Network and System Administration

Course Title: Network and System Administration
Course No: BIT451
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60+ 20+20
Pass Marks: 24+8+8
Credit Hrs: 3

Course Description:
This course focuses on the network and system operation and management and covers subjects of day-to-day administrative tasks such as Network and Server Configurations, management of user accounts and disk space, and the trouble-shooting skills future networking and system administrations.

Course Objectives:
To provide the concept of network and system operation, management and administration, Furthermore, it discusses about different configurations and trouble-shooting.

Course Contents:

Unit 1: Networking Fundamentals (4 Hrs.)
Overview of Network Reference Model (OSI, TCP/IP), Concepts of Ipv4 Addressing, VSLM, CIDR, Introduction to Ipv6 Addressing, Types, Formats, Address Auto-Configuration, Networking Configuration Basics for Windows and Linux System, Fundamentals of Unicast and Multicast Routing in Ipv6, Introduction to Programmable Networks: SDN and Openflow

Unit 2: Systems Administration (8 Hrs.)
Linux Server and Desktop OS Installation, Disk Partitioning, Logical Volume Manager, Boot Process and Startup Services: Xinetd/Inetd, Managing Accounts: Users, Groups and Other Privileges Job Scheduling with Cron, Crontab, Anacron and System Log Analysis, Introduction to Cell, Programming, Online Server Upgrade/Update Process, Server Monitoring and Management Basics

Unit 3: Network Administrations (7 Hrs.)
Network Interface Configuration, Diagnosing Network Startup Issues, Introduction to Packet Level and Application Level Firewall, Fundamental Commands in Network Troubleshooting, SDN Operations and Management, SDN Controller and Dataplane Communication, Fundamental of Open Source Networking Monitoring (E.G. Nagios)

Unit 4: Dynamic Host Configuration Protocol (DHCP) (3 Hrs.)
DHCP Principle, DHCP Options, Scope, Reservation and Relaying, DHCP Troubleshooting

Unit 5: DNS Server Administration (7 Hrs.)
DNS Principles and Operations, Types of DNS Queries, DNS Server Types and Functionalities, Caching Only Name Server, DNS Zone Transfers, DNS Dynamic Updates, DNS Delegation

Unit 6: Web and Proxy Server Administration (7 Hrs.)
Web Server Configuration Basics, Name Based and IP Based Virtual Hosting, Caching only Name Server – Proxy Cashing Server Administration, Proxy ACL, Bandwidth Management, Proxy Firewall Implementation Basics

Unit 7: Print and FTP Server Administration (4 Hrs.)
General Samba Configuration, CUPS Configuration Basics, FTP Principles, Anonymous FTP, Server Configuration

Unit 8: Mail Server basics (5 Hrs.)
SMTP, POP and IMAP Principles, SMTP Relaying Principles, Mail Domain Administration, Basic Mail Server Configuration (Sendmail, Postfix), SPAM Control and Filtering

Laboratory works:
The laboratory works should include all the features mentioned in the course

Samples:
1. Server/Client Installation over VMware Environment
2. Network Practice with Packet Tracer
3. System Administration: User/Group management, File System Management ….
4. Network Configuration: Start/Stop network Service, network interface configuration
5. Firewall Configuration
6. DNS and DHCP Configuration and Troubleshooting
7. Web and Proxy Server Configuration and Troubleshooting
8. Basic Mail Server Configuration and Troubleshooting

References:

1. The Practice of System and Network Administration, Second Edition Thomas A. Limoncelli, Christina J. Hogan , Strata R. Chalup
2. Advanced Linux Networking, Roderick W. Smith, Addison-Wesley Professional (Pearson Education), 2002.
3. Linux Network Administrator's Guide, Tony Bautts, Terry Dawson, Gregor N. Purdy, O'Reilly, Third Edition, 2005

E-Governance

Course Title: E-Governance
Course No: BIT452
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course familiarizes students with different concepts of E-Government and E-Governance, different E-Governance models and infrastructure development, E-government security.

