Tribhuvan University

Faculty of Education

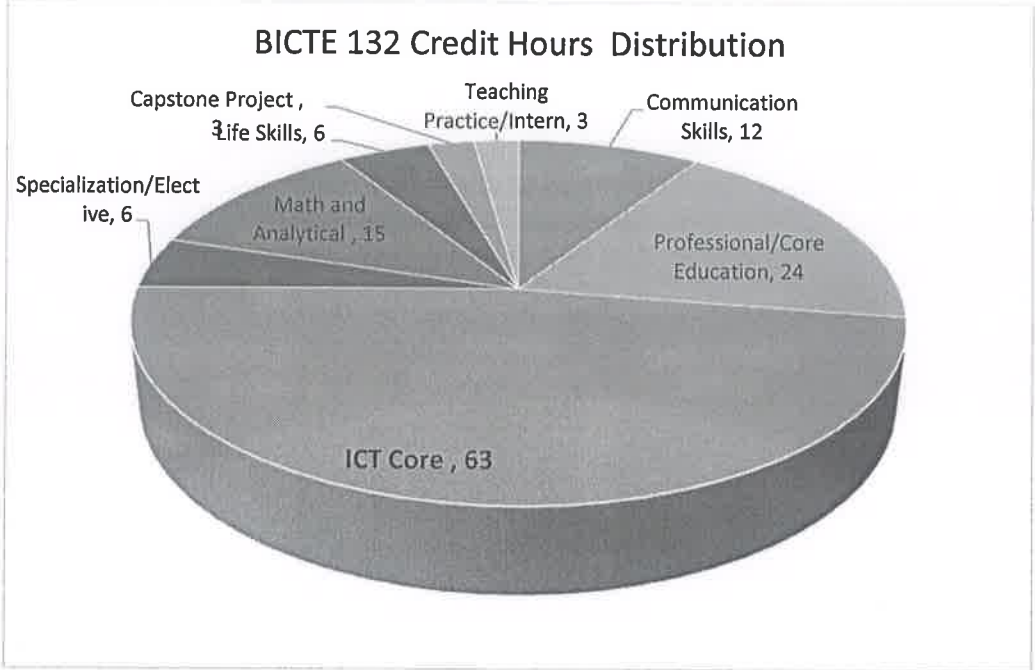
Office of the Dean

BACHELOR of INFORMATION and COMMUNICATION TECHNOLOGY EDUCATION (BICTE)

EIGHT SEMESTER COURSE

Effective form 2021

4 Year 8 Semester
Bachelor of ICT Education (BICTE) Course
Effective from the Administration Batch 2078 BS



S.N.	Course Categories	Semester								Total Course	Total Credit Hours (3 Credit to each)
		1st	2nd	3rd	4th	5th	6th	7th	8th		
1	Communication Skills	2	2	-	-	-	-	-	-	4	12
2	Professional/Core Education	1	1	1	1	1	1	1	1	8	24
3	ICT Core Courses	2	2	3	3	3	4	2	2	21	63
4	Specialization/Elective	-	-	-	-	-	-	1	1	2	6
5	Math and Analytical Course	1	1	1	1	1	-	-	-	5	15
6	Life Skills	-	-	1	1	-	-	-	-	2	6
7	Capstone Project	-	-	-	-	-	-	1	-	1	3
8	Teaching Practice/Intern	-	-	-	-	-	-	-	1	1	3
Total		6	6	6	6	5	5	5	5	44	132

शिक्षाशास्त्र संकाय
जिनको कार्यालय
ललितपुर, काठमाडौं

कीर्तिपुर

BICTE (Eighth Semester)

S. N.	Course Code	Course Title	Credit Hours
1	Ed. 482	Classroom Pedagogy	3
2	ICT. Ed. 481	Teaching Practicum in ICT Education	3
3	ICT. Ed. 484	Artificial Intelligence in Education	3
4	ICT. Ed. 486	System Administration using Linux	3
5	ICT. Ed. 488	Cloud Computing (Elective II)	3
6	ICT. Ed. 489	Big Data and Data Analysis (Elective II)	3

Table of Contents

Course Title: **Classroom Pedagogy**
Course Code: Ed. 482
Level: Bachelor
Semester: Eighth

Program: **BICTE**
Nature of Course: Theory
Credit Hours: 3
Teaching Hours: 48

1. Course Description

This course is designed to equip students with pedagogical methods which can be applied across the school level subjects. It intends to provide students with knowledge and skills of pedagogical methods for making classroom teaching learning child/student centered, interactive and joyful. The instructional approaches stated in this course, viz. teacher centered, learner centered, review and reflection can be smoothly transferred in the classroom of Nepalese schools. It also deals with classroom ecology to improve quality of teaching and learning.

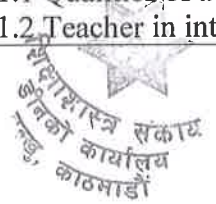
2. General Objectives

The general objectives of the course are as follows:

- To familiarize the students with various concepts of pedagogy.
- To clarify roles of teacher and learners for improving classroom teaching learning.
- To enable the students to prepare various instructional plans.
- To enable the students to use lesson plans for classroom delivery.
- To help the students to conceptualize and use relevant methods: teacher and students centered.
- To enable the students to develop sample lesson plans using variety of teaching strategies.

3. Specific Objectives and Contents

Specific Objectives	Contents
• Define pedagogy. • Explain theories of learning. • Relate theories of learning with classroom practices. • Explain different approaches of teaching methods. • Compare and contrast different approaches of teaching methods. • Exemplify inclusive methods.	**Unit 1: Introduction to Pedagogy (5 Hours)** 1.1 Meaning of pedagogy 1.2 Behaviorist, cognitivist, constructivist theories of learning 1.3 Teacher centered and student centered 1.4 Inclusive methods
• Elaborate and analyze roles of teacher and learners in teaching learning. • Discuss classroom ecology and its importance in quality teaching and learning	**Unit 2: Teacher, Learners and Classroom (7 Hours)** 2.1 Teacher 2.1.1 Qualities of a good teacher 2.1.2 Teacher in interactive classroom



• Explain different forms of class organizations	2.2 Learners 2.2.1 Learning style 2.2.2 Diversity 2.3 Classroom ecology 2.3.1 Concept: physical and non-physical aspects 2.3.2 Seating arrangement 2.3.3 Classroom display 2.3.4 Class organization: Subject, Grade, Multi-grade multi-level (MGML)
• Justify the need of teaching plan and structuring lesson in terms of students' learning. • Describe different types of instructional plans. • Prepare sample of different types of plans. • Prepare a sample of individualized education plan.	**Unit 3: Instructional Planning (4 Hours)** 3.1 Need for plan and lesson structuring: preparatory, delivery and consolidation 3.2 Types of plans – Annual, unit and daily 3.3 Individualized education plan
• Explain when teacher-centered methods are best to use. • Describe various teacher-centered methods. • Prepare sample lesson plan using teacher-centered methods. • Present sample lesson plan in the classroom.	**Unit 4: Teacher Centered Methods (5 Hours)** 4.1 Direct instruction 4.2 Concept teaching 4.3 Presenting and explaining 4.4 Preparation of sample lesson plan
• Explain when student centered methods are best to use. • Elaborate various categories of student centered methods. • Describe various strategies of student centered approaches under different categories of learning and their use. • Prepare sample lesson plan using different strategies of student centered approaches	**Unit 5: Student Centered Methods (20 Hours)** 5.1 Learner engaged learning category 5.1.1 Concept 5.1.2 Strategies: Brainstorming, Think Pair Share, Directed Reading Activity, Prediction from Terms, Direct Listening Thinking Activity, Text Coding, Know Want to Learn Know – KWL, What? So what? Now what?, Verbalized Learning, Learning Stations 5.2 Cooperative learning category 5.2.1 Concept 5.2.2 Strategies: Paired Reading Paired Summarizing, Reciprocal Teaching, Read Summarize Question, Jigsaw, One Stay Others Stray, Mix Freeze Pair, Pens in the

