Tribhuvan University
Faculty of Education
Office of the Dean

BACHELOR OF INFORMATION AND COMMUNICATION TECHNOLOGY EDUCATION (BICTE)
Fifth Semester Curriculum

Office of the Dean
Faculty of Education
Tribhuvan University
Kathmandu

Table of Contents

Ed. 452 : Assessment and Evaluation in Education 1
ICT. Ed 455 : Java Programming Language 2 6
ICT. Ed. 456: Data Communication and Networks 12
ICT Ed. 457: Software Engineering and Project Management 18
Math. Ed. 456 : Discrete Mathematics 23

Course Title: Assessment and Evaluation in Education

Course No.: Ed. 452
Level: Bachelor
Semester: Fifth
Program: BICTE

Nature of Course: Theoretical
Credit Hours: 3
Teaching hours: 48

1. Course Description

This course is designed to provide students with an understanding of the basic concepts of test, assessment, measurement and evaluation in education. It also intends to help students understand different types of evaluation and qualities of a test. It further deals with the construction and purposes of teacher made test, measuring instruments, administration and scoring of the test, use of statistics in the interpretation of test results. Moreover, students will be familiar with the current assessment system at the school level of Nepal.

2. General Objectives

The general objectives of the course are as follows:

- To provide the students with a deeper understanding of the concept of test, assessment, measurement and evaluation
- To acquaint the students with types and qualities of the test
- To develop skills among the students in constructing test items with technical qualities
- To enable the students in administering and scoring different types of test items
- To enable the students to analyze the test results
- To familiarize the students with the existing evaluation practices of the schools of Nepal

3. Specific objectives and contents

Specific Objectives	Contents
• Differentiate test, measurement, assessment and evaluation. • Explain various types of evaluation in terms of purpose, tools and uses.	**Unit 1: Assessment and Evaluation (8)** 1.1 Concept of test, measurement, assessment and evaluation 1.2 Types of evaluation: purpose, tools and uses 1.4.1 Diagnostic 1.4.2 Placement 1.4.3 Formative 1.4.4 Summative
• Explain the essential qualities of a test.	**Unit 2: Characteristics of a Test (10)** 2.1. Essential qualities of a test 2.1.1 Reliability 2.1.2 Validity

• Explain the methods of estimating reliability. • Describe various types of validity.	2.1.3 Objectivity 2.1.4 Usability 2.2 Methods of estimating reliability 2.2.1 Test-retest 2.2.2 Parallel form 2.2.3 Split halves 2.2.4 Kuder-Richardson method 2.3 Types of validity 2.3.1 Content 2.3.2 Criterion: concurrent and predictive 2.3.3 Construct
• Explain the teacher made test. • Discuss the purposes of testing. • Explain the meaning, types, construction and uses of subjective and objective type tests. • Identify necessary process for preparing test items. • Discuss the cognitive domain of the taxonomy of educational objectives • Plan the test for classroom testing purpose • Write instructional objectives for testing. • Prepare specification chart. • Construct subjective and objective test items.	**Unit 3: Construction of Teacher Made Test (12)** 3.1 Concept of teacher made test 3.2 Purposes of testing: Instructional, grading, diagnostic, selection, placement, counseling, curricular decisions and policy making 3.3 Types of test items 3.3.1 Subjective test: types, construction and uses 3.3.2 Objective test items: types construction and uses 3.4 Taxonomy of educational objectives: cognitive domain 3.5 Teacher made test: construction process 3.5.1 Planning the test • Writing instructional objectives • Preparing specification chart 3.5.2 Preparing the test • preparing test items • Preparing instructions • Preparing scoring key and marking scheme
• Describe the necessary conditions and administration of test. • Suggest measures for scoring the subjective and objective answer sheets • Apply frequency of distribution, graphical representation, central tendency	**Unit 4: Administration, Scoring and Analysis of Test (8)** 4.1 Conditions and administration of test 4.2 Scoring of subjective and objective answer sheets 4.3 Statistical analysis of test scores 4.3.1 Frequency distribution 4.3.2 Graphical representation: line-graph, bar-graph and pie chart 4.3.3 Central tendency: Mean, Median, Mode 4.3.4 Measure of dispersion: Standard deviation

and standard deviation in interpreting test scores.	
• Explain the current assessment system of school education in Nepal. • Describe the techniques for assessing students with special needs • Explain the meaning, process and practice of continuous assessment system. • Describe the policies, practices, challenges and issues related to student assessment system at the school level of Nepal.	**Unit 5: Current Student Assessment System in Nepal (10)** 5.1 Existing student assessment system at school level 5.2 Assessing students with special needs 5.3 Continuous assessment system (CAS): concept, process and practice 5.4 Challenges and issues of existing student assessment system at school level

Note: Figures within parenthesis indicate approximate teaching hours.