Course Objectives:
To develop knowledge of e-governance and e-government, to know different e-governance models and infrastructure development, to study the security issues and solving strategies of e-governance

Course Contents:

Unit 1: Introduction to E-Government and E-Governance (5 Hrs.)
Difference between E-Government and E-Governance; E-Government as Information System; Benefits of E-Government; E-Government Life Cycle; Online Service Delivery and Electronic Service Delivery; Evolution, Scope and Content of E-Governance; Present Global Trends of Growth in E-Governance

Unit 2: Models of E-Governance (10 Hrs.)
Introduction; Model of Digital Governance: Broadcasting / Wider Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive – Service Model / Government-to-Citizen-to-Government Model (G2C2G); Evolution in E-Governance

Unit 3: E-Government Infrastructure Development (10 Hrs.)
Network Infrastructure; Computing Infrastructure; Data centers; E-Government Architecture; Interoperability Framework; Cloud Governance; E-readiness; Data System Infrastructure; Legal Infrastructural Preparedness; Institutional Infrastructural Preparedness; Human Infrastructural Preparedness; Technological Infrastructural Preparedness

Unit 4: Security for e-Government (5 Hrs.)
Challenges and Approach of E-government Security; Security Management Model; E- Government Security Architecture; Security Standards

Unit 5: Applications of Data Warehousing and Data Mining in Government (5 Hrs.)
Introduction; National Data Warehouses: Census Data, Prices of Essential Commodities; Other Areas for Data Warehousing and Data Mining: Agriculture, Rural Development, Health, Planning, Education, Commerce and Trade, Other Sectors

Unit 6: Case Studies (10 Hrs.)
E-Government Initiatives in Nepal, Cyber Laws, Implementation in the Land Reform, Human Resource Management Software, NICNET, Collectorate , Computer-aided Administration of Registration Department (CARD), Smart Nagarpalika, National Reservoir Level and Capacity

Monitoring System, Computerization in Andra Pradesh, Ekal Sewa Kendra, Sachivalaya Vahini, Bhoomi, IT in Judiciary

Laboratory Works:

The laboratory works should implementing e-governance models and systems using suitable platform

References:

1. Richard Heeks, Implementing and managing e-Government
2. C.S.R Prabhu, e-Governance: Concepts and Case studies, prentice hall of India Pvt. Ltd.
3. J. Satyanarayana, e-Government, , prentice hall of India Pvt. Ltd.
4. Backus, Michiel, e-Governance in Developing Countries, IICD Research Brief, No. 1, March 2001

Internship

Course Title: Internship
Course No: BIT453
Nature of the Course: Lab/Internship
Semester: VIII

Full Marks: 160+40
Pass Marks: 64 +16
Credit Hrs: 6

Course Description:
This course covers the real world practice in industry. It includes using theoretical and practical knowledge while working in industry together with the understanding of industry culture.

Course Objectives:
The objective of this course is to allow students into market industry and gain real world experience. The course is expected to make students more pragmatic and professional.

Course Contents:

Nature of Internship:

The internship work should be relevant to the field of information technology. The nature internship may include design, development, and application of software, hardware, network services, database systems and other IT infrastructures. The internship duration should be minimum of 180 hours or ten weeks. The internship should be started tentatively by the 3rd week of start of eighth semester. The internship host organizations can be software/hardware development companies, telecommunications companies, network and internet service providers, financial organizations, health organizations etc.

The internship is an individual activity. The student should be responsible for the timely completion of all the activities and projects assigned, maintaining the professional quality. Each student should be facilitated with a mentor at the intern organization and a supervisor at the campus. Student should inform the status of all assignments to the mentor and supervisor. The student is expected to communicate frequently with the advisors on the progress and status of intern project(s)/activities. Each student must prepare and submit individual internship report on the basis of his/her work done during the internship period. Students working in group at the same organization should be able to distinguish their nature of work.

Phases of Internship:

The following are the phases of internship evaluation:

1. **Proposal Submission:** Students must submit and present internship proposal plan after 2nd week of start of the internship.

