Web Technology II

Course Title: Web Technology II
Course No: BIT301
Nature of the Course: Theory + Lab
Semester: V

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

Course Description:
This course covers the concepts of server side scripting using the PHP programming language.

Course Objectives:
The main objective of this course is to provide basic concepts of PHP including handling of functions, arrays, strings, class and objects, forms, databases, cookies, sessions, exceptions and file handling so that students should be able to develop dynamic web applications.

Course Contents:

Unit 1: Introduction (8 Hrs.)
Server Side Scripting, Introduction to PHP, Language Basics: Lexical Structure, Data Types, Variables, Expression and Operators, Flow Control Statements, Including PHP Code, Embedding PHP in Web Pages

Unit 2: Functions (5 Hrs.)
Functions, Defining and Calling Functions, Variable Scope, Function Parameters, Return Values, Variable Functions, Anonymous Functions, Date and Time functions

Unit 3: Strings and Arrays (8 Hrs.)
String Constants, Printing Strings, Accessing Characters in Strings, Cleaning Strings, Encoding and Escaping, Comparing, Manipulating and Searching Strings, Regular Expressions, Array, Indexed vs. Associative Arrays, Defining Array, Storing Data in Array, Multidimensional Array, Extracting Multiple Values, Conversion between Array and Variables, Traversing Arrays

Unit 4: Objects (6 Hrs.)
Objects, Creating Object, Accessing Properties and Methods, Declaring Class, Anonymous Class, Examining Class and Object

Unit 5: Handling Forms (4 Hrs.)
Building forms, Retrieving Form Data, Processing Forms, Setting Response Headers

Unit 6: Working with Database (5 Hrs.)
Using PHP to Access Database, Querying a Database with PHP, CRUD Operations Using Forms

Unit 7: Cookies, Sessions and Authentication (3 Hrs.)
Using Cookies in PHP, HTTP Authentication, Using Sessions

Unit 8: Debugging PHP (3 Hrs.)
The PHP.ini Settings, Error Handling, Error Reporting, Exceptions, Error Suppression, Triggering Errors, Error Handlers, Error Logs

Unit 9: File Handling (3 Hrs.)
File Read, Write, Close, File upload, Parsing CSV File, Parsing JSON File

Laboratory Works:
Laboratory work includes implementing all of the concepts in each chapter. Students have to create a dynamic website using core PHP concepts studied in this course.

References:

1. Kevin Tatroe , Peter MacIntyre, Programming PHP: Creating Dynamic Web Pages, O′Reilly, 2021
2. Robin Nixon , Learning PHP, MySQL & JavaScript: A Step-by-Step Guide to Creating Dynamic Websites, O'Reilly Media, 2021

Software Engineering

Course Title: Software Engineering
Course No: BIT302
Nature of the Course: Theory + Lab
Semester: V

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

Course Description:
This course familiarizes students with different concepts and techniques of software engineering mainly focusing on software practices, different process models, requirements engineering, project management, project planning, quality assurance and software testing techniques.

Course Objectives:
The main objective of this course is to give knowledge of software engineering so that the students will be able to use different methodologies and techniques to develop high quality software.

Course Contents:

Unit 1: Introduction (2 Hrs.)
Professional Software Development**,** Software Engineering Ethics, Case Studies

Unit 2: Software Process Model (8 Hrs.)
Software Process Models, Process Activities, Coping with Change, Process Improvement, Agile Software Development

Unit 3: Requirements Engineering (3 Hrs.)
Functional and Non-Functional Requirements, Requirements Engineering Processes, Requirements Elicitation, Requirements Validation, Requirements Change

Unit 4: System Modeling (6 Hrs.)
Context Models, Interaction Models, Structural Models, Behavioral Models, Model Driven Architecture

Unit 5: Architectural Design (6 Hrs.)
Architectural Design Decisions, Architectural Views, Architectural Patterns, Application Architectures