	Middle, Pyramid Learning, Paragraph Expert, Student Teams-Achievement Division (STAD) 5.3 Problem-based Learning category 5.3.1 Concept 5.3.2 Strategies: Identify Define Explore Act Look (IDEAL), Defining Understanding Planning Evaluating (DUPE), I-Search, Socratic Questioning
• Describe importance of review and reflections. • Explain various strategies of review and reflections. • Discuss reflective approaches.	**Unit 6: Review and Reflection (7 Hours)** 6.1 Concept 6.2 Strategies: Question Answer pair, Classify Categorize Organize, Relay, Guess Who?, Two Truths and A Lie, Snowballing, Question ball and Run to the Board 6.3 Reflective approaches

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

4. Instructional Techniques

4.1 General Techniques

- Direct Instruction followed by discussion/sharing/interaction
- Analyze and relate Nepalese school practices with various concepts to improve classroom practices
- Student preparation and sharing of relevant samples/models
- Sharing, review and discussion in the group and whole class
- Home assignment and self study.

4.2 Specific Instructional Techniques

Teachers are required to use different instructional strategies while teaching the contents of this course from unit 1 to 4. Teachers can adapt and use the following strategies contextually.

Unit	Activity and Instructional Techniques
Unit 1	• Use appropriate strategies such as direct instruction, presenting and explaining, DRA, KWL, PRPS, Reciprocal Teaching as stated in unit five.
Unit 2	• Use direct instruction in most of the content parts of this unit.

	• What? So what? Now What?, Pens in the middle, One Stay Others Stray, RSQ, IDEAL, DUPE strategies as stated in unit five
Unit 3	• Jigsaw, Mix Freeze Pair, Text Coding strategies can be used as stated in unit five.
Unit 4	• KWL and RSQ family strategies can be used as stated in unit five.
Unit 5-6	• Students will work individually, in pair and in group using the strategies to prepare model lesson plans and present them followed by discussion and feedback.

Note: Figures within parenthesis indicate approximate number of teaching hours

5. Evaluation

5.1 Internal Evaluation 40%

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 School visit- Unit 3)	10
4) Second Assignment (Based on Reports on Nepalese Education System Unit 4)	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 Questions)	(10 × 1) = 10
Short Answer Questions (6 Questions with 2 Or)	(6× 5) = 30
Long Answer Questions (2 Questions with 1 Or)	(2 × 10) = 20
Total	60

6. Recommended Books and Reading Materials

Arends, R. I. (2013). *Learning to Teach (8th edition).* New Delhi: McGraw – Hill Education Indian Edition. (Units 1, 2, 4, 5)

Crawford, A; Saul, EW; Mathews, S; and Makinster, J. (2005). *Teaching and Learning Strategies for the Thinking Classroom.* New York: Open Society Institute. (Also available in Nepali translation). (Units 2, 5)

Elliott, S. N., Kratochwill, T. R., Cook, J. L. and Travers, J. F. (2000). *Educational Psychology: effective teaching, effective learning.* New York: McGraw – Hill. (Units 1, 2)

Karmacharya, D. M. (2070 BS). *Teacher and Teaching. (In Nepali).* Kathmandu: Makalu Publication House. (Units 3)

Singh, G. B. (2071 BS). *Active and Thinking Teaching Learning Methods (2nd edition). (In Nepali).* Kathmandu: Jupitar Publications. (Units 2, 3, 4, 5, 6)

Ashman, A. F. and Conway, R. N. F. (1997). *An Introduction to Cognitive Education: Theory and Application.* New York: McGraw – Hill International Edition.

Cotton, J. (2004). *The Complete Guide to Learning and Assessment: Learning Vol. 2.* New Delhi: Crest Publishing House.

DOE. (2010). *Framework of Child Friendly School for Quality Education.* Sanothimi: Author.

DOE/SC. (2005). *Child-friendly Schooling Teachers' Training Manual, 2062.* Kathmandu: Author.

Joyce, B., Weil, M. and Calhoun, E. (2009). *Models of Teaching (8th edition).* New Delhi: Prentice-Hall of India Pvt. Ltd.

Pollard, A. (2006). *Reflective Teaching* (2nd Edition). London and New York: Viva-Continuum.

Udvari-Solner, A. and Kluth, P. (2008). *Joyful Learning – Active and Collaborative Learning in Inclusive Classrooms.* California: Corwin Press. (Units 5, 6)

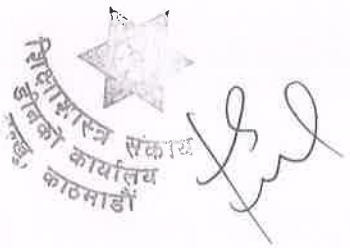
UNESCO. (2004). *Changing Teaching Practices.* Paris: UNESCO.

UNESCO. (2015). *Transforming Teaching and learning in Asia and The Pacific: Case Studies from Seven Countries.* Paris: UNESCO. (http://www.unesco.org/open-access/terms-use-ccbysa-en).

UNICEF. (2003). *Happy Learning! A Guide to Best Practices for Achieving the Potential of Children.* Kathmandu: UNICEF.

Westwood, Peter. (2008). *What teachers need to know about Teaching Methods.* Victoria: Acer Press.

NCED teacher training packages



Course Title: **Teaching Practicum in ICT Education**
Course Code: ICT. Ed. 481
Level: Bachelor
Semester: Eighth

Program: **BICTE**
Nature of Course: Practical
Credit Hours: 3
Duration: 1 Semester

1. Course Description

This course aims to provide hands-on experiences to the students in ICT education equipping them with the skills and opportunity to be become effective teachers and professionals. It creates enabling condtions to the students for bringing professionalism through rigorous practice. It emphasizes professionalism through rigorous practice, enabling students to gain valuable teaching experience in cooperating schools under the close supervision of campus faculty members. In this course has divided into number of activites in sequential phaes: orientation of practice teaching, development of observation guideliences and observation of teaching of school teacher, experience sharing among the students, on-campus micro-teaching, teaching at school, and preparation of overall report.