2. **Mid-Term Submission:** Students must submit progress report and defend midterm progress of their internship work in the 11th week of the eight semester.

3. **Final Submission:** Students must submit and defend the internship work during last week of the eight semester but before final board examination. The final defense will be followed a viva voice conducted by an evaluation committee. Students must have to submit the

internship final report to their respective department of college/campus before at least 10 days of final defense date. The report should be submitted in standard format as prescribed. The hard/soft copy of report should be made available to the external before a week of presentation date.

Provision of Supervision:

There should be a regular faculty member of the college assigned as a supervisor. The role of supervisor is to supervise the students throughout the internship period. A supervisor can supervise at most four internship students in a section.

Provision of Mentorship:

There should be a regular employee of the intern providing organization assigned as a mentor. The role of mentor is to guide the students throughout the internship period at the organization.

Evaluation Scheme:

1. **Proposal Defense** - 5% Marks of 200 (5 Marks Head/Program Coordinator + 5 Marks Supervisor)
2. **Midterm** - 15% Marks of 200 (5 Marks Head/Program Coordinator + 25 Marks Supervisor)
3. **Final Defense -** 80% Marks of 200 (100 Marks Mentor + 20 Marks Supervisor + 40 Marks External)

The evaluation committee and evaluation criteria should be as follow;

a. Evaluation committee

- HOD/Coordinator
- Project Supervisor
- Mentor
- External Examiner

b. Marks Distribution:

- Head / Program Coordinator – 10
- Supervisor – 50
- Mentor – 100
- External Examiner – 40
- Total – 200 (Out of which 160 is considered as internal marks and 40 marks is considered as final external marks. Student have to pass in both separately scoring 64 and 16 marks respectively)

c. Focus of the evaluation

- Presentation Skills
- Level of Work Done and Understanding of Internship Activities
- Internship Report
- Viva/Question Answer

Roles and Responsibilities:

- **HOD/Coordinator:** The role of HOD/Coordinator is to coordinate with supervisor, internal examiner, external examiner and students. The HOD/Coordinator should monitor the students' project progress in coordination with the respective supervisor and mentor. The

HOD/Coordinator is responsible for arranging the proposal defense, midterm and final defense. The HOD/Coordinator should maintain rigorous contact with students, supervisors, mentors and company/industry. The HOD/Coordinator should participate and evaluate proposal defense, midterm, and final defense.

- **Project Supervisor:** The role of project supervisor is to supervise students' internship project throughout the semester. The supervisor should rigorously feedback and guide the students so as to transform their industry work into academic. The supervisor should monitor the progress of projects under supervision. Supervisor should participate and evaluate proposal defense, midterm and final defense.

- **Mentor:** The role of mentor is to guide students and their project during their intern period at the host institution. The mentor should nurture student with industry culture. The mentor should rigorously feedback and guide the students as well as communicate with their campus/college administration. By the end of internship work, the mentor should evaluate the student work done during intern period under his/her mentorship.

- **External Examiner:** The role of external examiner is to evaluate the students' internship work during final defense evaluation. The examiner should participate and evaluate viva voce and presentation session during the final defense.

- **Student:** The role and responsibilities of student include pursuing internship in relevant field, preparing project report, and defending the internship work throughout each evaluation phases. Internship is an individual work. Student should be able to demonstrate his/her contribution in the project work done during the internship period individually. Students should maintain a log visits with their supervisors as well as mentors at different dates during their work. The log should include technical details with appropriate feedbacks.