Unit 6: Design and Implementation (5 Hrs.)
Object-Oriented Design Using the UML, Design Patterns, Implementation Issues, Open-Source Development

Unit 7: Software Testing (5 Hrs.)
Introduction to Software Testing, Development Testing, Test-Driven Development, Types of Testing

Unit 8: Project Management and Planning (5 Hrs.)
Introduction to Project Management, Management Activities, Introduction to Project Planning, Software Pricing, Plan-Driven Development, Project Scheduling, Agile Planning, Estimation Techniques, COCOMO Cost Modeling

Unit 9: Software Quality Assurance (3 Hrs.)
Introduction to Software Quality, Software Quality Assurance, Software Reviews

Unit 10: Configuration Management (2 Hrs.)
Introduction to Version Management, Change Management and Release Management

Laboratory Works:
Student should use project management tools focusing on resource management, project scheduling and people management. They should be use CASE tools for drawing UML diagrams. They should use tools for realizing agile development, version control and change control respectively. They should be able to develop test cases and use tools to demonstrate different types of testing.

References:

1. Software Engineering, 10th Edition, Ian Sommerville, Pearson Education 2016
2. Software Engineering: A Practitioner's Approach, 8th Edition, Roger S. Pressman and Bruce R. Maxim, McGraw-Hill Education 2015
3. C. Ghezzi, M. Jazayeri and D. Mandrioli, Fundamentals of Software Engineering Prentice Hall of India, Ltd.
4. G. Booch, J. Rambaugh, J. Jacobson, The unified Modeling Language – User Guide Addison - Wesley

Information Security

Course Title: Information Security
Course No: BIT303
Nature of Course: Theory + Lab
Semester: V

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

Course Description:
This course familiarizes with basic concepts of information security. This course includes cryptographic algorithms, authentication systems, access controls, malicious logics, network security and security audits and ethical issues.

Course Objectives:
The objective of this course is to familiarize the students with the concepts of information security, different security measures, policies and security mechanisms, security auditsso that students will be able to design, implement and manage the information and computers securely.

Course Contents:

Unit 1: Introduction (4 Hrs.)
1.1. Computer Security Concepts
1.2. Threats, Attacks and Assets
1.3. Security Functional Requirements
1.4. Security Design Principles
1.5. Attack Surfaces and Attack Trees
1.6. Computer Security Strategy

Unit 2: Symmetric and Asymmetric Encryption Algorithms (10 Hrs.)
2.1. Classical Cryptosystems: Substitution and Transposition Ciphers
2.2. Symmetric Encryption Principles
2.3. Data Encryption Standards (DES),
2.4. Basic concepts of fields, Modular Arithmetic, Galois Fields, Polynomial Arithmetic,
2.5. Advanced Encryption Standards (AES)
2.6. Prime Numbers, Fermat's Theorem, Primality Testing: Miller-Rabin Algorithm, Euclidean Algorithm, Extended Euclidean Algorithm, Euler Totient Function
2.7. Asymmetric Encryption
2.8. Diffie-Hellman Protocol , RSA Algorithm

Unit 3: Message Authentication (6 Hrs.)
3.1. Message Authentication
3.2. Secure Hash Functions
3.3. Message Digests: MD5
3.4. Secure Hash Algorithms: SHA-1, SHA-2
3.5. Digital Signature

Unit 4: User Authentication (5 Hrs.)

4.1. User Authentication Principles
4.2. Password-Based Authentication
4.3. Token-Based Authentication
4.4. Biometric Authentication
4.5. Two Factor Authentication
4.6. Security Issues for User Authentication

Unit 5: Access Control (5 Hrs.)

5.1. Access Control Principles
5.2. Subjects, Objects and Access Rights
5.3. Discretionary Access Control
5.4. Role Based Access Control
5.5. Attribute Based Access Control
5.6. Identity, Credential and Access Management
5.7. Trust Frameworks

Unit 6: Malicious Software (6 Hrs.)