4. 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.

4.1 General Instructional Techniques

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

4.2 Specific Instructional Techniques

Unit	Suggested specific Instructional Techniques
III	• Students will be divided into groups and they will be sent to school with their constructed test items for their administration. • Students will have to score different types of test items administered in the schools • Students will have to calculate frequency distribution, mean, mode and median, and standard deviation.
V	• Students will be assigned individually to visit schools in order to study assessment system. • Students will prepare reports on policy and practices of assessment system in the schools of Nepal and present in the class. • Presentation will be followed by teacher's feedback.

5. Evaluation

5.1 Internal Evaluation 40%

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

1) Attendance	5 Points
2) Class participation	5 Points
3) First assignment (Group work based on school visit- unit III)	10 Points
4) Second assignment (Based on reports on Nepalese education system Unit IV)	10 Points
5) Third assignment (Written test: objectives and subjective)	10 Points
Total	40 Points

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 1ponts)	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

Aggarwal, J.C. (1997). *Essential of examination system (Evaluation, test and measurement).* New Delhi: Vikas Publishing House.(Pvt.) Ltd. (Unit I-IV)

Ebel, R.C. (1972). *Essentials of educational measurement.* Englewood Cliffs, New Jersey: Prentice-Hall. (Unit I and II)

Gupta, S.P. (1991). Statistical methods. New Delhi: Sultan Chand and Sons Publishers. (Unit IV)

Kubiszyn, T. & Borich, G. (2003). *Educational testing and measurement: Classroom application and practice.* Singapore: John Wiley Sons. (Unit 1 and 2)

Linn, R.L. & Gronlund, N.E. (2008). *Measurement and assessment in teaching (9th Ed.).* India: Pearson Education. (Unit 1-3)

Popham, W.J. (1981). *Modern Educational Measurement.* Englewood Cliffs, New Jersey: Prentice-Hall.(Unit 1 and 2)

Singh, A.K. (2004). *Test, measurement and research method in behavioural science, 3rd Ed.* (Revised reprinted). Bharati Bhaban (P & D). (Unit 1-4)

Thorndike, R.L. and Hegen (1977). *Measurement and evaluation in psychology and education, 4th ed.* New York: John, Willey and Sons. (Unit 1 and 2)

References

Adhikari, B.K. (1959 BS). *Educational measurement and evaluation.* Kathmandu: Pinacal Publication.

Freeman, R. & Lewis, R. (2005). *Planning and implementing assessment.* London and New York: Rutledge Falmer Publication.

JBR, S. P. and et. al. (2061 BS). *Theory and practice of measurement and evaluation in education.* Kathmandu: Viddyarthy Pustak Bhandar.

Khanal, P. (2061). *Education research methodology*. Kathmandu, Kirtipur: Students' Book Publishers and Distributers.

Sidhu, K.S. (2005). New approaches to measurement and evaluation. New Delhi:

ICT.Ed.455 : Java Programming Language

Course No. : ICT.Ed.455
Level: Bachelor.
Semester: Fifth
Program: BICTE

Nature of course: Theoretical + Practical
Credit Hour: 3 hours (2T+1P)
Teaching Hour: 80 hours (32+32)

1. **Introduction:**

This course covers object-oriented dimensions of computer programming. It aims to provide students with knowledge and skills on programming terminologies including features of object oriented, data type, operators, variables, constants, control statements, arrays, classes and objects, inheritance and interfaces, exception handling, multithreading programming, I/O handling, event handling, swing and java database connectivity.

2. **Course Objectives:**

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

- explain the Java programming environment
- describe and apply the concepts of programming elements using Java and object-oriented programming concepts
- make use of multithreading programming, exception handling and input/output handling in Java
- apply the event handling, GUI programming using swing, and Java database connectivity

3. **Course Outlines:**

Specific Objectives	Contents	Teaching Hours (T+P)
• Describe the basic concept of Java Programing • Make use of different data types and variable. • Use control structure to control execution of programs	**Unit 1: Java Fundamentals, Data Types, Operators and Control Statements** 1.1. History and Philosophy of Java 1.2. Object Oriented Programming 1.3. Java Development Kit 1.4. A First Simple Java Program 1.5. Packages in Java 1.6. Java's Data Types 1.6.1 Integers 1.6.2 Characters 1.6.3 Floating Point Types 1.6.4 Strings	7+7