Report Contents:

1. **Prescribed content flow for the internship proposal**

    1. Introduction
    2. Problem Statement
    3. Objectives
    4. Description of Internship Work/Project
    5. Internship Plan
    6. Expected Outcome of Internship Activities
    7. References

2. **Prescribed content flow for the internship report**

    1. Cover & Title Page
    2. Certificate Page
        i. Mentors' Recommendation from Company
        ii. Supervisors' Recommendation
        iii. Examiners' Approval Letter
    3. Acknowledgement
    4. Abstract Page
    5. Table of Contents
    6. List of Abbreviations, List of Figures, List of Tables, List of Abbreviations

7. Main Report
8. References
9. Bibliography (if any)
10. Appendix

3. Prescribed chapters in the main report

1. Chapter 1: Introduction

1.1. Introduction (Introduce the project(s)/activities done during internship)
1.2. Problem Statement (Problems associated with the project(s)/activities done during internship)
1.3. Objectives
1.4. Scope and Limitation
1.5. Report Organization

2. Chapter 2: Organization Details and Literature Review

2.1. Introduction to Organization
2.2. Organizational Hierarchy
2.3. Working Domains of Organization
2.4. Description of Intern Department/Unit
2.5. Literature Review / Related Study

3. Chapter 3: Internship Activities

3.1. Roles and Responsibilities (With respect to the project(s)/activities during internship)
3.2. Weekly log (Log containing the list of technical activities performed with respect to the project(s)/activities during internship)
3.3. Description of the Project(s) (Involved during internship)
3.4. Description of the Tools (Used in the projects/activities during internship)
3.5. Description of Tasks/Activities Performed (Technical and implementation details of the activities done during the internship. Screenshot of outputs/ Code snippets/ Configuration details/ Result and Findings, etc. followed by detailed description)

4. Chapter 4: Conclusion and Learning Outcomes

4.1. Conclusion
4.2. Learning Outcome (With respect to the project(s)/activities during internship)

Students should be able to relate and contextualize the above mentioned concepts with their project work/activities done during internship at the host organization.

Citation and Referencing

The listing of references should be listed in the references section. The references contain the list of articles, books, URLs that are cited in the document. The books, articles, and others that are studied during the study but are not cited in the document can be listed in the bibliography section. The citation and referencing standard should be APA referencing standard. The text inside the document should be cited accordingly. The APA referencing standard can be found in the web at https://apastyle.apa.org/

Report Format Standards

A. Page Number

The pages from certificate page to the list of tables/figures/abbreviations/approvals should be numbered in roman starting from i. The pages from chapter 1 onwards should be numbered in numeric starting from 1. The page number should be inserted at bottom, aligned center.

B. Page Size and Margin

- The paper size must be a page size corresponding to A4. The margins must be set as

  Top = 1; Bottom = 1; Right = 1; Left 1.25

C. Paragraph Style

- All paragraphs must be justified and have spacing of 1.5.

D. Text Font of Document

- The contents in the document should be in Times New Roman font
- The font size in the paragraphs of document should be 12

E. Section Headings

- Font size for the headings should be 16 for chapter headings, 14 for section headings, 12 for sub-section headings. All the headings should be bold faced.

F. Figures and Tables

- Position of figures and tables should be aligned center. The figure caption should be centred below the figure and table captions should be centred above the table. All the captions should be of bold face with 12 font size.

Final Report Binding and Submission:

No of Copies: 3 (College Library + Self + Dean Office)

Look and Feel: Golden Embracing with Black Binding

A final approved signed copy of the report should be submitted to the Dean Office, Exam Section, Institute of Science and Technology, Tribhuvan University

References:

None

Data Warehousing and Data Mining

Course Title: Data Warehousing and Data Mining
Course No: BIT454
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course introduces advanced aspects of data warehousing and data mining, encompassing the principles, research results and commercial application of the current technologies

Course Objectives:
The main objective of this course is to provide knowledge of different data mining techniques and data warehousing

Course Contents:

Unit 1: Introduction to Data Warehousing (5 Hrs.)
Data Warehouse and Data Warehousing, Differences between Operational Database and Data Warehouse, MOLAP, OLAP Operations, Conceptual Modeling of Data Warehouse, Components of Data Warehouse

Unit 2: Introduction to Data Mining (2 Hrs.)
Motivation for Data Mining, Introduction to Data Mining System, Data Mining Functionalities, KDD, Data Mining Goals

Unit 3: Data Preprocessing (3 Hrs.)
Data Types and Attributes, Various Similarity Measures, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation