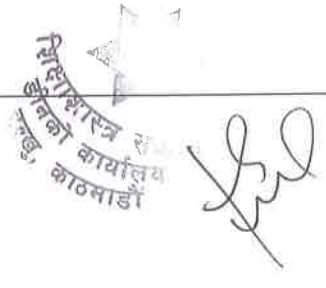
2. General Objectives

The objectives of the course are as follows:

- To Familiarize students with practice teaching principles and develop observation guidelines.
- To enable students to observe and evaluate the teaching methods of school teachers critically, fostering reflection and understanding of effective teaching strategies.
- To provide students with hands-on teaching experiences through on-campus micro-teaching sessions, preparing them for real-world classroom environments.
- To facilitate collaborative learning and experience sharing among students, encouraging teamwork and the exchange of innovative teaching ideas.
- To integrate theoretical knowledge with practical teaching by engaging students in lesson planning, classroom management, and teaching in school settings.
- To guide students in preparing comprehensive reports based on their teaching experiences, promoting critical analysis and reflective learning.

3. Specific Objectives and Activities

Specific Objectives	Major Activities
Phase 1: Orientation of Practice Teaching [2 Days]	
• To introduce students to the phases of the teaching practice program and its structure. • To clarify the requirements and expectations to be fulfilled during the teaching practice.	1.1. Introduction to the phases of teaching practice programme 1.2. Requirements to be fulfilled



Phase 2: Observation of School [One Week]	
• To prepare observation guidelines in consultation with the internal supervisor • Collect subject-relevant information during observation of teaching. • Analyse information, prepare report and share it in the group.	2.1. Preparation of observation guidelines in consultation with internal supervisor for observing the teaching of teacher in computer science. 2.2. Observation of teaching of teachers, computer lab, ICT tools in schools. 2.3. Analysis of information collected from observation of teaching including curriculum, materials, evaluation, computer lab, ICT tools.
Phase 3: Experience Sharing [Four Days]	
• To prepare a brief report summarizing the observations of teaching ~~practices.~~ • To present the observation report at the campus and share experiences with peers and supervisors. • To receive constructive feedback from the supervisor to refine observation and reporting skills.	3.1. Brief report preparation of observation of teaching 3.2. Presentation for sharing experiences of observation report at the campus with feedback from supervisor.
Phase 4: On-Campus Micro-Teaching [1.5 weeks]	
• To define micro-teaching and explain its cycle and relevance in teacher training. • To introduce the concept of reflective practice and its role in improving teaching skills. • To prepare micro-teaching lessons using ICT-integrated pedagogy for teaching computer science. • To demonstrate the delivery of micro-teaching lessons in a simulated on-campus environment.	4.1. Introduction of Micro-teaching and its cycle. 4.2. Reflective practice: learning to teach 4.3. Preparation of micro-teaching lessons for teaching students on computer science with ICT integrated Pedagogy. 4.5. On-Campus simulated micro-teaching practices to develop teaching skills. 4.5 Planning micre teaching sessions, including setting objectives and preparing at least 10 lesson plans with at least 3 teaching lessons (time 10min) 4.6 Peer observation of at least 1 lesson of Micro-teaching with feedback. **(18 students *10min *3teaching=540min/60=9 Hour)**

Phase 5: Peer Teaching on Campus [Two Week]	
• To understand the purpose and benefits of peer teaching in teacher training programs. • To plan and prepare effective peer teaching sessions with clear objectives and lesson plans. • To deliver lessons using ICT tools in a simulated classroom setting. • To develop observation skills by assessing peer teaching practices and providing constructive feedback. • To evaluate teaching effectiveness based on peer feedback and identify areas for improvement.	5.1. Introduction to the purpose and benefits of peer teaching. 5.2. Planning peer teaching sessions, including setting objectives and preparing at least 10 lesson plans. 5.3. Delivering at least 2 lessons using ICT tools in a simulated classroom environment and materials 20 minutes for each of 2 lessons. 5.4. Observing peer teaching and providing constructive feedback. 5.5. Evaluating teaching effectiveness and reflecting on feedback for improvement. 5.6. Integrating theoretical concepts with practical teaching scenarios. 5.7. Conducting a final peer teaching demonstration and receiving feedback. 5.8 Peer observation of at least 2 lesson of Micro-teaching with feedback 18student *2 lesson *20min=720/60=12 Hour)
Phase 6: Teaching at Schools Campus [Six Week]	
• To prepare and deliver 30 ICT pedagogy lessons in a real classroom setting using diverse teaching methods and materials. • To construct and utilize instructional materials, including digital interactive resources, for effective lesson delivery. • To manage the classroom effectively to ensure optimal instruction and learning outcomes. • To observe at least three lessons conducted by peers and provide constructive feedback. • To receive feedback from the internal supervisor by having at least three lessons observed and evaluated.	6.1. Teaching (30 lessons) - Preparing and delivery 30 lessons of the ICT pedagogy in real classroom in cooperating school using different methods and materials - Construction of instruction materials for delivery of lessons including digital interactive materials - Managing classroom for effective instructin and learning 6.2. Peer observation (3 lessons) - Observation of at least 3 lessons of peer's teaching with feedback. - Observation of at least 3 lessons by internal supervisor with his/her feedback. 6.3. Tests - Test construction of both subjectives and objective test item on the basis of the lessons taught - Administration of both tests

• To construct both subjective and objective test items based on the lessons taught. • To administer the tests effectively in the classroom setting. • To analyze and interpret the results of the tests to evaluate learning outcomes and improve teaching strategies.	- Analysis and interpretation of test results.
Phase 7: Preparation of Overall Report [One week]	
• Prepare overall report of teaching practice including all the components as mentioned in phase 7 in the next column	7.1. Preparation of overall report of teaching practice in a given format Title page Acknowledgements Abbrivations Table of Contents Part I: On-Campus activities Background Preparation of instruments for class observation Analysis of observation Brief report including material constructin and lesson learned Part II: Activities in School Analysis of teaching activities carried out in school Analysis of peer observation Assessment of teaching Assessment of teaching Lessons learned Part III: Test Construction, Administration and analysis and interpretation of Test Results (difficulty level and discrimination index) References Appendics

Note: The figures within the parentheses indicate approximate periods allotted to respective activties.

4. Guidelines for Conduction Major Activities

4.1 Orientation of Practicum:

- Conduct a orientation for those campus tutors/supervisors who will be involved in practicum and it will be facilitated by experts from faculty of education/ICT coordinator/chairperson of practice teaching instruction committee of respective campus addressing five parts of the course.

4.2 Activity 1: Experience as a Learner:

On-campus activities	Organization/School/institutes
• Participation in orientation program. • Preparation of guidelines for observing the teaching • Experience share and demonstrate the observation report to internal supervisor.	Observe the minimum three class of computer science or ICT in school with given format. Observe the computer lab and other ICT tools, infrastructure which is related to ICT in education.

