Practical Works</b> <b>9.1 Computer Program:</b> write program to simulate associative memory (key value pair mapping) implementation.	5
<ul style="list-style-type: none"> <li>Specify the use of multiprocessor</li> <li>Demonstrate interconnection structures of processors and IPC</li> <li>Identify cache coherence problem with its solution</li> </ul>	<b>Unit 10: Multiprocessors</b> 10.1 Characteristics of Multiprocessor 10.2 Interconnection Structures 10.3 Inter Processor Communication and Synchronization 10.4 Cache Coherence  <b>Practical Works</b> <b>10.1 Computer Program:</b> write program to simulate cache coherence problem and its solution.	5

#### 4. Instructional Techniques

The instructional techniques for this course are divided into two groups. First group consists of general instructional techniques applicable to most of the units. The second group consists of specific instructional techniques applicable to particular units.

##### 4.1 General Techniques

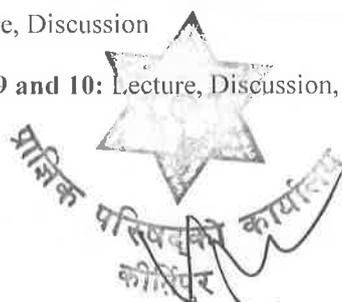
Reading materials will be provided to students in each unit. Lecture, Discussion, use of multi-media projector, brain storming are used in all units.

##### 4.2 Specific Instructional Techniques

Demonstration is an essential instructional technique for all units in this course during teaching learning process. Specifically, demonstration with practical works will be specific instructional technique in this course. The details of suggested instructional techniques are presented below:

**Unit 2 and 4:** Lecture, Discussion

**Unit 1, 3, 5, 6, 7, 8, 9 and 10:** Lecture, Discussion, Practical



Faculty of Education  
Office of the Dean  
Balkhu, Kathmandu

## 5. Evaluation

Evaluation of students' performance is divided into parts: Internal assessment (theory and practical and internal external examinations (theory and practical). The distribution of points is given below:

Internal Assessment Theory	Internal Assessment Practical	Semester Examination (Theoretical exam)	External Practical Exam/Viva	Total Points
25 Points	15 Points	40 Points	20 Points	100 Points

*Note: Students must pass separately in internal assessment, external practical exam and semester examination.*

### 5.1. Internal Assessment (25 Points) of Theoretical Part

Internal assessment will be conducted by subject teacher based on following criteria:

Attendance and learning Activities	5 points
First assignment (Written assignment)	5 points
Second assignment (Project work with presentation)	10 points
Third assignment/written examination	5 point
<b>Total</b>	<b>25 points</b>

### 5.2. Internal Assessment (15 Points) of practical part

Internal practical assessment will be conducted by subject teacher based on following criteria:

Attendance and learning Activities	5 points
Practical work/project work/lab work	10 points
<b>Total</b>	<b>15 points</b>

### 5.3. Semester Final Examination (40 Points) theoretical part

Examination Division, Dean office will conduct final examination at the end of semester.

Objective question (Multiple choice questions 10 x 1 point)	10 Points
Subjective questions (6 questions x 5 marks with 'OR' two questions)	30 Points
<b>Total</b>	<b>40 points</b>

### 5.4. Practical Exam/Viva (20 Points)

Examination Division, Office of the Dean will appoint an external examiner (ICT teachers working another campus) for conducting practical examination

Items	Points
Evaluation of Record Book	4
Project work/practical work presentation/skill test	10
Viva	6
<b>Total</b>	<b>20</b>

## 6. Recommended books and References materials (including relevant published articles in national and international journals)

**Recommended books:**



Faculty of Education  
Office of the Dean  
Baljuu, Kathmandu

1. Mano, M. M. (2003), *Computer System Architecture*, (3<sup>rd</sup> Ed.), Prentice Hall of India.
2. Stalling, W. (2016), *Computer Organization and Architecture: designing for performance* (10<sup>th</sup> Ed.), Pearson Education.
3. Tanenbaum, A.S. (2013), *Structured Computer Organization*, (6<sup>th</sup> Ed.), Pearson Education.