Unit 4: Data Cube Technology (4 Hrs.)
Cube Materialization (Introduction to Full Cube, Iceberg Cube, Closed Cube, Shell Cube), General Strategies for Cube Computation, Attribute Oriented Analysis (Attribute Generalization, Attribute Relevance, Class Comparison)

Unit 5: Mining Frequent Patterns (6 Hrs.)
Frequent Patterns, Market Basket Analysis, Frequent Itemsets, Generating Itemsets and Association Rules, Finding Frequent Itemset (Apriori Algorithm, FP Growth), Generating Association Rules from Frequent Itemset, Limitation and Improving Apriori, Association Mining to Correlation Analysis, Constraint-Based Association Mining

Unit 6: Classification and Prediction (10 Hrs.)
Definition (Classification, Prediction), Learning and Testing of Classification, Classification by Decision Tree Induction, ID3 and Gini Index as Attribute Selection Algorithm, Bayesian Classification, Laplace Smoothing, Classification by Back Propagation, Rule Based Classifier (Decision Tree to Rules, Rule Coverage and Accuracy, Efficient of Rule Simplification), Support Vector Machine, Associative Classification, Lazy Learners, Accuracy and Error Measures, Ensemble Methods, Issues in Classification

Unit 7: Cluster Analysis (8 Hrs.)
Types of Data in Cluster Analysis, Similarity and Dissimilarity between Objects, Clustering Techniques: - Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis

Unit 8: Graph Mining and Social Network Analysis (5 Hrs.)
Graph Mining, Why Graph Mining, Graph Mining Algorithm (Beam Search), Mining Frequent Sub-Graph, Apriori Graph, Pattern Growth Graph, Graph Indexing, Social Network Analysis, Characteristics of Social Network (Densification Power Law, Shrinking Diameter, Heavy-Tailed Out-Degree and In-Degree Distributions), Link Mining (Task Involved in Link Mining, Challenges Faced by Link Mining), Friends of Friends, Viral Marketing, Community Mining, Theory of Balance, Theory of Status, Conflict Between The Theory of Balance and Status), Predicting Positive and Negative Links

Unit 9: Mining Spatial, Multimedia, Text and Web Data (2 Hrs.)
Spatial Data Mining, Mining Spatial Association, Multimedia Data Mining, An Introduction to Text Mining, Natural Language Processing and Information Extraction, Web Mining (Web Content Mining, Web Structure Mining, Web Usage Mining)

Laboratory Works:
The laboratory should contain all the features mentioned in a course, which should include data preprocessing and cleaning, implementing classification, clustering, association algorithms in any programming language, and data visualization through data mining tools.

References:

1. Data Mining: Concepts and Techniques, 3rd ed. Jiawei Han, Micheline Kamber, and Jian Pei. Morgan Kaufmann Series in Data Management Systems Morgan Kaufmann Publishers, July 2011
2. Introduction to Data Mining, 2nd ed. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar. Pearson Publisher, 2019
3. Mining of Massive Datasets by Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, 2014

Knowledge Management

Course Title: Knowledge Management
Course No: BIT455
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:

This course introduces fundamental concept of knowledge and different issues in managing the knowledge

Course Objectives:

This course enables to learn about the Evolution of Knowledge management, be familiar with tools, be exposed to applications, and be familiar with some case studies

Course Contents:

Unit 1: Introduction (4 Hrs.)

Introduction to Knowledge Management, Multidisciplinary Nature of KM, Techniques History of Knowledge Management, Why KM is Important Today?, KM for Individuals, Communities and Organizations, Perspective of KM; The Evolution of Knowledge Management: From Information Management to Knowledge Management, Knowledge Management Cycle (Wiig KM Cycle, Meyer And Zack KM Cycle), Ethics for Knowledge Management, Ethics Dimension, Intellectual Property Right

Unit 2: Creating the Culture of Learning and Knowledge Sharing (9 Hrs.)