	1.6.5 Arrays 1.6.6 The Boolean Types 1.7. Literals 1.7.1. Hex, Octal and Binary 1.7.2. Character Escape Sequences 1.7.3. String Literals 1.8. Variables and Constants 1.9. Operators 1.10. Type Casting 1.11. Control Statements 1.11.1. if statement 1.11.2. switch statement 1.11.3. loop statement 1.11.4. continue statement 1.11.5. break statement **Practical Work** • Installation of Java SE and Editors (Notepad++ or NetBeans or Eclipse) on local machine • Writing, Compiling and Executing the first program • Realize different data types in programs • Make use of variables and constants • Write programs to realize different types of operators • Write expression to deploy type conversion • Apply Decision Making and Loop Control • Apply String manipulation and array manipulation	
• Explain and apply the principles of the object-oriented programming • Create programs with methods, constructors, nested and inner classes	**Unit 2: Introducing Classes, Objects and Methods** 2.1 Class Fundamentals 2.2 Object Creation 2.3 Methods 2.4 Command Line Arguments 2.5 Constructors 2.6 Garbage Collection 2.7 This keyword	**6+6**

• Explain garbage collection and variable length arguments • Analyze and apply static fields and methods, this keyword • Demonstrate skills to write. Program to illustrate class and objects, and implement command line arguments in Java • Able to write program with multiple methods	2.8 Static Fields and Methods 2.9 Nested and Inner Classes 2.10 Variable Length Arguments **Practical Work** • Write program to illustrate Class and objects. • Implement command line arguments in java • Write program with multiple methods • Write program that contains constructors • Write program to make use of static methods and members	
• comprehend inheritance, polymorphism, abstract classes and interfaces • Describe and apply access control, super and final keyword • Demonstrate skills for writing program to illustrate simple hierarchical and multilevel inheritance, and implement polymorphism. • Design abstract class, and create and make use of interface	**Unit 3: Inheritance and Interfaces** 3.1 Inheritance Basics 3.2 Inheritance and Constructors 3.3 super keyword 3.4 Method Overriding 3.5 Polymorphism 3.6 Dynamic Binding 3.7 final Keyword 3.8 Abstract Classes 3.9 Access Specifiers 3.10 Interfaces **Practical Work** • Write program to illustrate simple, hierarchical and multilevel inheritance. • Write program to implement polymorphism. • Design abstract class. • Create and make use of interface.	**4+4**
• Explain how to deploy error handling gracefully in java • Describe process of deploy multithreading • Describe and apply skills for writing program to implement exception handling in program, and	**Unit 4: Exception Handling and Multithreading** 4.1 The Exception Hierarchy 4.2 Exception handling fundamentals 4.3 Throwing, Re-throwing and Catching Exceptions 4.4 try, catch, throw, throws, and finally keywords 4.5 Multithreading fundamentals	**3+3**

apply try, catch, throws and finally • Apply of theoretical knowledge to Write program to create threads and multiple threads	4.6 Thread class and Runnable Interface **Practical Work** • Write program to implement exception handling in program. • Apply try, catch, throws and finally • Write program to create threads and multiple threads	
• Identify different I/O streams in Java • Read and Write File effectively • Access files randomly	**Unit 5: Using I/O** 5.1 Console and File I/O 5.2 Opening and closing files 5.3 Scanner Class 5.4 Byte Streams and Character Streams 5.5 Reading and Writing Byte Streams 5.6 Reading and Writing Character Streams 5.7 Random Access Files **Practical Work** • Write program to apply different input and output classes. • use various methods for file I/O	**4+4**
• Describe philosophy and contents of Swing, layout manager and events handling. • Describe process of swing event handling and generate layout with layout managers • Build GUI with Swing components. • Connect the data and java interface using JDBC	**Unit 6: Introducing Swing and Java Database Connectivity (JDBC)** 6.1 Design philosophy of Swing 6.2 Components and Containers 6.3 Layout Managers 6.4 Swing Event Handling 6.5 Basic Swing Components: JButton, JTextField, JCheckBox, JList 6.6 Use Anonymous Inner Classes to Handle Events 6.7 The Design of JDBC 6.8 Executing SQL Statements 6.9 Query Execution **Practical Work** • Write program to apply event handling classes	**8+8**

	• Design layout using swing • Write java program that establish connection with database and execute CRUD operations using JDBC	

4 Instructional Techni

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:

Laboratory Work: The laboratory work includes writing programs to understand all the programming concepts of Java including data types, operators, control statements, objects and classes, inheritance, interface, multithreading, exception handling, input/output handling, event handling, swing and JDBC.