**Course Title: Data Structures and Algorithms** Program: BICTE

Course No. : ICT. Ed. 435

Nature of course: Theoretical + Practical

Level: Bachelor

Credit Hour: 3 hours (2T+1P)

Semester: Third

Teaching Hour: 64 hours (32+32)

### 1. Course Description

The purpose of this course is to provide the students with solid foundations in the basic concepts of data structures and algorithms. The main objective of the course is to teach the students how to select and design data structures and algorithms that are appropriate for problems that they might occur. This course is also about showing the correctness of algorithms and studying their computational complexities. This course offers the students a mixture of theoretical knowledge and practical experience. Programming language C will be used for practical work.

### 2. General Objectives

The general objectives of this course are as follows:

- To introduce data abstraction and data representation in memory
- To describe, design and use elementary data structures such as stack, queue, linked list, tree and graph
- To decompose complex programming problems into manageable sub-problems
- To introduce algorithms and their complexity

### 3. Specific Objectives and Contents

Specific Objectives	Contents	LH
<ul style="list-style-type: none"> <li>• Define Data structure and ADT</li> <li>• Define algorithms and its types and asymptotic notations</li> </ul>	<b>Unit 1: Introduction to Data Structures &amp; Algorithms</b> 1.1 Data type and Abstract data types 1.2 Data structures : linear and non-linear, static and dynamic 1.3 Algorithms 1.3.1 Greedy algorithm 1.3.2 Divide and Conquer 1.3.3 Backtracking 1.3.4 Randomized algorithms 1.4 Analysis of Algorithms 1.4.1 Big O notation and its rule	5
<ul style="list-style-type: none"> <li>• Demonstrate relationship between array and pointer</li> <li>• Implement structure</li> </ul>	<b>Unit 2: Arrays, Pointers and Structures</b> 2.1 Array and Pointer	6

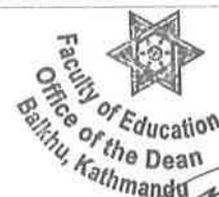
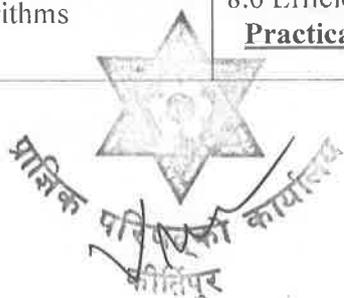


Faculty of Education  
Office of the Dean  
Balkhu, Kathmandu

<p>pointers and self-referential pointer</p> <ul style="list-style-type: none"> <li>Allocate memory dynamically using malloc, calloc, realloc and free functions</li> </ul>	<p>2.2 Structure and Pointer</p> <p>2.2.1 Structure pointer</p> <p>2.2.2 Self-referential pointer</p> <p>2.3 Dynamic Memory Allocation: malloc, calloc, realloc, free</p> <p><b><u>Practical Works</u></b></p> <p>2.1 Write program to illustrate memory allocation dynamically.</p>	
<ul style="list-style-type: none"> <li>Define linked list its type and applications</li> <li>Implement different types of linked list with its operations</li> <li>Make comparison between array list and linked list</li> </ul>	<p><b>Unit 3: Linked Lists</b></p> <p>3.1 Single Linked list: traversing, searching, inserting and deleting in single linked list</p> <p>3.2 Doubly Linked List: traversing, inserting, creating and deleting in doubly linked list</p> <p>3.3 Circular Linked List: traversing, inserting, creating and deleting in circular linked list</p> <p>3.4 Comparison of Array list and Linked list</p> <p><b><u>Practical Works</u></b></p> <p>3.1 Write a program to implement singly, doubly and circular linked list operations</p>	8
<ul style="list-style-type: none"> <li>Define and implement stack and stack operations</li> <li>Convert expressions in to different forms: infix, prefix and postfix</li> <li>Describe the applications of the stack</li> </ul>	<p><b>Unit 4: Stack</b></p> <p>4.1 Introduction</p> <p>4.2 Array Implementation of Stack</p> <p>4.3 Linked List Implementation of Stack</p> <p>4.4 Applications of Stack</p> <p>4.4.1 Conversion from infix to postfix expression</p> <p>4.4.2 Evaluation of postfix expressions</p> <p><b><u>Practical Works</u></b></p> <p>4.1 Write program to create stack with array and linked list implementation</p> <p>4.2 Write program to illustrate expression conversion and expression evaluation</p>	6
<ul style="list-style-type: none"> <li>Define queue and its operations</li> <li>Implement different types of queue</li> </ul>	<p><b>Unit 5: Queue</b></p> <p>5.1 Introduction</p> <p>5.2 Array Implementation of Queue</p> <p>5.3 Linked List Implementation of Queue</p>	6