4.3 Activity 2: Workshop on Micro-Teaching and Peer Teaching

On-campus activities	Organization/School/institutes
• Prepare the micro-teaching lesson 10 with 3 teaching • Micro-teaching practices with the support of the campus supervisor: • Teach at least 5(3 micro 2 peer) lessons to develop teaching skills using the micro-teaching cycle • Prepare peer observation report 3 (1 micro 2 Peer) with feedback **Note: Group divide up to 18 students in one group if more then 18 divide into multiple group**	

4.4 Activity 3: Teaching Practice Activities

On-campus activities	Organization/School/institutes
• Prepare a comprehensive practicum report including teaching practice, observation of organization in given format and structure.	• Observation of teaching of school or campus teachers. • Study of management and ICT tools and infrastructure at school. • Preparation of at least 30 lesson plans using variety of instructional techniques and ICT integrated pedagogy. • Preparation of teaching aids with the support of interactive multimedia tools. • Teaching of at least 30 lessons. • Improve the lessons through continual repetitions with the suggestions of campus supervisor and concerned subject teacher

	• Observation of at least **three** lessons of peers' teaching and prepare its report after analyzing the results and provide knowledge of results to both students • Preparation of a report of in-depth case study • Report preparation along with the record of all the activities conducted during practicum period.

5 Evaluation of Practicum

The evaluation process is divided into two sperate part. The first part is teaching practices and second part is internships. Marks and evaluation process are given following table.

Part 1: Teaching Practices 100 Marks

Working area	Internal Supervisor (50%)	Cooperating School (10%)	External Examiner (40%)	Evaluation Indicator
Experience share as a Learner	10	-	5	Observation Report
Micro Teaching and Peer Teaching	10	-	-	Lesson Plan, Classroom Simulation
Construction of Instructional Materials	5		3	Classroom presentaion digital materials (ppt, video, tutorials, simulation, and soon)
Peer Observation and tis report	5		2	At least 3 peer observation form
Test Construction, Administration, analysis and interpretation	5	5	5	Report of test conduction
The overall report of teaching practice	5		5	Report of on-campus to real-school teaching
Experience as full-teacher in school	10	5	20	Lesson plan, Teaching aids, Classroom performance, Report on feedback to peers, Test construction, administration and analysis of test results
Total	50	10	40	

Note: Students' performance in all headings mentioned in above table should be evaluated addressing practical activities as well as their respective report. Detailed evaluation forms will be developed for evaluating the performance of the students in two different parts. Office of the controller of examination, FOE Dean office assign the external examiner for the evaluation process.

6 Recommended Books and Reading Materials

American Psychological Association.(2009). *Publication manual of American Psychological Asssociation.* (6th ed.). Washington DC: APA.

Baharain Teachers College. (2008). Teaching practice: Student teacher handbook. Baharain: Baharain University http://www.btc.uob.edu.bh/UltimateEditorInclude/UserFiles/StuTeach%20TP1.pdf (Retrieved 8/23/2015)

Cohen, L., Menion, L., & Morrioson, K. (2010). *Teaching practice*. India: Routledge.

School of Education. (2013). *Teaching practice handbook.* Cape Town: University of Cape Town

The Open University (Posted in 27th August 2015). *Learning to teach: Becoming a reflective practitioner.* http://www.open.edu/openlearn/education/learning-teach-becoming-reflective-practitioner/content-section-2.1

Course Title: **Artificial Intelligence in Education**
Course Code: ICT. Ed. 484
Level: Bachelor
Semester: Eighth

Program: **BICTE**
Nature of Course: Theory + Practical
Credit Hours: 3 (2 + 1)
Teaching Hours: 64 (32 Th + 32 Pr)

1. Course Description

This course provides an introduction to Artificial Intelligence (AI) concepts and their applications in education. Students will explore key AI techniques such as search algorithms, knowledge representation, reasoning, machine learning, and natural language processing (NLP) while focusing on practical applications for educational systems.

2. General Objectives

The general objectives of this course are as follows:

- Understand fundamental AI concepts and their relevance to education.
- Explore AI techniques such as search, reasoning, and planning in the context of educational problem-solving.
- Apply machine learning and NLP methods in educational scenarios.
- Analyze the role of AI in adaptive learning and intelligent tutoring systems.
- Discuss ethical issues and emerging trends in AI for education.

3. Specific Objectives and Contents

Specific Objectives	Contents
• Understand the basics of AI and its applications in education. • Explore the historical development of AI. • Evaluate the effectiveness of AI applications in education. • Examine the use of learning agents in Education	**Unit 1: Introduction to AI (3 Hours)** 1.1 Definition and evolution of AI 1.2 Applications of AI in education (adaptive learning, virtual tutors, etc.) 1.3 Importance of knowledge and learning agents in educational AI **Practical Works (3 Hours)** • **Case Study Analysis**: Assign students to analyze real-world case studies of AI applications in education. They could explore platforms like Duolingo (adaptive learning) or IBM Watson Tutor and prepare a report on their AI-driven features and effectiveness.
• Implement and compare different search strategies	**Unit 2: Search Techniques (4 Hours)** 2.1 Uninformed Search Techniques

• Understand the basic principles of uninformed search algorithms. • Understand the role of heuristics in search algorithms. • Understand the principles of adversarial search.	2.1.1 Depth-first search, breadth-first search, depth-limited search, iterative deepening search 2.2 Heuristic Search Techniques 2.2.1 A* search, greedy best-first search, hill climbing 2.3 Adversarial Search 2.3.1 Minimax algorithm and alpha-beta pruning **Practical Works (4 Hours)** • Implement a basic search algorithm to solve a real-world educational problem. For example: Implement DFS or BFS to search for books in the library catalog, helping to locate and retrieve books efficiently.
• Define propositional and predicate logic • Learn the components of logical expressions • Learn how rule-based systems represent knowledge as a set of rules and use inference mechanisms to make decisions or recommendations. • Understand statistical reasoning and its applications. • Develop automated grading systems	**Unit 3: Knowledge Representation and Reasoning (5 Hours)** 3.1 Propositional and Predicate Logic 3.1.1 Syntax, semantics, and inference (forward chaining, backward chaining) 3.2 Rule-based Systems and Statistical Reasoning 3.2.1 Probability, Bayes' theorem, and belief networks 3.3 Applications in Education 3.3.1 Automated grading and lesson planning **Practical Works (5 Hours)** • Implement a simple program to evaluate propositional logic expressions, including truth tables, to check the validity and satisfiability of logical statements. • Build a basic expert system for educational purposes, such as a career counseling system that suggests potential career paths based on student inputs (grades, interests, etc.). Use simple if-then rules to simulate expert advice. • Create a simple automated grading system that uses logical rules to grade multiple-choice or short-answer questions. Extend it to include probabilistic reasoning for handling uncertain or partial answers.
• Define machine learning and understand its significance in AI.	**Unit 4: Machine Learning and Neural Networks (6 Hours)** 4.1 Overview of Machine Learning

• Compare and contrast different learning paradigms. • Understand the structure and components of neural networks. • Apply neural networks to educational problems.	4.1.1 Supervised, unsupervised, and reinforcement learning 4.2 Basics of Neural Networks 4.2.1 Architecture, training, and applications in education 4.3 Applications 4.3.1 Predicting student performance, learning analytics **Practical Works (6 Hours)** • Develop a simple machine learning model using Python libraries like Scikit-learn. • Implement a simple supervised learning model (like linear regression or decision trees) to predict student grades based on features such as attendance, homework scores, and previous test scores. • Develop a machine learning model to predict student performance in upcoming exams based on historical performance data, demographics, and engagement metrics.
• Explain the NLP. • Develop NLP applications to solve Educational problems.	**Unit 5: Natural Language Processing and Applications (4 Hours)** 5.1 Overview of NLP 5.1.1 Parsing, text classification, and sentiment analysis 5.2 Applications in Education 5.2.1 Chat-bots, automated grading, and virtual assistants **Practical Works (4 Hours)** • Create a basic chatbot for answering educational queries using Python's NLTK or Hugging Face.
• Discuss ethical implications and future trends in AI for education. • Understand the role of Generative AI in education. • Examine the ethical implications of emerging AI technologies.	**Unit 6: Ethical Considerations and Emerging Trends in AI (2 Hours)** 6.1 Ethical considerations: Bias, Privacy, and Equity in AI systems **6.2** Emerging trends: Generative AI, Adaptive Learning Platforms, and Augmented Reality **Practical Works (2 Hours)** • Use a generative AI model (like GPT or DALL·E) to create educational content, such as quizzes, lesson plans, or visual aids. Evaluate the

	quality and relevance of the generated content in a real educational context.