5 Evaluation

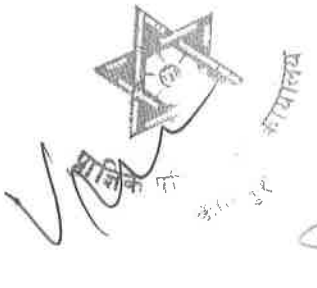
Internal Assessment	External Practical Exam/Viva	Semester Examination	Total Marks
40 Points	20 Points	40 Points	100 Points

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

a. Internal Evaluation (40 Points):

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

6) Class Attendance	5 points
7) Learning activities and class performance	5 points
8) First assignment (written assignment)	10 points
9) Second assignment (Case Study/project work with presentation)	10 points
10) Terminal Examination	10 Points
Total	40 points



b. Semester Examination (40 Points)

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

1) Objective question (Multiple choice 10 questions x 1mark)	10 Points
2) Subjective answer questions (6 questions with 2 OR x 5 marks)	30 Points
Total points	40

c. **External Practical Exam/Viva (20 Points):**
Examination Division, Dean Office will conduct final practical examination at the end of semester.

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

Prescribed Text Book:
Java: A Beginner's Guide (2022), 9th Ed., Herbert Schildt, MC Graw Hill

Recommended books:
Core java Volume I – Fundamentals, Ninth Edition, Cary S. Horstmann and Gary Cornell
Core java Volume II – Advanced Features, Ninth Edition, Cary S. Horstmann and Gary Cornell
Java: The Complete Reference, Ninth Edition, Herbert Schildt
Effective Java, Third Edition, Joshua Bloch
Head First Java, 2nd Edition, Kathy Sierra and Bert Bates

Course Title: Data Communication and Networks

Course No.: ICT. Ed. 456
Level: Bachelor.
Semester: Fifth
Program: BICTE

Nature of course: Theoretical + Practical
Credit Hour: 3 hours (2T+1P)
Teaching Hour: 64hours (32+32)

1. Course Description

This course introduces the fundamental concepts on data communication, data transmission mechanisms, Network Architectures, Internet protocols, Local area networks and the practical aspects of networking. It also aims to develop networking skill such as sub-netting and network infrastructure design and development among students.

2. General Objectives

After successful completion of this course students will be able to

- Identify the different components and their respective roles in computer network and internet
- Explain different services provided by the Network Layers
- Design an enterprise network employing the WLAN, LAN and VLAN technologies and be able to evaluate the advantages and disadvantages
- Configure a PC to work as a host in a TCP/IP network and to use the IP based commands

3. Course Outlines:

Specific Objectives	Contents	Lecture Hrs
• Describe the basic concept of computer network and Internet • Explain layered architecture • Apply computer network skills for installation of Wireshark • Describe process and components of computer networking and install Wireshark for the networking	**Unit 1: Computer Networks and the Internet** 1.1. The Internet 1.2. The Network Edge : Access Networks, Physical Media 1.3. The Network Core : Packet Switching, Circuit Switching 1.4. Delay,Loss, and Throughput in Packet-Switched Networks 1.5. Protocol Layers and Their Service Models : Layered Architecture, Encapsulation 1.6. History of Computer Networking and the Internet **Practical Work** • Installation of Wireshark (free packet sniffer app) and able to use it	3+3

• Describe different services provided by application layer • Identify different application layer protocols • Discuss and apply DNS, peer to peer file distribution and video streaming and content distribution networks • Apply of knowledge and skills for Netflix, youTube, and Wireshark Lab.	**Unit 2: Application Layer** 2.1. The Web and HTTP: overview of HTTP, HTTP Message Format, User-Server Interaction: Cookies, Web Caching 2.2. Electronic Mail in the Internet : SMTP, Mail Message Formats, Mail Access Protocols 2.3. DNS—The Internet's Directory Service 2.4. Peer-to-Peer File Distribution 2.5. Video Streaming and Content Distribution Networks **Case Studies:** • Netflix and YouTube **Practical Works:** • Wireshark Lab: HTTP and DNS	**5+5**
• Describe the basics of transport layer • Compare and contrast different aspect of TCP and UDP • Discuss connection less and connection-oriented transport • Apply knowledge and skills of transport layer for Wireshark Lab	**Unit 3: Transport Layer** 3.1. Introduction and Transport-Layer Services 3.1.1. Relationship Between Transport and Network Layers 3.1.2. Overview of the Transport Layer in the Internet 3.2. Multiplexing and De-multiplexing 3.3. Connectionless Transport: UDP 3.3.1. UDP Segment Structure 3.3.2. UDP Checksum 3.4. Principles of Reliable Data Transfer 3.4.1. Go-Back-N (GBN) 3.4.2. Selective Repeat (SR) 3.5. Connection-Oriented Transport: TCP 3.5.1. Round-Trip Time Estimation and Timeout 3.5.2. Reliable Data Transfer 3.5.3. Flow Control 3.6. TCP Congestion Control **Practical Works:** • Wireshark Lab: Exploring TCP and UDP	**6+6**