	<p>5.4 Circular Queue 5.5 Priority Queue. <b><u>Practical Works</u></b></p> <p>5.1 Write a program to implement linear, circular and priority queue with array and linked list</p>	
<ul style="list-style-type: none"> <li>Define recursion.</li> <li>Differentiate between recursion and iteration</li> <li>Implement recursion to solve TOH and Fibonacci series</li> </ul>	<p><b>Unit 6: Recursion</b></p> <p>6.1 Introduction 6.2 Examples of Recursion: factorial, fibonacci sequence, Tower of Hanoi(TOH) 6.3 Applications and Efficiency of recursion <b><u>Practical Works</u></b></p> <p>6.1 Write a program to solve the problem of TOH 6.2 Write a program to print Fibonacci series 6.3 Write a program to calculate factorial</p>	4
<ul style="list-style-type: none"> <li>Define tree and tree operations</li> <li>Create and manipulate Binary tree, BST, AVL tree</li> </ul>	<p><b>Unit 7: Trees</b></p> <p>7.1 Introduction 7.2 Binary Tree : Construction, Traversal (pre-order, in-order, post-order) 7.3 Binary Search Tree: Construction, Traversal 7.4 AVL tree: Construction, Traversal 7.5 Heap: Building a heap <b><u>Practical Works</u></b></p> <p>7.1 Write program to implement binary tree. 7.2 Write program to implement binary search tree 7.3 Write program to implement AVL tree</p>	8
<ul style="list-style-type: none"> <li>Define sorting and its type</li> <li>Demonstrate hashing</li> <li>Illustrate and implement bubble, selection, insertion, merge, quick and heap sort.</li> <li>Implement searching algorithms</li> <li>Identify and compare the efficiency of mentioned sorting algorithms</li> </ul>	<p><b>Unit 8: Searching, Sorting and Hashing</b></p> <p>8.1 Introduction 8.2 Sequential and Binary Search 8.3 Hashing: Hash function (truncation, division method, folding, midsquare) 8.4 Hash collision and resolution techniques 8.5 Sorting Algorithms: Bubble, Selection, Insertion, Merge, Quick and Heap Sort 8.6 Efficiency of Sorting Algorithms <b><u>Practical Works</u></b></p>	15



	<p>8.1 Write program to implement:</p> <p>a) Bubble sort b) Selection sort c) Insertion sort</p> <p>d) Quick sort e) Merge sort f) Heap sort</p> <p>8.2 Write program to implement searching algorithms: binary search and linear search</p> <p>8.3 Write program to implement hash function.</p>	
<ul style="list-style-type: none"> <li>Define graph and graph terminologies</li> <li>Explain and implement graph traversal algorithms</li> <li>Find the shortest path using Dijkstra's Algorithm</li> <li>Define MST and implement kruskal's</li> </ul>	<p><b>Unit 9: Graphs</b></p> <p>9.1 Graph Terminology</p> <p>9.2 Directed and undirected graph</p> <p>9.3 Graph Traversal: BFS and DFS</p> <p>9.4 Minimum Spanning Trees: Kruskal Algorithm</p> <p>9.5 Shortest Path Algorithms: Dijkstra's Algorithm</p> <p><b><u>Practical Works</u></b></p> <p>9.1 Write a program to implement graph traversal algorithms : BFS and DFS</p> <p>9.2 Write program to implement Kruskal algorithm and Dijkstra's algorithm</p>	6

#### 4. Instructional Techniques

The instructional techniques for this course are divided into two groups. First group consists of general instructional techniques applicable to most of the units. The second group consists of specific instructional techniques applicable to particular units.

##### 4.1 General Techniques

Reading materials will be provided to students in each unit. Lecture, Discussion, use of multi-media projector, brain storming, and problem solving methods are used in all units.