Organization and Knowledge Management, Building the Learning Organization. Knowledge Markets (purpose, method, benefit): Cooperation among Distributed Technical Specialists, Tacit Knowledge, Tacit knowledge Capture at Individual Level, Interviewing Experts, Structured Interviewing, Stories, Learning by Being Told, Learning by Observation, Knowledge Audit, Gap Analysis, KM Metrics, Von Krogh and Roos Model of Organizational Epistemology, Choo Sense Making KM Model, Inukshuk KM Model

Unit 3: Knowledge Management – The Tools (10 Hrs.)

Telecommunications and Networks in Knowledge Management, Internet Search Engines and Knowledge Management, Information Technology in Support of Knowledge Management, Networking technologies, Knowledge acquisition and application tools (Intelligent filtering tools, Adaptive technologies; Knowledge Management and Vocabulary Control, Information Mapping in Information Retrieval, Information Coding in the Internet Environment, Repackaging Information

Unit 4: Knowledge Management – Application (8 Hrs.)

Knowledge capture and codification ,Tacit Knowledge Capture, Tacit Knowledge Capture at the Individual, Group and Organizational Levels, Explicit Knowledge Codification, Cognitive Maps, Decision Trees, Knowledge Taxonomies

Unit 5: Future Trends (9 Hrs.)

Knowledge Management Value , KM Return on Investment (ROI) and Metrics, Benchmarking Method , Balanced Scorecard Method , House of Quality Method, Results-Based Assessment Framework , Measuring The Success of Cop; Future Challenges for KM, Political Issues Regarding Internet Search Engine, Intellectual Property Issues, How to Provide Incentives for Knowledge Sharing, How to Provide Incentives for Knowledge Sharing, Future Challenges for KM, KM Research, A Postmodern KM, Concluding Thought

Laboratory Works:

Upon completion of the course, the student should be able to:

- Use the knowledge management tools.
- Develop knowledge management Applications (Social network analysis, document management).
- Design and develop enterprise applications (Aggregation, E-Learning).

References:

1. Srikantaiah. T. K., Koenig, M., "Knowledge Management for the Information Professional" Information Today, Inc., 2000
2. Dalkir, K. (2011). Knowledge Management in Theory and Practice (2nd edition) Cambridge, Massachusetts: The MIT Press
3. Nonaka, I., Takeuchi, H., "The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation", Oxford University Press, 1995
4. Knowledge Management in Theory and Practice, Kimiz Dalkir, 2005

Image Processing

Course Title: Image Processing
Course No: BIT456
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course covers the investigation, creation and manipulation of digitalimages by computer. The course consists of theoretical material introducing the mathematics of images and imaging. Topics include representation of two-dimensional data, time and frequency domain representations, filtering and enhancement, the Fourier transform, convolution, interpolation. The student will become familiar with Image Enhancement, ImageRestoration, Image Compression, Morphological Image Processing, Image Segmentation, Representation and Description, and Object Recognition.

Course Objectives:
To enhance a theoretical foundation of Digital Image Processing concepts, To provide mathematical foundations for digital manipulation of images; image acquisition; preprocessing; segmentation; Fourier domain processing; and compression, To make able to gain experience and practical techniques to write programs for digital manipulation ofimages; image acquisition; pre-processing; segmentation; Fourier domain processing; and compression.

Course Contents:

Unit 1: Introduction and Fundamentals (5 Hrs.)
Definition of digital image, pixels, representation of digital image in spatial domain as well as in matrix form, Block diagram of fundamentals steps in digitalimage processing, Elements of Digital Image Processing systems, Light and EM Spectrum, Image acquisition using a single sensor, Image Acquisition Using Sensor Strips, Image Acquisition process, A simple image formation model, Representing Digital Images, Spatial and Intensity Resolution, Image Interpolation, Neighbors of a Pixel, Adjacency, Connectivity,Regions, and Boundaries

Unit 2: Intensity Transformations and Spatial Filtering (8 Hrs.)
Spatial domain, Transform domain, Spatial Domain Process, Image Negatives, Log Transformations, Power-Law (Gamma) Transformations, Bit-plane Slicing, Histogram Equalization, Histogram Matching, Basics of Spatial Filtering, Spatial Correlation, Spatial Convolution, Linear filters, Spatial Low pass smoothing filters, Averaging, Weighted Averaging, Non-Linear filters, Median filter, Maximum and Minimum filters, High pass sharpening filters, High boost filter, high frequency emphasis filter, Gradient based filters