• Describe the network layer data plane and control plane differently • Explain the router and different routing algorithms • Make distinction between IPv4 and IPv6 • Apply knowledge and skills of the network layer such Data Plane, Control Plan for Wireshark Lab as well as practicing sub-netting to create small networks	**Unit 4: The Network Layer** 4.1. Data Plane 4.1.1. Inside the Router 4.1.1.1 Input Port Processing and Destination Based Forwarding 4.1.1.2 Switching 4.1.1.3 Output Port Processing 4.1.1.4 Queuing 4.1.1.5 Packet Scheduling 4.1.2. The Internet Protocol (IP) 4.1.2.1 IPv4 Datagram Format 4.1.2.2 IPv4 Addressing 4.1.2.3 Subnetting 4.1.2.4 Network Address Translation (NAT) 4.1.2.5 IPv6 4.2. Control Plane 4.2.1. Routing Algorithms 4.2.1.1 The Link-State (LS) Routing Algorithm 4.2.1.2 The Distance-Vector (DV) Routing Algorithm 4.2.2. Intra-AS Routing in the Internet: OSPF 4.2.3. Routing Among the ISPs: BGP 4.2.4. ICMP: The Internet Control Message Protocol **Practical Works:** • Wireshark Lab: IP • Practice Sub-netting to create small networks	**8+8**
• Explain Link Layer protocols and services provided by link layer • Get insight and analyze error detection and error correction techniques • Explain DHCP, Ethernet technology and VLANs	**Unit 5: The Link Layer and LAN** 5.1. Introduction to the Link Layer 5.1.1 The Services Provided by the Link Layer 5.2. Error-Detection and -Correction Techniques 5.2.1 Parity checks 5.2.2 Check Sum Methods 5.2.3 Cyclic Redundancy Check (CRC) 5.3. Multiple Access Links and Protocols 5.3.1 Channel Partitioning Protocols	**6+6**

• Apply knowledge and skills of the link layer and LAN including multiple access links and protocols switched local area networks, DNS, ARP and Web Client-Server Interaction for Wireshark Labs: 802.11 Ethernet	5.3.2 Random Access Protocols 5.3.3 Taking-Turns Protocols 5.3.4 DOCSIS: The Link-Layer Protocol for Cable Internet Access 5.4. Switched Local Area Networks 5.4.1 Link-Layer Addressing and ARP 5.4.2 Ethernet 5.4.3 Link-Layer Switches 5.4.4 Virtual Local Area Networks (VLANs) 5.5. A Day in the Life of a Web Page Request 5.5.1 DHCP, UDP, IP, and Ethernet 5.5.2 DNS and ARP 5.5.3 Intra-Domain Routing to the DNS Server 5.5.4 Web Client-Server Interaction: TCP and HTTP **Practical Works:** • Wireshark Labs: 802.11 Ethernet	
• Describe and apply Wireless technologies: WiFi and cellular networks • Apply knowledge and skills related to wireless and mobile networks for Wireshark Lab: Wif-Fi	**Unit 6: Wireless and Mobile Networks** 6.1. WiFi: 802.11 Wireless LANs 6.1.1 The 802.11 Wireless LAN Architecture 6.1.2 The 802.11 MAC Protocol 6.1.3 The IEEE 802.11 Frame 6.1.4 Mobility in the Same IP Subnet 6.1.5 Personal Area Networks: Bluetooth 6.2. Cellular Networks: 4G and 5G **Practical Works:** • Wireshark Lab: Wi-Fi	**4+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:

Unit 1: Assign students to prepare presentation on Internet
Unit 2: Self-study and ask students to prepare case study report on YouTube and Netflix
Unit 3: Homework and Assignment on TCP and UDP
Unit 4: Homework and Assignment on subnetting
Unit 5: Homework and Assignment on Error Detection and Correction Methods
Unit 6: Self-study and ask students to make detail report and presentation on Wireless Technologies: CDMA, 4G, 5G, WiFi: 802.11 Wireless LANs

5 Evaluation :

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

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

a. Internal Evaluation (40 Points):

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

11) Class Attendance	5 points
12) Learning activities and class performance	5 points
13) First assignment (written assignment)	10 points
14) Second assignment (Case Study/project work with presentation)	10 points
15) Terminal Examination	10 Points
Total	40 points

b. Semester Examination (40 Points)