6.1. Malicious Software
6.2. Types of Malicious Software
6.3. Advanced Persistent Threat
6.4. Virus
6.5. Worms
6.6. Spam E-mail, Trojans
6.7. System Corruption,
6.8. Zombie, Bots
6.9. Key loggers, Phishing, Spyware
6.10. Backdoors, Rootkits
6.11. Countermeasures for Malwares

Unit 7: IT Security Management, Risk Assessment and Security Auditing (5 Hrs.)

7.1.IT Security Management
7.2.Organizational Context and Security Policy
7.3. Security Risk Assessment
7.4. Security Risk Analysis
7.5. Security Auditing Architecture
7.6. Security Audit Trails
7.7. Implementing Logging Function
7.8. Audit Trail Analysis

Unit 8: Legal and Ethical Issues (4 Hrs.)

8.1.Cybercrime and Computer crime
8.2.Intellectual Property
8.3. Privacy
8.4. Ethical Issues

8.5. Cyber Law in Nepal

Laboratory Works:

The laboratory work includes implementing and simulating the concepts of cryptographic algorithms, hash functions, digital signatures, authentication & authorization systems, and malicious logics. The laboratory work covers implementing programs for following;

- Classical ciphers like Caeser, Railfence
- DES, AES
- Primality Testing, Euclidean Algorithms, Deffie-Hellman RSA
- MD5, SHA-1, SHA-2
- Authentication systems like password based, token based, two factor authentication etc.
- Access control and capability lists
- Malicious Logics

In addition, students have to perform case studies including preparation of security policies for some system and perform the security audits.

References:

1. William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Pearson, Latest Edition
2. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson
3. Mark Stamp, Information Security: Principles and Practices, Wiley
4. Matt Bishop, Introduction to Computer Security, Addison Wesley
5. Matt Bishop, Computer Security, Art and Science, Addison Wesley
6. Charles P. Pfleeger and Shari Lawrence Pfleeger, Security in Computing, Pearson
7. William Stallings, Information Privacy Engineering and Privacy by Design, Pearson

Computer Graphics

Course Title: Computer Graphics
Course No: BIT304
Nature of the Course: Theory + Lab
Semester: V

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

Course Description:
This course covers the basic concepts of Computer Graphics, various algorithms for basic graphics primitives, 2-D geometric transformations on graphical objects, various Clipping algorithms on graphical objects, 3-D geometric transformations, curve representation techniques and projections methods, object surface modeling, visible surface detection, application of illumination and rendering algorithms, virtual reality and animation technique along with basic concept of Open GL.

Course Objectives:
The main Objective of this course is to equip students with the fundamental knowledge and basic technical competence in the field of Computer Graphics, to emphasize on implementation aspect of Computer Graphics Algorithms and to prepare the student for advance areas and professional avenues in the field of Computer Graphics.

Course Contents:

Unit 1: Introduction and Overview of Graphics System (3 Hrs.)
Definition and Representative uses of Computer Graphics, Computer Graphics vs. Image Processing, Application Areas, Overview of Coordinate System, Definition of Scan Conversion, Rasterization and Rendering, Raster Scan & Random Scan Displays, Architecture of Raster Graphics System with Display Processor, Architecture of Random Scan Systems

Unit 2: Output Primitives (6 Hrs.)
Scan conversions of point, line, circle and ellipse: DDA algorithm and Bresenham algorithm for line drawing, midpoint algorithm for circle, midpoint algorithm for ellipse drawing (Mathematical derivation for above algorithms is expected), Filled Area Primitive: Scan line Polygon Fill algorithm, inside outside tests, Boundary Fill and Flood fill algorithm.