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 specific units.

4.1 General Techniques

- Providing the reading materials to the students to familiarize the units.
- Lecture, question-answer, discussion, brainstorming, practical, hands-on labs, project-based learning and flipped classrooms.

4.2 Specific Instructional Techniques

Unit	Activity and Instructional Techniques (48 Hours)
1 to 6	• Organize coding labs where students can implement AI algorithms in languages like Python or tools like TensorFlow, PyTorch, or Scikit-learn. • Use Jupyter Notebooks for data analysis, visualizations, and model development, enabling students to work through real-world datasets. • Assign machine learning projects that require students to train AI models (e.g., predicting student performance, automating grading systems). • Include AI development tools for building neural networks or other machine learning models that can be directly applied to educational contexts (e.g., adaptive learning platforms). • Demonstrate various AI-based educational tools (e.g., virtual tutors, adaptive learning systems) and show how they work in a real classroom setting. • Encourage students to showcase their AI projects (e.g., predictive models, AI-based content creation) in a demo day format, allowing them to present their work to peers and instructors.

5. Evaluation (Internal Assessment and External Assessment):

Nature of Course	Internal Assessment	External Practical Exam/Viva	Semester Examination	Total Marks
Theory	40	20	40	100

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

5.1 Evaluation for Part I (Theory): Internal Evaluation 40%

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

1) Attendance 5 Marks

2)	Participation in Learning Activities	5 Marks
3)	First Assessment (Written Assignment)	10 Marks
4)	Second Assessment (Term Examination)	10 Marks
5)	Third Assessment (Internal Practical Exam/Case Study)	10 Marks
	Total	40 Marks

5.2 External Evaluation (Final Examination) 40%

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

1) Objective Type Question (Multiple Choice Questions) 10× 1 = 10 Marks
2) Short Answer Questions (6 Questions with 2 Or) 6× 5 = 30 Marks

Total	40 Marks

5.3 Evaluation for Part II (practical) 20%

Nature of the Course	Semester Final Examination by External Examiner	Total Percent
Practical	100%	100

5.3.1 Practical Examination Evaluation Scheme

a) External Assessment 100%
   i) Lab Report/Project Report 20%
   ii) Laboratory work exam/Case.....40%
   iii) VIVA.....40%

6. Recommended Books and Reading Materials

- Russell, S., & Norvig, P. (2021). *Artificial intelligence: A modern approach* (4th ed.). Pearson
- Holmes, W., Bialik, M., & Fadel, C. (2021). *Artificial intelligence for education: Promise and implications*. Center for Curriculum Redesign.
- Müller, V. C. (Ed.). (2020). *Ethics of artificial intelligence and robotics*. Stanford Encyclopedia of Philosophy.
- Holmes, W., Bialik, M., & Fadel, C. (2019). *AI in education: Challenges and opportunities*. Center for Curriculum Redesign.

- Shukla, N. (2019). *Deep learning for education*. Springer.
- Ng, A. (2018). *Machine learning yearning*. Deeplearning.ai.
- Goldman, R., Anderson, R. C., & Sullivan, P. S. (Eds.). (1999). *Artificial intelligence in education: Promises and implications for teaching and learning*. Springer.

Course Title: **System Administration using Linux**
Course Code: ICT. Ed. 486
Level: Bachelor
Semester: Eighth

Program: **BICTE**
Nature of Course: Theory + Practical
Credit Hours: 3 (2 +1)
Teaching Hours: 48 (32 Th+ 32 Pr)

1. Course Description

This course provides students with the skills to install, configure, and troubleshoot computer networks and system administration using Linux. The course covers server/client installation and configuration, IP, DHCP, Name Server, DNS, Web server, file, print, and mail server configuration and troubleshooting.

2. General Objectives

The general objectives of this course are:

- To provide knowledge in system administration and computer networks, including components, features, and architecture.
- To explore network standards, protocols, and access methods for network system implementation.
- To develop skills in the installation, configuration, and management of network services.
- To describe actions for enforcing network-level security.

3. Specific Objectives and Contents

Specific Objectives	Contents
• Understand the foundational principles and advantages of open-source software and its role in modern computing. • Gain proficiency in navigating Unix and Linux systems, including command syntax, file management, and shell commands. • Develop skills in text processing and job control for efficient system administration and task automation. • Learn filesystem concepts and package management to effectively manage system resources and software installations.	**Unit 1: Introduction to Linux and CLI Commands (5 Hours)** 1.1 Introduction to Open-Source Software 1.2 Unix System Architecture, Linux Differences, Using a Linux System, Command Syntax 1.3 File Management 1.4 Shell Commands 1.5 Text Processing 1.6 Job Control 1.7 Filesystem Concepts 1.8 Package Management **Practical Works (5 Hours)** • Create and manage files and directories using CLI commands. • Practice text processing with commands like grep, awk, sed. • Manage processes using ps, top, and job control commands.

• Perform Linux installation, manage the boot sequence, and configure kernel and boot loaders. • Manage user accounts, groups, password policies, and authentication settings. • Configure file permissions and access control lists for secure resource management.	**Unit 2: Installation, Boot Process and User Administration (5 Hours)** 2.1 Linux Installation, Network-Based Installation, Boot Sequence, Kernel Initialization, Boot Loaders, Kernel Modules 2.2 User Account Management, Group Administration, Password Policies, Authentication Configuration, File Permissions, Access Control Lists **Practical Works (5 Hours)** • Install Linux on a virtual machine and configure boot loader settings. • Create, modify, and delete user accounts and groups. • Set file and directory permissions and configure ACLs.
• Configure and manage disk quotas to control user storage usage. • Implement RAID levels for data redundancy and performance optimization. • Create and manage logical volumes for flexible storage allocation. • Configure and manage IPv4 and IPv6 addressing and routing. • Diagnose and resolve network connectivity issues using troubleshooting tools.	**Unit 3: Disk Quotas, Storage Management, and Network Configuration (5 Hours)** 3.1 Quotas, RAID Implementation, Logical Volumes, Disk and Inode limits. 3.2 IPv4 and IPv6 Addresses, IP Configuration, Network Troubleshooting **Practical Works (5 Hours)** • Configure and manage disk quotas for users. • Implement RAID 1 using mdadm. • Configure static and dynamic IP addresses and troubleshoot network connectivity.
• Configure DNS and DHCP servers • Demonstrate hostname resolution • Set up and manage FTP, NFS, and Samba servers • Apply best practices for secure file sharing and directory access.	**Unit 4: Network Services and File Sharing (5 Hours)** 4.1 DNS and DHCP Configuration, Hostname Resolution, DNS Queries, Implementing Servers 4.2 FTP, NFS, Samba Server Configuration, Directory Access **Practical Works (5 Hours)** • Configure a DNS server and resolve domain names. • Set up and manage a DHCP server. • Configure and share directories using Samba and NFS.
• Configure Apache, MySQL, Postfix, and Dovecot for seamless operations.	**Unit 5: Web, Email, Database Services, and Network Security (4 Hours)** 5.1 Apache, HTTPD, Email Operations (SMTP, Postfix, Dovecot) 5.2 MySQL Administration.