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

3) Objective question (Multiple choice 10 questions x 1mark)	10 Points
4) Subjective answer questions (6 questions with 2 OR x 5 marks)	30 Points
Total points	40

c. External Practical Exam/Viva (20 Points):

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

Faculty of Education
Office of the Dean
Balkhu, Kathmandu

6 Prescribed Textbook, Recommended books and References materials (including relevant published articles in national and international journals)

Prescribed Text Book:

James F. Kurose & Keith W. Ross, Computer Networking: A Top-Down Approach, 8th Ed., Pearson Education

Recommended Books and Reference Materials:

Tanenbaum Andrew S., Computer Networks, 4th edition (2nd Impression 2006) or available latest edition

William Stallings, Data and Computer Communications, 7th Edition (3rd Impression 2007) or available latest edition

Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, 4th Edition

Halsall Fred, Data Communications, Computer Networks and OSI, 4th edition (10th Indian reprinting 2005)

Course Title: Software Engineering and Project Management

Course No. : ICT Ed. 457
Level: Bachelor
Semester: Fifth
Program: BICTE

Nature of course: Theory + Project
Credit Hour: 3 hours (2T+1P)
Teaching Hour: 64 hours (32+32)

4. Course Description

This course is designed to introduce the fundamental concepts of Software and professional development techniques to the students. It aims to provide in depth knowledge regarding process models, agile development, requirement engineering, software design, software validation, software evolution and maintenance including software management terminologies.

5. General Objectives

Through this course, students shall be able to :

- Evaluate and relate different software processes, system models and architectural designs and assess their suitability in a given context
- Describe and apply basic concepts and principles of requirements engineering, software implementation, testing and maintenance
- Describe the software configuration process and quality assurance
- Apply the software project manage practices and principle in software development.

6. Course Outlines:

Specific Objectives	Contents	Lecture Hours
• Describe the concept of professional development and software engineering ethics • Analyze different types of system through case studies • Identify business problem and prepare software project proposal to solve the problem	**Unit 1: Introduction to Software Engineering** 1.7. Professional Software Development 1.8. Software Engineering Ethics **Case Studies** • Prepare summary report of the following case studies and present it in the classroom: -An Embedded System -An Information System -A Sensor Based Data Collection System -A Support Environment **Practical Works** • Visit any local organization to identify problem of their business process	3 + 6

	• Discuss with your class teacher and prepare software project proposal to address the problem identified	
• Describe the types of software development process • Make comparison of different software process model • Analyse changing business environment with software change management • Explain agile development models and agile project management	**Unit 2: Software Processes and Agile Software Development** 2.6. Software Process Models 2.7. Process Activities 2.8. Coping with Change 2.9. Agile Methods 2.10. Agile Development Techniques 2.11. Agile Project Management 2.12. Scaling Agile Method	**6**
• Identify types of requirements • Explain requirement engineering process • Apply knowledge and skills of requirements engineering for the software project	**Unit 3: Requirements Engineering** 3.1. Functional and Non-Functional Requirements 3.2. Requirements Engineering Processes 3.3. Requirements Elicitation 3.4. Requirements Specification 3.5. Requirements Validation **Practical Works** • Gather functional requirements for the software project and prepare requirement document	**4 + 4**
• Describe need and importance of software architectural design and system modeling • Discuss and apply about different design models in architectural and system modeling • Make distinction between different architectural patterns and application architectures	**Unit 4: Architectural Design And System Modeling** 4.1. Context Models 4.2. Interaction Models 4.3. Structural Models 4.4. Behavioural Models 4.5. Architectural Design Decisions 4.6. Application Architectures **Practical Works** • Prepare design document for the software project	**6 + 4**

• Able to prepare design document for the software project.		
• Describe the need of software validation • Discuss different stages in testing and its process • Explain the concept of software evolution process • Make list of software maintenance issues • Analyze the concepts of legacy system • Able to prepare test case document for the software project	**Unit 5: Software Testing and Software Evolution** 5.1. Development Testing 5.2. Test-Driven Development 5.3. Release Testing 5.4. User Testing 5.5. Evolution Processes 5.6. Legacy Systems 5.7. Software Maintenance **Practical Works** • Prepare test case document for the software project	**5 + 4**
• Explain software project management and planning • Discuss about project estimation techniques • Illustrate the COCOMO model • Discuss about risk management • Explain about software management: quality, software standards, version management, change management and version management	**Unit 6: Software Management** 6.1. Project Management 6.1.1 Risk Management 6.1.2 Managing People 6.1.3 Teamwork 6.2. Project Planning 6.2.1 Software Pricing 6.2.2 Project Scheduling 6.2.3 Agile Planning 6.2.4 Estimation Techniques 6.3. Software Quality and Standards 6.4. Version Management 6.5. Change Management 6.6. Release Management	**8**
• Transform theoretical knowledge to solve real world problems	**Unit 7: Software Engineering Project (Practical Works)** 7.1 Design and develop software project in any of the high level language for partial fulfillment of the course Software Engineering.	**14**