Unit 3: Filtering in the Frequency Domain (8 Hrs.)
Fourier Series and Fourier Transform, Impulses and the Sifting Property, The Discrete Fourier Transform (DFT) of One Variable, 2-D Fourier Transform, Aliasing in Images, Moiré patterns, Properties of the 2-D DFT, Zero Padding, Zero-Phase-Shift Filters, Image Smoothing Using Filter Domain Filters, Image Sharpening Using Frequency Domain Filters, Computing and Visualizing the 2D DFT (Time Complexity of DFT), Derivation of 1-D Fast Fourier Transform, Time Complexity of FFT, Concept of Convolution, Correlation and Padding, Hadamard transform, Haar transform and DiscreteCosine transform

Unit 4: Image Restoration & Reconstruction (8 Hrs.)
A Model of Image Degradation/Restoration Process , Noise Sources , Range Imaging, Noise Models, Mean Filters: Arithmetic, Geometric, Harmonicand Contraharmonic Mean Filters, Order Statistics Filters: Median, Min and Max,Midpoint and Alpha trimmed mean filters, Band pass and Band Reject filters: Ideal, Butterworth and Gaussian Band pass and BandReject filters, Introduction, Definition of Compression Ratio, Relative Data Redundancy, Average Length ofCode, Redundancies in Image: Coding Redundancy(Huffman Coding), Interpixel Redundancy (Run Length Coding) and Psychovisual Redundancy (4-bit Improved Gray Scale Coding: IGS Coding Scheme)

Unit 5: Introduction to Morphological Image Processing (2 Hrs.)
Logic Operations involving binary images, Introduction to Morphological Image Processing, Definition of Fit and Hit, Dilation and Erosion, Opening and Closing

Unit 6 Image Segmentation (8 Hrs.)
Definition, Similarity and Discontinuity Based Techniques, Point Detection, Line Detection, Edge Detection Using Gradient and Laplacian Filters; Mexican Hat Filters, Edge Linking and Boundary Detection, Hough Transform; Thresholding: Global, Local and Adaptive; Region Based Segmentation: Region Growing Algorithm, Region Split and Merge Algorithm

Unit 7 Wavelet Transform (2 Hrs.)

Fourier vs. Wavelet, Shifting, Five Steps to a Continuous Wavelet Transform, Coefficient Plots, Wavelet synthesis

Laboratory Works:
Students are required to develop programs in related topics using suitable programminglanguages such as Python or other similar programming languages.

References:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson Edition,Latest Edition.
2. I. Pitas, "Digital Image Processing Algorithms", Prentice Hall, Latest Edition.
3. A. K. Jain, “Fundamental of Digital Image processing”, Prentice Hall of India Pvt. Ltd.,Latest Edition.
4. K. Castlemann, “Digital image processing”, Prentice Hall of India Pvt. Ltd., Latest Edition.
5. P. Monique and M. Dekker, “Fundamentals of Pattern recognition”, Latest Edition.

Network Security

Course Title: Network Security
Course No: BIT457
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course covers the fundamental concepts of network security protocols, wireless security concepts, basics of security in cloud and IoT.

Course Objectives:
The main objective of this course is to provide knowledge of network security so that students will be able to implement a secure network architecture using different security protocols and technologies.