Unit 3: Two Dimensional Geometric Transformations (3 Hrs.)
Basic transformations: Translation, Scaling, Rotation, Matrix representation and Homogeneous Coordinates, Composite transformation, Other transformations: Reflection and Shear

Unit 4: Two-Dimensional Viewing and Clipping (3 Hrs.)
Viewing transformation pipeline and Window to Viewport coordinate transformation, Clipping operations: Point clipping, Line clipping algorithms: CohenSutherland, Liang: Barsky, Polygon Clipping Algorithms: Sutherland Hodgeman

Unit 5:Three-Dimensional Graphics (6 Hrs.)
3D Transformations: Translation, Rotation, Scaling, Reflection and Shear, Composite transformations: Rotation about an arbitrary axis, Projections – Parallel, Perspective. (Matrix Representation)

Unit 6: Three-Dimensional Object Representation and Curve Modeling (6 Hrs.)
Boundary Surface Representation Vs Space Partitioning Representation, Polygon Surface Representation: Polygon Table and Polygon Meshes, Wireframe and Sweep Representation, Octree Representation, Bezier Curve, B-Spline Curve, Fractal-Geometry: Fractal Dimension, Koch Curve

Unit 7: Visible Surface Detection (6 Hrs.)
Image Space and Object Space techniques, Back Face Detection, Z-Buffer, A-Buffer, Scan-Line method, Painter's Algorithms, Area Subdivision method

Unit 8: Illumination and Surface Rendering methods (6 Hrs.)
Introduction, Ambient, Diffuse and Specular reflections illumination Model, Constant, Gouraud and Phong shading models

Unit 9: Virtual Reality and Animation (3 Hrs.)
Virtual Reality : Concept of Virtual Reality, Components of VR System, Types of VR System, 3D position Tracker, Navigation and Manipulation Interface, Application of VR, Animation: Introduction to Animation, Traditional Animation Techniques, Principles of Animation, Key framing: Character and Facial Animation, Deformation, Motion capture

Unit 10: Introduction to Open GL (2 Hrs.)
Introduction to OpenGL, Callback Functions, Color Commands, Drawing Pixels, Lines, and Polygons using OpenGL, Viewing, Lighting

Laboratory Works:
Scan conversions: lines, circles, ellipse, filling algorithms, clipping algorithms, 2D and 3D transformation Curves Visible surface determination, Simple animations, Application of these through exercises using appropriate programming languages. List of experiment are:

1. Implement DDA Line Drawing algorithm
2. Implement Bresenham's Line algorithm
3. Implement midpoint Circle algorithm.
4. Implement midpoint Ellipse algorithm.
5. Implement Area Filling Algorithm: Boundary Fill, Flood Fill.
6. Implement Scan line Polygon Filling algorithm
7. Implement 2D Transformations: Translation, Scaling, Rotation, Reflection, Shear.

8. Implement Line Clipping Algorithm: Cohen Sutherland / Liang Barsky.
9. Implement 3D transformation.
10. Implement Curve: Bezier for n control points, B Spline
11. Perform Animation (such as Rising Sun, Moving Vehicle, Smileys, Screen saver etc.)

References:

1. Hearn & Baker, “Computer Graphics C version”, 2nd Edition, Pearson Publication
2. James D. Foley, Andries van Dam, Steven K Feiner, John F. Hughes, “Computer Graphics Principles and Practice in C”, 2nd Edition, Pearson Publication
3. D. Rogers, “Procedural Elements for Computer Graphics”, Tata McGraw-Hill Publications
4. Zhigang Xiang, Roy Plastock, “Computer Graphics”, Schaum‟s Outlines McGraw-Hill Education
5. Rajesh K. Maurya, “Computer Graphics”, Wiley India Publication
6. F. S. Hill, “Computer Graphics using OpenGL”, Third edition, Pearson Publications

Technical Writing

Course Title: Technical Writing
Course No: ENG305
Nature of the Course: Theory + Lab
Semester: V

Full Marks: 80+20
Pass Marks: 32+8
Credit Hrs: 3

Course Description:
This course is designed for students to enhance their skills for workplace writing. This course aims in helping students to produce practical writing in specialized topics necessary for them in their professional life. Furthermore, this course provides students with practical approach to producing their own proposal content, memos, emails, instructions, procedures, manuals, informative briefs, presentations and other pragmatic documents.