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 1: Self reading, and making study reports
Unit 2: Comparison about different software process model and Assign group discussion task about agile development models
Unit 3: Homework and Assignment on Requirement engineering process
Unit 4: Homework and Assignment to design different system models
Unit 5: Group Discussion on Software testing strategies, Software Evolution and legacy systems
Unit 6: Self reading, creating and presenting on different topics related to software management
Unit 7: Assign to develop a software that can solve real world problem

5 Evaluation

Internal Assessment	External Project Demo Exam/Viva	Semester Examination	Total Marks
40 Points	20 Points	40 Points	100 Points

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

a. Internal Evaluation (40 Points):

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

16) Class Attendance	5 points
17) Learning activities and class performance	5 points
18) First assignment (written assignment)	10 points
19) Second assignment (Case Study/project work with presentation)	10 points
20) Terminal Examination	10 Points
Total	40 points

b. Semester Examination (40 Points)

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

5) Objective question (Multiple choice 10 questions x 1mark) 10 Points
6) Subjective answer questions (6 questions with 2 OR x 5 marks) 30 Points

Total points	40

c. **External Project Demonstration Exam/Viva (20 Points):**

External Examination will be evaluated on the basis of following:

1. Project Report: 10 points
2. Project Demonstration: 5 points
3. VIVA: 5 points

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

Prescribed Text Book:

Ian Sommerville. (2015). *Software Engineering* (10th Ed.). Pearson Education

Ian Sommerville (2020). *Engineering Software Products: An Introduction to Modern Software Engineering*, Pearson Education

References materials:

Pressman, R. S. (2010). *Software Engineering: A practitioner's Approach*, 7th Ed. Boston, Mass: McGraw Hill.

John Ousterhout (2021). *A Philosophy of Software Design*, 2nd Ed.

Course Title: Discrete Mathematics

Course No.: Math. Ed. 456
Level: BICTE
Semester: Fifth
Program: BICTE

Nature of course: Theoretical
Credit Hour: 3
Teaching Hour: 48 hours

1. Course Description:

This course is designed for the students of BICTE under Faculty of Education, Tribhuvan University. The course, Discrete Mathematics, is a 3- credit unit course for students studying towards acquiring the Bachelor of Information and communication technology in Education. In this course we will study about discrete objects and the relationship between them and introduce the applications of discrete mathematics in the field of Computer Science. This course provides an introduction to foundational topics in discrete mathematics and the theory of computation. It covers essential concepts such as combinatory, induction and recurrence relations, Boolean algebra, cryptography, functions and sorting algorithms, and finite state automata. Students will develop problem-solving skills and gain a solid understanding of the theoretical foundations of computer science.

2. General Objectives

The general objectives of this course are as follows:

1. To understand the fundamental principles and techniques of combinatory and their applications.
2. To analyze mathematical statement and proofs using induction and recurrence relations.
3. To apply Boolean algebra to analyze and design digital circuits and logical expressions.
4. To explore the principles of cryptography and understand various cryptographic algorithms and protocols.
5. To describe and apply the concepts of functions and sorting algorithms and analyze their efficiency and performance.
6. To understand finite state automata and their applications in formal languages and computational models.

1. Specific Objectives and Contents

Unit 1	I: Combinatory (6 hr)
• to describe and apply counting principles to solve problems. • to solve problems by using the pigeonhole principle • To apply Ramsey's theorem to solve problems. • to calculate and use of the binomial coefficients to solve problems. • to apply the principle of inclusion and exclusion to solve problems.	1.1 Counting principles 1.2 The Pigeonhole Principle and uses 1.3 Ramsey's Theorem 1.4 Outing Strategies 1.5 The binomial coefficients 1.6 principle of inclusion and exclusion
Unit 2	**II: Induction and Recurrence Relations (10 hr)**
• To apply inductive and deductive reasoning to prove mathematical statements. • To use mathematical induction and strong induction to prove mathematical statements. • To solve linear recurrence relations with constant coefficients. • To describe Predicates and Quantification. • To find a particular solution to a linear recurrence relation with constant coefficients. • To apply particular solutions to solve problems. • To apply total solutions to solve problems. • To use generating functions to solve problems involving recurrence relations.	2.1 Inductive and deductive reasoning Mathematical induction 2.2 Applications of mathematical induction 2.3 Strong induction 2.4 Predicates and Quantification 2.5 Recurrence Relations 2.6 Linear recurrence Relations with constant Coefficients 2.7 Particular solution 2.8 Total solution 2.9 Generating function
Unit 3	**III: Boolean Algebra (6 hr)**
• To understand the basic concepts of Boolean algebra, with operators. • To construct and simplify Boolean expressions. • To describe and use of Boolean fuctions. • To use Karnaugh maps to simplify Boolean expressions.	3.1 Boolean Algebra 3.2 Boolean Expression POS and SOP expressions 3.3 Boolean functions Representation, minimization, duality, and complement 3.5 Karnaugh Maps