• Troubleshoot and resolve issues in servers and networks. • Secure systems using SSL/TLS, SSH, and firewalls. • Implement ACLs and anti-spam measures for security.	5.3 Cryptography, SSH, Firewall Configuration, ACLs **Practical Works (4 Hours)** • Set up a basic Apache web server and host a sample website. • Configure an email server using Postfix and Dovecot. • Secure a Linux server using SSH keys, configure a firewall with iptables or firewall.

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.

5 Evaluation

Internal Assessment	External Practical Exam/Viva	Semester Examination	Total Marks
40	20	40	100

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

5.1 Internal Evaluation (40 %):

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

1) Class Attendance	5 Marks
2) Learning Activities and Class Performance	5 Marks
3) First Assignment (Written assignment)	10 Marks
4) Second Assignment (Case Study/Project work with Presentation)	10 Marks
5) Terminal Examination	10 Marks
Total	40 Marks

5.2 Semester Examination (40 Marks)

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

1) Objective Question (Multiple Choice Questions) Marks	(10 × 1) = 10
2) Subjective Answer Questions (6 Questions with 2 Or) Marks	(6× 5) = 30
Total	40 Marks

5.3 External Practical Exam/Viva (20 Marks):

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

6 Recommended Books and Reading Materials

- Negus, C. (2020). *Linux Bible* (10th ed.). Wiley.
- Negus, C. (2025). *Linux Bible* (11th ed.). Wiley.
- Nemeth, E., Snyder, G., Hein, T. R., Whaley, B., & Mackin, D. (2021). *UNIX and Linux system administration handbook* (5th ed.). Addison-Wesley.
- Fox, R. (2021). Linux with Operating System Concepts (2nd ed.). CRC Press.
- Wale Soyinka, W. (2020). Linux Administration: A Beginners Guide (8th ed.). McGraw Hill.
- Limoncelli, T. A., Hogan, C. J., & Chalup, S. R. (2017). *The practice of system and network administration* (3rd ed.). Addison-Wesley.
- Rankin, K., & Hill, B. M. (2013). The official Ubuntu server book (3rd ed.). Pearson.
- Smith, R.W. (2002). Advanced Linux Networking (1st ed.). Addison-Wesley Professional.
- Frisch, Æ. (2002), Essential System Administration: Tools and Techniques for Linux and Unix Administration, 3rd Edition, O'Reilly

Course Title: **Cloud Computing**
Course Code: ICT. Ed. 488 (Elective II)
Level: Bachelor
Semester: Eighth

Program: **BICTE**
Nature of Course: Theory + Practical
Credit Hours: 3 (2 + 1)
Teaching Hours: 64 (32 Th +32 Pr)

1. Course Description

This course introduces undergraduate students to the foundational concepts, architecture, and practical applications of cloud computing. Students will explore the different cloud service models (IaaS, PaaS, SaaS) and deployment strategies (public, private, hybrid, and community clouds). The course provides hands-on experience with industry-leading cloud platforms such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP).

Students will apply their knowledge to design and deploy scalable, cloud-based solutions, preparing them for careers in cloud computing and related fields. By the end of the course, students will gain the technical and practical skills necessary to leverage cloud technologies effectively in real-world scenarios.

2. General Objectives

The general objectives of this course are as follows:

- Develop an understanding of the fundamental concepts of cloud computing.
- Gain familiarity with cloud service models and deployment strategies.
- Learn to design and deploy basic cloud-based applications.
- Develop an understanding of security and compliance in the cloud.
- Acquire practical experience with leading cloud platforms

3. Specific Objectives and Contents

Specific Objectives	Contents
• Explain the concept of Cloud Computing with characteristics. • Understand the basic terminologies related to cloud and traditional IT infrastructure. • Identify major cloud service providers	**Unit 1: Introduction (4 Hours)** 1.1 History and Evolution of Cloud Computing 1.2 Characteristics of Cloud Computing 1.3 Cloud vs Traditional IT Infrastructure 1.4 Major Cloud Service Providers Overview **Practical Works (4 Hours)** • Compare the services, pricing, and user interfaces offered by different providers. • Analyze a case study where an organization transitioned from traditional IT infrastructure to the cloud, and present the benefits and challenges faced.

• Explain different cloud services model • Compare and contrast different deployment models • Understand the role of virtualization in cloud	**Unit 2: Cloud Computing Architecture (5 Hours)** 2.1 Cloud Service Models: 2.1.1 Infrastructure as a Service (IaaS) 2.1.2 Platform as a Service (PaaS) 2.1.3 Software as a Service (SaaS) 2.2 Deployment Models: 2.2.1 Public, Private, Hybrid, and Community Clouds 2.3 Virtualization and its Role in Cloud Computing **Practical Works (4 Hours)** • Use a PaaS provider (e.g., AWS Elastic Beanstalk, Azure App Service, or Google App Engine) to deploy a simple application, such as a "Hello World" web app. • Sign up for a SaaS application (e.g., Google Workspace, Microsoft 365, or Salesforce) then explore and document its features, benefits, and limitations.
• Explain different cloud platforms. • Apply different cloud tools for computation, storage and data management.	**Unit 3: Cloud Platforms and Tools (5 Hours)** 3.1 Introduction to AWS, Microsoft Azure, and Google Cloud Platform (GCP) 3.2 Overview of cloud tools 3.2.1 Compute 3.2.2 Storage 3.2.3 Database **Practical Works (6 Hours)** • Guide students through the process of setting up a free-tier account for AWS, Azure, and GCP. Ask students to document the steps involved in setting up the free-tier account for each provider, including limitations (e.g., compute hours, storage, or data transfer limits). • Set up cloud storage on AWS (S3), Azure (Blob Storage), and GCP (Cloud Storage) then upload a file (e.g., a text document or image) to each platform and access it through a browser or API. • Perform a basic SQL query (e.g., SELECT, INSERT) on each cloud provider's database service.
• Develop cloud native application.	**Unit 4: Application Development in the Cloud (3 Hours)** 4.1 Basics of Cloud-native Development