##### 4.2 Specific Instructional Techniques

Demonstration is an essential instructional technique for all units in this course during teaching learning process. Specifically, demonstration with practical works will be specific instructional technique in this course. The details of suggested instructional techniques are presented below:

Units	Activities
-------	------------



Faculty of Education  
Office of the Dean  
Ballina, Kathmandu

Unit 1: Introduction to Data Structures & Algorithms	<ul style="list-style-type: none"> <li>• Define and Describe the different types of data structures</li> <li>• State different operations occurring in data structures</li> <li>• Write a program to implement dynamic memory management functions</li> <li>• Explain asymptotic notations and complexity on time and space of algorithm</li> <li>• Monitor of students' work by reaching each student and providing feedback for improvement</li> <li>• Presentation by students followed by peers' comments and teacher's feedback</li> </ul>
Unit 3: List	<ul style="list-style-type: none"> <li>• Demonstrate operations of linked list with algorithms</li> <li>• Lab work in pairs to implement linked list operations</li> <li>• Monitor students' work by reaching each student and providing feedback for improvement</li> <li>• Presentation by students followed by peers' comments and teacher's feedback</li> </ul>
Unit 2, 4: Array, Pointer and Structure, Stacks	<ul style="list-style-type: none"> <li>• Illustrate array, pointer and structure of C language</li> <li>• Illustrate the algorithms of stack operations</li> <li>• Lab works in pair to implement stack operations</li> <li>• Convert expression in other from one form to another making group and individually</li> <li>• Monitoring of students' work by reaching each pair and providing feedback for improvement</li> <li>• Presentation by students followed by peers' comments and teacher's feedback</li> </ul>
Unit 5: Queues	<ul style="list-style-type: none"> <li>• Demonstrate queue and queue operations with algorithms</li> <li>• Lab work in pairs to implement queue operations</li> <li>• Group discussion in advantages and limitations of queues</li> <li>• Monitoring of students' work by reaching each student and providing feedback for improvement</li> <li>• Presentation by students followed by peers' comments and teacher's feedback</li> </ul>
Unit 6, 7: Recursion, Trees	<ul style="list-style-type: none"> <li>• Apply recursive function to calculate factorial, solve TOH problem and generate Fibonacci series</li> <li>• Demonstrate operations and types of tree</li> <li>• Lab work in pairs to implement BST</li> <li>• Trace a working principle of AVL</li> <li>• Assign students to create AVL</li> <li>• Monitor students' work by reaching each student and providing feedback for improvement</li> <li>• Presentation by students followed by peers' comments and teacher's feedback</li> </ul>
Unit 8: Searching, Sorting and Hashing	<ul style="list-style-type: none"> <li>• Demonstrate the working principle of different searching algorithms</li> <li>• Lab work in pair to implement searching algorithms</li> <li>• Implement Hashing</li> <li>• Trace the working principle of different sorting algorithms</li> <li>• Lab work in pair to implement sorting algorithms</li> </ul>



Faculty of Education  
Office of the Dean  
Balju, Kathmandu

	<ul style="list-style-type: none"> <li>Analyze efficiency of sorting algorithms</li> <li>Monitor students' work by reaching each student and providing feedback for improvement</li> <li>Presentation by students followed by peers' comments and teacher's feedback</li> </ul>
Unit 9: Graphs	<ul style="list-style-type: none"> <li>Explain the graph and graph terminology</li> <li>Solve the practical problems of shortest path and spanning tree using different algorithms</li> <li>Assign student to solve graph problems</li> <li>Lab work in pair to implement graph traversing algorithms</li> <li>Monitor students' work by reaching each student and providing feedback for improvement</li> <li>Presentation by students followed by peers' comments and teacher's feedback</li> </ul>

### 5. Evaluation

Evaluation of students' performance is divided into parts: Internal assessment (theory and practical and internal external examinations (theory and practical). The distribution of points is given below:

Internal Assessment Theory	Internal Assessment Practical	Semester Examination (Theoretical exam)	External Practical Exam/Viva	Total Points
25 Points	15 Points	40 Points	20 Points	100 Points

**Note:** Students must pass separately in internal assessment, external practical exam and semester examination.

#### 5.1 Internal Assessment (25 Points) of Theoretical Part

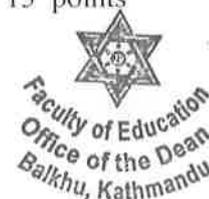
Internal assessment will be conducted by subject teacher based on following criteria:

Attendance and learning Activities	5 points
First assignment (Written assignment)	5 points
Second assignment (Project work with presentation)	10 points
Third assignment/written examination	5 point
<b>Total</b>	<b>25 points</b>

#### 5.2 Internal Assessment (15 Points) of practical part

Internal practical assessment will be conducted by subject teacher based on following criteria:

Attendance and learning Activities	5 points
Practical work/project work/lab work	10 points
<b>Total</b>	<b>15 points</b>



### 5.3 Semester Final Examination (40 Points) theoretical part

Examination Division, Dean office will conduct final examination at the end of semester.