Unit 4	IV: Cryptography (10 hr)
• To review modular arithmetic, such as the modulus, the Euclidean algorithm, and Fermat's little theorem. • To describe classical cryptography, such as substitution ciphers, transposition ciphers, and the one-time pad. • To apply the basic principles of modern cryptography, public-key cryptography, symmetric cryptography, and hash functions. • To use the basic principles of private-key cryptography, RSA algorithm, modulus,	4.1. Modular arithmetic and properties 4.2. Classical cryptography 4.3. Modern cryptography 4.4. Private- key cryptography 4.5. Public- key cryptography 4.6. The RSA system
Unit 5	**V: Functions and Sorting Algorithm (6 hr)**
• To define relations and functions using graphs and tables. • To find the composite of two functions and inverse of a function. • To understand the special properties of some common functions, such as hashing, greatest integer function, celling function, and floor function. • To use different notations to represent algorithms, such as pseudo code and flowcharts. • To understand and use of the different sorting algorithms.	5.1 Relations (equivalence relation and ordering (partial and linear) relation) and functions 5.2 Composite and inverse function 5.3 Special types of functions(Hashing, Greatest integer function, celling function, floor function) **5.4** Sorting algorithm(Quick, insertion, Radix, Heap, Bubble, Merge, counting)
Unit 6	**VI: Finite State Automata. (10hr)**
• Review the basic concepts of graphs, such as vertices, edges, and paths, adjacency matrix, etc. • To understand the basic concepts of alphabets, languages, and grammars. • To construct and classify different types of grammars.	6.1. Review of graphs (concept only) 6.2. Alphabet, Languages and Grammars 6.2.1 Introduction 6.2.2 Phrase- structure grammar and types 6.2.3 Deviation tree 6.3. Finite-State Machines with Output 6.4. Finite-State Machines with No Output 6.5. Sequence Recognizer Machine

• To construct derivation trees for different types of grammars. • To construct and analyze finite-state machines with output. • To construct and analyze finite-state machines with no output. • To design and implement language recognizers. • To prove that Turing machines are computationally universal.	6.6. Language Recognition 6.7. Turing Machines

2. Instructional Techniques

Units	Activity and Instructional Techniques
Unit I	• Individual and group discussion on calculating errors • Individual and group discussion on bisection and iteration methods
Unit II	• Group and individual discussion on different methods of solving linear simultaneous equations
Unit III	• Group and individual discussion on Differences of polynomials and operators
Unit IV	• Individual and group assignments on Interpolations
Unit V	• Presentation and discussion with problem solving method on interpolations with unequal intervals.
Unit VI	• Individual and group presentation on Numerical Differentiation and integration
Unit I - V	• *The classroom instructions may include the numerical calculation and computation by using programming language C++ or JAVA or different computer applications like: Matlab, Geogebra and MS Excel.*

3. Evaluation

A. Internal evaluation

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

a. Attendance 5 points
b. Participation in learning activity 5 points
c. First assignment / test 10 points
d. Second assignment / test 10 points
e. Third assignment / test 10 points

Total	40 points

NOTE: Internal evaluation and assignments may include the numerical calculation and computation by using different computer application like as Matlab, Geobebra and MS Excel also.

B. External Evaluation:

Faculty of Education, Examination division will conduct final examination of weight 60 points at the end of semester. This 60 points is divided in final examination paper as

Objective questions	(10 Questions x 1 Marks)	10 points
Short answer questions	(6 Questions with 2 OR x 5 Marks)	30 points
Long answer questions	(2 Questions with 1 OR x 10 Marks)	20 points
Total		60 points

4. Recommended books

Kenneth, H. Rosen (2012). *Discrete mathematics and its applications*, Seventh Edition McGraw Hill Publication.

B. Kolman, R. Busby, Sharon C. Ross (2015). *Discrete Mathematical Structures*, Sixth Edition Pearson Publications,

Joe L Mott, Abraham Kandel, Theodore P Baker (2008), *Discrete Mathematics for Computer Scientists and Mathematicians*, Printice Hall of India, Second Edition,