Course Contents:

Unit 1: Computer Network Security Fundamentals (3 Hrs.)
Introduction, Securing the Computer Network, Forms of Protection, Security Standards

Unit 2: User Authentication (4 Hrs.)
Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Remote User-Authentication Using Asymmetric Encryption, Federated Identity Management

Unit 3: Transport Level Security (6 Hrs.)
Web Security, Transport Layer Security (TLS), HTTPS, Secure Shell (SSH)

Unit 4: Wireless Network Security (6 Hrs.)
Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN Overview,IEEE 802.11i Wireless LAN Security

Unit 5: Electronic Mail Security (8 Hrs.)
Internet Mail Architecture, E-mail Formats, Email Threats and Comprehensive Email Security, S/MIME, Pretty Good Privacy (PGP), DNSSEC, DNS-Based Authentication of Named Entities, Sender Policy Framework, Domain Keys Identified Mail, Domain-Based Message Authentication, Reporting, and Conformance

Unit 6: IP Security (6 Hrs.)
IP Security Overview**,** IP Security Policy, Authentication Header, Encapsulating Security Payload**,** Security Associations, Internet Key Exchange

Unit 7: Network Endpoint Security (5 Hrs.)
Firewalls, Intrusion Detection System, Malicious Software, Distributed Denial of Service Attacks

Unit 8: Cloud and Internet of Things (IOT) Security (7Hrs.)

Cloud Computing**,** Cloud Security Concepts, Cloud Security Risks and Countermeasures, Cloud Security as a Service,Open-source Cloud Security Module,Internet of Things (IoT),IoT Security Concepts and Objectives, Open-source IoT Security Module

Laboratory Works:

The laboratory work includes implementation and simulation of Network Security Protocols, Intrusion Detection Systems, DDoS Attacks, Cloud Security and IoT Security Systems.

References:

1. William Stallings, Cryptography and Network Security: Principles and Practice, 8th Edition, Pearson, 2020
2. Joseph MiggaKizza, Computer Network Security Fundamentals, 5thEdition, Springer, 2020
3. William Stallings, Network Security Essentials: Applications and Standards, 6th Edition, Pearson, 2017
4. Sarhan M. Musa, Network Security and Cryptography: A Self-Teaching Introduction, Mercury Learning and Information LLC, 2018

Introduction to Telecommunications

Course Title: Introduction to Telecommunications
Course No: BIT458
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60+20+20
Pass Marks: 32+8
Credit Hrs: 3

Course Description:
This course covers the basic concepts of Telecommunication System including History of telecommunications, Basic communication system elements, Optical fiber communication, Wireless Communication systems, Status of Telecommunication services in Nepal, Convergence of technologies and services and role of Telecommunications in national development.

Course Objectives:
The main objective of this course is to provide students, knowledge on Telecommunications systems and its role in digital economy.

Course Contents:

Unit 1: Introduction of Telecommunication (5 Hrs.)
Basic Communication System elements, Purpose of communication systems, Communication Technology History (Morse's Telegraph, Telephone, Radio, TV, Cable TV, Cellular Phone 2G, 3G, 4G etc)

Unit 2: Transmission Network (8 Hrs.)
Basic Transmission Network, Analog and Digital Transmission Basics, Microwave Transmission System: Radio and Antenna Basics, Optical Transmission System (ADSS, OPGW, GPON), IP Concept of Transmission Network

Unit 3: Fixed Telephone Network Basics (6 Hrs.)
Plain Old Telephone System, Public Switched Telephone Network, No 7. Signaling basics, NGN and FTTH Basics

Unit 4: Wireless Cellular Communication Basics (8 Hrs.)
2G, 3G, 4G, LTE and 5G, GSM Roaming and Billing Basics

Unit 5: Role of Telecommunication services for Nation Development (8 hrs)
Service Delivery to Citizen using Telecommunication Network, Customer Service Enhancement, Transformation of Financial Services, Education System for Better Learning

Unit 6: Convergence of Telecommunication Technologies (10 hrs)
Voice, Data and Multimedia Convergence, Over The Top (OTT) services development

Laboratory works:

The laboratory works should include all the features mentioned in the course

References:

1. John C. Bellamy “Digital Telephony“John Wiley & Sons, Inc.
2. Roger L. Freeman “Telecommunication System Engg. “ John Wiley & Sons, Inc.
3. A. S. Tanenbaum, “Computer Networks”, Prentice Hall.
4. Telecommunication Switching Systems and Networks, by Thiagarajan Vishwanathan