Objective question (Multiple choice questions 10 x 1 point)	10 Points
Subjective questions (6 questions x 5 marks with 'OR' two questions)	30 Points

---

Total	40 points
-------	-----------

---

### 5.4 Practical Exam/Viva (20 Points)

Examination Division, Office of the Dean will appoint an external examiner (ICT teachers working another campus) for conducting practical examination

Items	Points
Evaluation of Record Book	4
Project work/practical work presentation/skill test	10
Viva	6
Total	20

### Recommended Books and References

#### Recommended Books

1. Srivastava, S.K. & Srivastava, D. (2011). *Data structure Through C in Depth*, (2<sup>nd</sup> Ed.), BPB Publication
2. Langsam, Y., Augenstein, M.J. & Tenenbaum, A.M., *Data Structures using C*, Prentice Hall India.



**Course Title: Probability and Statistics**

**Course Title: Math. Ed. 436**

**Level: Bachelor's Degree**

**Nature of Course: Theory**

**Credit Hour: 3**

**Total Period: 48 hour**

### 1. Course Description

This is an integrated course of probability and statistics for students with bachelor's degrees in Information and Communication Technology (BICTE). This course provides a foundation for the students to understand the basic concept of mathematics to be applicable in the field of technology. The main aim of this course is to develop an in-depth understanding of different aspects of probability and statistics. This course covers correlation and regression, probability distributions, sampling distributions, estimation of parameters, and hypothesis testing.

### 2. General Objectives

The general objectives of this course are as follows:

- To impart practical knowledge and skills in deriving properties of correlation and regression and applying them to solve problems.
- To make the students familiar with random variables, and different discrete and continuous probability distributions.
- To make the students able to use sampling distribution and estimation of parameters, and use test of hypothesis in research work.

### 3. Specific Objectives and Contents

Unit	Objectives	Contents
I	<ul style="list-style-type: none"> <li>• Define correlation and describe its types.</li> <li>• Interpret the different values of <math>r</math>.</li> <li>• Compute Pearson's moment correlation and writes its properties</li> </ul>	Unit I: Correlation (4) <ul style="list-style-type: none"> <li>• Types of correlation</li> <li>• Computation of correlation coefficient (<math>r</math>) and its interpretation,</li> <li>• Rank correlation,</li> <li>• Properties of correlation.</li> </ul>
II	<ul style="list-style-type: none"> <li>• Define regression and describe its types</li> <li>• Find the equation of regression and its properties</li> <li>• Write the relation between correlation and regression.</li> </ul>	Unit II: Regression (6) <ul style="list-style-type: none"> <li>• Types of relationship</li> <li>• Estimation of regression equations,</li> <li>• Properties of regression equations</li> <li>• Relationship between correlation and regression.</li> </ul>
III	<ul style="list-style-type: none"> <li>• Explain sample space, events, probability of an event, Axioms</li> </ul>	Unit III: Probability Distribution (9)