• Explain containers and automate container deployment using Kubernetes.	4.2 Introduction to Containers and Kubernetes **Practical Works (6 Hours)** • Develop a simple cloud-native application using a microservices architecture. Implement basic services (e.g., a user service, a product service) that communicate over REST APIs or gRPC. Use a cloud provider (AWS, Azure, or GCP) to host these services, demonstrating key cloud-native principles like scalability and resilience. • Set up a local Kubernetes environment using tools like **Minikube** or **K3s**. Deploy a multi-container application (e.g., front-end and back-end services) to Kubernetes and expose the application through a LoadBalancer or Service.
• Explain the different security challenges in Cloud. • Implement IAM. • Know different compliance standards. • Know pricing models in Cloud Services.	**Unit 5: Cloud Security, Compliance, and Pricing (4 Hours)** 5.1 Security Challenges in Cloud Computing 5.2 Identity and Access Management (IAM) 5.3 Encryption and Data Privacy 5.4 Compliance Standards 5.5 Pricing Models in Cloud Computing **Practical Works (4 Hours)** • Set up security configurations on a cloud platform (e.g., AWS, Azure, or GCP) to demonstrate protections such as: Configuring firewalls or security groups to control network traffic. • Implement IAM in a cloud platform (e.g., AWS IAM, Azure AD, or GCP IAM). Create and assign different roles and permissions to users (e.g., admin, developer, read-only) for accessing specific resources.
• Define Edge computing and serverless architecture • Identify the application of AI and Big Data in Cloud	**Unit 6: Emerging Trends in Cloud Computing (3 Hours)** 6.1 Edge Computing and Serverless Architectures **6.2** Artificial Intelligence (AI) and Big Data in the Cloud

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 specific units.

4.1 General Techniques

- Providing the reading materials to the students to familiarize the units.
- Lecture, question-answer, discussion, brainstorming, practical, hands-on labs, project based learning and flipped classrooms.

4.2 Specific Instructional Techniques

Unit	Activity and Instructional Techniques (48 Hours)
1 to 6	Use Interactive cloud platforms and simulations can be used

5. Evaluation (Internal Assessment and External Assessment):

Nature of course	Internal Assessment	External Practical Exam/Viva	Semester Examination	Total Marks
Theory	40	20	40	100

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

5.1 Evaluation for Part I (Theory): Internal Evaluation 40%

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

1) Attendance	5 Marks
2) Participation in Learning Activities	5 Marks
3) First assessment (Written Assignment)	10 Marks
4) Second assessment (Term Examination)	10 Marks
5) Third assessment (Internal Practical Exam/Case Study)	10 Marks
Total	40 Marks

5.2 External Evaluation (Final Examination) 40%

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

1) Objective Type Question (Multiple Choice Questions)	(10 × 1) = 10 Marks
2) Short Answer Questions (6 Questions with 2 Or)	(6× 5) = 30 Marks
Total	40 Marks

5.3 Evaluation for Part II (Practical) 20%

Nature of the Course	Semester Final Examination by External Examiner	Total percent
Practical	100%	100

5.3.1 Practical Examination Evaluation Scheme

a) External assessment 100%
   i) Lab Report/Project Report 20%
   ii) Laboratory Work Exam/Case.....40%
   iii) VIVA.....40%

6. Recommended Books and Reading Materials

- Erl, T. & Monroy, E. (2023). *Cloud Computing: Concepts, Technology, Security and Architecture, 2nd Edition.* Pearson Education
- Hurwitz, J.S. & Kirsch, D. (2020). *Cloud Computing For Dummies, 2nd Edition,* John Wiley and Sons Inc.
- Hoff, T. (2017). *Explain the Cloud Like I'm 10, 1st Edition,* Possibility Outpost Inc.
- Marinescu, D.C. (2022). *Cloud Computing Theory and Practice, 3rd Edition*, Morgan Kaufmann
- Linthicum, D. (2023). *Insider's Guide to Cloud Computing, 1st Edition*, Pearson Education

Course Title: **Big Data and Data Analysis**
Course Code: ICT. Ed. 489 (Elective II)
Level: Bachelor
Semester: Eighth

Program: **BICTE**
Nature of Course: Theory + Practical
Credit Hours: 3 (2 + 1)
Teaching Hours: 64 (32 Th +32 Pr)

1. Course Description

This course provides an extensive overview of big data topics, tools, and methodologies. Students will examine the features and uses of big data, acquire foundational knowledge of Hadoop and its ecosystem, and obtain practical experience in data visualization via Power BI. The course includes data pretreatment methodologies and data analysis with Python modules such as NumPy, Pandas, and PySpark. Practical exercises will consolidate theoretical understanding and generate real-world experience in large data analysis and visualization.

2. General Objectives

The general objectives of this course are as follows:

- Explain the definition and attributes of big data, including volume, velocity, diversity, truth, and value.
- Examine the utilization of big data within the educational framework by comparing big data with conventional data methodologies.
- Discuss the Hadoop ecosystem, encompassing HDFS, MapReduce, YARN, and Hadoop applications such as Hive, Spark, Sqoop, and Pig.
- Integrate Power BI with diverse data sources to develop dynamic dashboards and reports.
- Prepare and modify data for extensive data analysis, encompassing the management of absent and inconsistent data.
- Conduct data analysis utilizing Python libraries (NumPy, Pandas, PySpark) and show data findings.

3. Specific Objectives and Contents

Specific Objectives	Contents
• Define the key characteristics of big data. • Analyze the applications of big data in the education system. • Compare big data with traditional data to highlight their differences and advantages.	**Unit 1: Concept of Big Data (4 Hours)** 1.1 Definition and Characteristics (Volume, Velocity, Variety, Veracity, Value) 1.2 Applications in Education System 1.3 Big Data vs. Traditional Data 1.4 Recent Trends in Big Data and Practices in Education system
• Describe the components of the Hadoop ecosystem. • Explain the functionality of the Hadoop Distributed File System (HDFS).	**Unit 2: Basic Concepts of Hadoop (8 Hours)** 2.1 Hadoop Ecosystem Overview 2.2 Hadoop Distributed File System (HDFS) 2.3 MapReduce Framework 2.4 Hadoop YARN

• Implement a simple MapReduce program. • Explore resource management using Hadoop YARN. • Utilize Hadoop applications such as Hive, Spark, Sqoop, and Pig for data processing tasks.	2.5 Concept of Hadoop Applications: Hive, Spark, Sqoop, Pig **Practical Works (8 Hours)** • Install and configure Hadoop on a local machine. • Perform basic HDFS operations (upload, download, delete files). • Write and execute a simple MapReduce program. • Explore Hadoop YARN resource management.
• Identify the components and features of Power BI. • Connect Power BI to various data sources. • Transform and model data within Power BI. • Create interactive visualizations and dashboards. • Collaborate and share reports using Power BI.	**Unit 3: Data Visualization with Power BI (6 Hours)** 3.1 Power BI Overview and Components 3.2 Connecting to Data Sources 3.3 Data Transformation and Modeling 3.4 Creating Visualizations 3.5 Sharing and Collaborating with Power BI **Practical Works (6 Hours)** • Connect Power BI to various data sources. • Transform and model data in Power BI. • Create interactive dashboards and reports. • Share reports and collaborate with team members.
• Define the importance of data cleaning in big data analytics. • Recognize the impact of missing and inconsistent data on analysis results. • Explain the ETL process and its role in data integration. • Describe principles of data integration and aggregation. • Define the need for data reduction in big data analytics.	**Unit 4: Data Preprocessing for Big Data (6 Hours)** 4.1 Data Cleaning and Transformation 4.2 Handling Missing and Inconsistent Data 4.3 Introduction to ETL (Extract, Transform, Load) Processes 4.4 Concept of Data Integration and Aggregation 4.5 Data Reduction and Feature Selection
• Define the basic concepts and importance of data analysis and visualization in various fields. • Setup the key Python libraries (NumPy, Pandas, Matplotlib) and describe their roles in big data analysis.	**Unit 5: Data Analysis Using Python Libraries (8 Hours)** 5.1 Introduction to Data Analysis and Visualization 5.2 Concept of python library and bigdata analysis environment 5.3 NumPy and Statistical functions 5.4 Pandas for Data Handling 5.5 Matplotlib for Data Visualization 5.6 Data Ingestion and Exploration in python **Practical Works (8 Hours)**