Course Objectives:
To enable students to identify the importance and characteristics of technical writing and produce some quality technical pieces of workplace writing

Course Contents:

Unit 1: Why Technical People Needn't Fear Writing (3 Hrs.)
Writing in the Technical Workplace, Why Technical People Can Master Technical Writing, Attributes of Technical Writing, The Writing Process, Exercises: Writing in the Workplace

Unit 2: Technical Sentences Introduction (3 Hrs.)
Find the Real Subject, Find the Real Verb (Avoid Nominalizations), Edit for Conciseness, Edit for Clarity, Check for Inclusive Language, Check the Grammar and Mechanics, Exercises: Editing Technical Sentences

Unit 3: Emails, Letters, and Memos (4 Hrs.)
Letter Format, Memo and Email Formats, Email Etiquette ("Netiquette"), Professional Correspondence: Style and Tone54, Exercises: Standard Correspondence

Unit 4: Short Reports, Proposals, and Technical Documents (4 Hrs.)
Report Structure, Documents That Report on Past Events or Completed Tasks Documents That Report on Ongoing Tasks: Progress Reports, Documents That Recommend Future Actions, Documents That Define Standards: Specifications Lab Reports, Engineering or Project Logs, Exercises: Informal Reports

Unit 5: Formal Reports (3 Hrs.)
Parts of a Formal Report, Formal Report Pagination, Exercises: Formal Reports

Unit 6: Intercultural Communication, Collaborative Writing, and Document Control (4 Hrs.)
Intercultural Communication, Writing in Teams Document Sharing and Control, Exercises: Intercultural Considerations

Unit 7: Technical Graphics (5 Hrs.)
Types and Uses of Graphics Putting Graphics into Reports Rules for Incorporating Report Graphics Avoiding Graphical Misrepresentation Exercises: Technical Graphics

Unit 8: Technical Definitions and Descriptions (3 Hrs.)
Technical Definitions, Technical Descriptions, Exercises: Technical Definitions and Descriptions

Unit 9: Instructions, Procedures, and Manuals55 (5 Hrs.)
The Introduction, the Step-by-Step Instructions, the Conclusion, Notes, Cautions, Warnings, and Danger Alerts, Usability, Manuals, Exercises: Writing and Editing Instructions

Unit 10: Oral Presentations (4 Hrs.)
Planning the Presentation, Making Speech Notes, Using Presenter View, Designing and Using Slides, Practicing the Presentation, Overcoming Stage Fright and Answering Questions, Exercises: Oral Presentations

Unit 11: Ethics (2 Hrs)
Ethics in the Professions, Ethics for Students, Ethics in Technical Writing, Exercises: Ethics

Unit 12: Job Application Packages (3 Hrs.)
The Myth of the Experience Trap, Résumés, Application Letters, Finding Job Openings, Exercises: Job Application Packages

Unit 13: Grammar and Usage (2 Hrs.)
Punctuation and Grammar, Mechanics and Conventions, Glossary of Commonly Misused Words and Phrases

References:

1. Ewald, Thorsten. Writing in the Technical Fields: A Practical Guide. 3rd ed. Canada: Oxford University Press, 2020
2. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. 7th ed. USA: Wadsworth Publishing, 2010
3. Markel, Mike and Stuart A. Selber. Technical Communication. 12th edition. USA: Bedford Books, 2017
4. Smith-Worthington, Daelene and Sue Jefferson. Technical Writing for Success. 3rd ed. USA: Cengage Writing, 2011
5. Tebeaux, Elizabeth and Sam Dragga. The Essentials of Technical Communication. 4th ed. London: Oxford University Press, 2010