	<p>of probability,</p> <ul style="list-style-type: none"> <li>• State and prove Baye's theorem.,</li> <li>• Define discrete random variables, probability function, probability distributions, cumulative distribution, moments, mean, and variance.</li> <li>• State uniform distribution and write its properties</li> <li>• State Binomial distributions and write their properties.</li> <li>• Define a continuous random variable, probability density, cumulative density, mean and variance,</li> <li>• State and prove Chebychev's inequality Describe laws of large numbers</li> </ul>	<ul style="list-style-type: none"> <li>• Basic terms of Probability.</li> <li>• Axioms and theorems of probability</li> <li>• Conditional probability &amp; Baye's theorem.</li> <li>• Discrete random variable, probability function, probability distributions, cumulative distribution, moments, mean, and variance.</li> <li>• Uniform distribution and its properties,</li> <li>• Binomial distributions and their properties.</li> <li>• Continuous random variable, probability density, cumulative density, mean, and variance.</li> <li>• Chebychev's inequality and laws of large numbers.</li> </ul>
IV	<ul style="list-style-type: none"> <li>• State normal distributions and writes its properties.</li> <li>• Calculate the area under the standard normal curves, Z score</li> <li>• Derive the normal approximations to the binomial distribution.</li> </ul>	<p>Unit IV: Normal distributions (4)</p> <ul style="list-style-type: none"> <li>• Measure of Divergence from Normality</li> <li>• Properties: mean and variance,</li> <li>• Area under the standard normal curves</li> <li>• Z score</li> </ul>
V	<ul style="list-style-type: none"> <li>• Define parameters and statistics</li> <li>• Explain sampling distribution of the mean, variance, standard error of statistics, and central limit theorem.</li> <li>• Define point and interval estimation.</li> <li>• State the properties of point estimation.</li> <li>• Compute the confidence interval for mean and variance.</li> </ul>	<p>Unit V: Sampling Distribution and Estimation (8)</p> <ul style="list-style-type: none"> <li>• Parameter and statistics, sampling distribution of mean/variance</li> <li>• Application of the central limit theorem</li> <li>• Estimation: Point estimation, interval estimation,</li> <li>• Confidence interval for mean and variance.</li> </ul>
VI	<ul style="list-style-type: none"> <li>• Define null and alternate hypotheses.</li> <li>• Identify one-tailed, two-tailed test, Type I, and Type II errors.</li> <li>• Set level of significance and calculate critical region.</li> <li>• Identify test statistics and describe sequential steps of</li> </ul>	<p>Unit VI: Test of Hypothesis (17)</p> <ul style="list-style-type: none"> <li>• Basic concepts.</li> <li>• Null/ Alternative hypothesis.</li> <li>• One-tailed / two-tailed tests</li> <li>• Type I / Type II errors</li> <li>• Level of significance, Critical region, and Test statistics</li> </ul>



<p>hypothesis testing.</p> <ul style="list-style-type: none"> <li>• Solve test of hypothesis for the difference between two means of large samples with unknown population variance.</li> <li>• Solve the Difference between two means of small samples with unknown common variance, the significance test of independence</li> </ul>	<ul style="list-style-type: none"> <li>• Steps in hypothesis testing.</li> <li>• Z-test: the difference between two means of large samples with unknown population variance.</li> <li>• T-test: difference between two means of small samples with unknown common variance.</li> <li>• Chi-square test: significance test of independence.</li> </ul>
--	---

#### 4. Specific Instructional Techniques

The specific teaching and learning techniques chapter wise are listed below:

Unit	Activity and Instructional Techniques	Teaching Hours (48)
I	Lecture, discussion in group and question answer	4
II	Lecture, discussion in group and question answer	6
III	Lecture, discussion in group and question answer	9
IV	Lecture, discussion in group and question answer	4
V	Lecture, discussion in group and question answer	8
VI	Lecture, discussion in group and question answer	17

#### 5. Evaluation

5.1 Internal Evaluation 40%

Internal evaluation will be conducted by the subject teacher based on the following aspects:

Attendance	4 marks
Participation in learning activities	6 marks
First assignment	10 marks
Second assignment	10 marks
Third assignment	10 marks
Total	40 marks

5.2 External Evaluation



Faculty of Education  
Office of the Dean  
Balikhu, Kathmandu

The examination section Dean Office, Faculty of Education will conduct the final examination at the end of the first semester. The type of questions and marks allocated for each question will be as follows:

Objective type questions (multiple choice)	10 x 1 mark	=	10 marks
Short answer questions with 2 OR	6 x 5 marks	=	30 marks
<u>Long answer questions</u> with 1 OR	2 x 10 marks	=	20 marks
<u>Total</u>		=	60 marks

### 6 Recommended Books

Freund J. E. (1997): Modern elementary Statistics, New Delhi: Prentice Hall of India

Garrett, H. E. (). *Statistics in psychology and education*. Longmans, NY: Green and Co. Inc.

Hayslett, H. T (1983): *Statistics Made Simple*, Heinemann: London

### 7. References

Mendenhall, W, Scheaffer, R. L. and Wackerly, D. D. (1987): *Mathematical Statistics with Applications*. Boston: PWS Publishers.

Wallpole, R. (1979): *Introduction to Statistics*, Delhi: Macmillan, India

Pandit, R. P. and Bhattarai, L. N. (2016). *Mathematical Statistics*, Kathmandu: Indira Pandit

Pandit Pandit, R. P. and Pahari, S. (2016): *Modern Elementary Mathematics*, Kathmandu: Indira Pandit