• Apply NumPy to create arrays and perform statistical functions such as mean, median, and standard deviation. • Clean and preprocess data using Pandas, including handling missing values and data aggregation. • Create and customize various types of plots (line, bar, scatter) using Matplotlib to visualize data effectively. • Load and explore large datasets from various sources (e.g., CSV, JSON) to gain insights and prepare for analysis.	• Installing and configuring Python and essential libraries (e.g., NumPy, Pandas, PySpark). • Create a NumPy array and perform basic operations (addition, subtraction, mean, standard deviation). • Load a dataset into a Pandas DataFrame, clean the data, and handle missing values. • Perform data aggregation and grouping on a Pandas DataFrame. • Create a line plot and a bar chart using Matplotlib with customized labels and titles. • Loading large datasets from various sources (e.g., CSV, JSON, databases).
• Define the basic concepts of big data and the role of PySpark in big data analysis. • Install and configure PySpark to set up the big data analysis environment. • Create and manipulate PySpark DataFrames for data analysis. • Perform large-scale data analysis using PySpark to gain insights. • Query data using Spark SQL to extract meaningful information from PySpark DataFrames. • Create interactive visualizations and generate reports to summarize data insights.	**Unit 6: Big Data Analysis Using Python Libraries (6 Hours)** 6.1 Introduction to Big Data and PySpark 6.2 Installing and configuring PySpark 6.3 PySpark DataFrames 6.4 Big Data Analysis with PySpark 6.5 Using SQL (DBMS tools) for querying data 6.6 Data Visualization and Reporting 6.7 Concept of Spark SQL and its appliction **Practical Works (8 Hours)** • Set up a PySpark environment and create a simple PySpark application. • Load a large dataset into a PySpark DataFrame and perform basic operations (filtering, grouping). • Handle missing data in a PySpark DataFrame and perform data cleaning. • Use Spark SQL to query a PySpark DataFrame and analyze the results. • Create interactive visualizations and dashboards using Pandas with Matplotlib/Seaborn and PySpark with Plotly. Generate a report summarizing the insights from the visualizations.

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 specific units.

4.1 General Techniques

- Providing the reading materials to the students to familiarize the units.
- Lecture, question-answer, discussion, brainstorming, practical, hands-on labs, project based learning and flipped classrooms.

4.2 Specific Instructional Techniques

Unit	Activity and Instructional Techniques (64 Hours)
1	• Use real-world examples to explain each characteristic of big data (Volume, Velocity, Variety, Veracity, Value) • Discuss case studies where big data has been used to improve educational outcomes. • Highlight the differences in data processing and analysis techniques. • Present current research and developments in big data practices
2	• Provide an overview of HDFS, MapReduce, YARN, and Hadoop applications. • Demonstrate basic HDFS operations (upload, download, delete files). • Write and execute a simple MapReduce program. • Discuss the role of YARN in managing cluster resources. • Provide examples of how each application is used in big data processing.
3	• Introduce the Power BI interface and its main features. • Demonstrate how to connect Power BI to different data sources (e.g., Excel, databases). • Show how to clean and prepare data for analysis in Power BI. • Guide students through creating various visualizations (e.g., charts, graphs). • Explain how to publish and share Power BI reports.
4	• Teach techniques for handling missing and inconsistent data. • Provide strategies for dealing with incomplete data. • Explain the steps involved in extracting, transforming, and loading data. • Discuss methods for combining and summarizing data. • Introduce techniques for data reduction and feature selection.
5	• Provide an overview of data analysis techniques and visualization tools. • Discuss the roles of NumPy, Pandas, and PySpark in data analysis. • Demonstrate how to perform basic operations with NumPy arrays. • Show how to load, clean, and manipulate data in Pandas DataFrames. • Guide students through creating and customizing plots.

	• Teach techniques for loading and exploring large datasets.
6	• Introduce PySpark and its capabilities. • Provide step-by-step instructions for setting up PySpark. • Demonstrate basic operations with PySpark DataFrames • Guide students through analyzing large datasets with PySpark. • Show how to write and execute SQL queries in PySpark. • Teach students how to create interactive visualizations and summarize insights in reports.

5. Evaluation (Internal Assessment and External Assessment):

Nature of course	Internal Assessment	External Practical Exam/Viva	Semester Examination	Total Marks
Theory	40	20	40	100

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

5.1 Evaluation for Part I (Theory): Internal Evaluation 40%

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

1) Attendance	5 Marks
2) Participation in Learning Activities	5 Marks
3) First Assessment (Written Assignment)	10 Marks
4) Second Assessment (Term Examination)	10 Marks
5) Third Assessment (Internal Practical Exam/Case Study)	10 Marks
Total	40 Marks

5.2 External Evaluation (Final Examination) 40%

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

1) Objective Type Question (Multiple Choice Questions)	(10 × 1) = 10 Marks
2) Short Answer Questions (6 Questions with 2 Or)	(6× 5) = 30 Marks
Total	40 Marks

5.3 Evaluation for Part II (Practical) 20%

Nature of the Course	Semester Final Examination by External Examiner	Total Marks
Practical	100%	20

5.3.1 Practical Examination Evaluation Scheme

a) External assessment 100%
   i) Lab Report/Project Report 20%
   ii) Laboratory Work Exam/Case.....40%
   iii) VIVA.....40%

6. Recommended Books and Reading Materials

1. Mayer-Schönberger, V., & Cukier, K. (2014). *Big Data: A Revolution That Will Transform How We Live, Work, and Think.* Houghton Mifflin Harcourt.
2. White, T. (2012). *Hadoop: The Definitive Guide*. O'Reilly Media.
3. Karau, H., & Warren, R. (2020). *Learning Spark: Lightning-Fast Data Analytics*. O'Reilly Media.
4. Knight, D. (2022). *Microsoft Power BI Quick Start Guide*. Packt Publishing.
5. Powell, B. (2024). *Mastering Microsoft Power BI.* Packt Publishing.
6. McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*. O'Reilly Media.
7. Grus, J. (2019). *Data Science from Scratch: First Principles with Python.* O'Reilly Media.
8. Holmes, D. E. (2017). *Big Data: A Very Short Introduction.* Oxford University Press.
9. Balusamy, B., Abirami, N. R., Kadry, S., & Gandomi, A. (2021). *Big Data: Concepts, Technology, and Architecture*. Wiley.