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BCSIT PROGRAM: SLIGHTLY AMENDED COURSE STRUCTURE

BCSIT Curriculum Structure

Foundation Courses		**(18 Credits)**
Course Code	**Course Title**	**Credit Hours**
ENG 111	English	3
MTH 113	Mathematics I	3
ENG 112	Business Communication	3
MTH 114	Mathematics II	3
STT 220	Statistics and Probability	3
ECO 322	Applied Economics	3

Management Courses		**(27 Credits)**
Course Code	**Course Title**	**Credit Hours**
MGT 222	Principles of Management	3
FIN 222	Fundamentals of Financial Management	3
MKT 351	Digital Marketing	3
MGT 322	Organizational Behavior	3
RCH 322	Research Methods	3
MGT 422	Strategic Management	3
MGT 423	Management of Human Resources	3
LAW 422	Legal Aspects of Business and Technology	3
MGT 424	Innovation and Entrepreneurship	3

Information Technology and Computing Courses		**(57 Credits)**
Course Code	**Course Title**	**Credit Hours**
CMP 173	Internet Technology I	3
CMP 171	Fundamentals of Computer Systems	3
CMP 172	Programming Language	3
CMP 174	Digital Systems	3
CMP 175	Object-Oriented Language (Java)	3
CMP 176	Data Structure and Algorithm	3
CMP 271	Database Management System	3
CMP 272	Object-Oriented Analysis and Design	3
CMP 273	Internet Technology II (Programming)	3
CMP 275	Computer Architecture and Microprocessor	3
CMP 274	Numerical Methods	3
CMP 276	Software Engineering and Project Management	3
CMP 277	Data Communication and Networks	3

CMP 381	Operating Systems	3
CMP 471	Artificial Intelligence	3
CMP 384	Computer Graphics	3
CMP 382	Cloud Computing	3
CMP 383	Digital Economy	3
CMP 472	Information System Security	3

Concentration Courses **(12 Credits)**

Course Code	Course Title	Credit Hours
	Concentration I	3
	Concentration II	3
	Concentration III	3
	Concentration IV	3

Project and Internship **(13 Credits)**

Course Code	Course Title	Credit Hours
PRJ 181	Project I	2
PRJ 281	Project II	2
PRJ 481	Major Project	3
INT 494	Internship	6

Summary Course structure

SN	Course	No. of Courses	Credit Hours	Percentage (%)
1.	Foundation Courses	6	18	14.17
2.	Management Courses	9	27	21.25
3.	Information Technology and Computing Courses	19	57	44.88
4.	Concentration Courses	4	12	9.44
5.	Project Work	3	7	6.29
6.	Internship	1	6	3.93
	Summary of Total Courses	42	127	100

Semester-wise Curriculum Structure

POKHARA UNIVERSITY
Bachelor of Computer System and Information Technology (BCSIT)

Semester I			Semester II		
Code	**Course Title**	**Credits**	**Code**	**Course Title**	**Credits**
ENG 111	English	3	ENG 112	Business Communication	3
MTH 113	Mathematics I	3	MTH 114	Mathematics II	3
CMP 173	Internet Technology I	3	CMP 174	Digital Systems	3
CMP 171	Fundamentals of Computer Systems	3	CMP 175	Object-Oriented Language (Java)	3
CMP 172	Programming Language	3	CMP 176	Data Structure and Algorithm	3
			PRJ 181	Project I	2
Total Credits		**15**	**Total Credits**		**17**

Semester III			Semester IV		
Code	**Course Title**	**Credits**	**Code**	**Course Title**	**Credits**
STT 220	Statistics and Probability	3	CMP 275	Computer Architecture and Microprocessor	3
CMP 271	Database Management System	3	CMP 274	Numerical Methods	3
CMP 272	Object-Oriented Analysis and Design	3	CMP 276	Software Engineering and Project Management	3
CMP 273	Internet Technology II (Programming)	3	CMP 277	Data Communication and Networks	3
MGT 222	Principles of Management	3	FIN 222	Fundamentals of Financial Management	3
			PRJ 281	Project II	2
Total Credits		**15**	**Total Credits**		**17**

Semester V			Semester VI		
Code	**Course Title**	**Credits**	**Code**	**Course Title**	**Credits**
MKT 351	Digital Marketing	3	CMP 384	Computer Graphics	3
CMP 381	Operating Systems	3	RCH 322	Research Methods	3
MGT 322	Organizational Behavior	3	CMP 382	Cloud Computing	3
CMP 471	Artificial Intelligence	3	ECO 322	Applied Economics	3
LAW 422	Legal Aspects of Business and Technology	3	MGT 424	Innovation and Entrepreneurship	3
	Concentration I	3		. Concentration II	3
	Total Credits	**18**		**Total Credits**	**18**

Semester VII			Semester VIII		
Code	**Course Title**	**Credits**	**Code**	**Course Title**	**Credits**
MGT 422	Strategic Management	3	PRJ 481	Major Project	3
MGT 423	Management of Human Resources	3	INT 494	Internship	6
CMP 383	Digital Economy	3			
CMP 472	Information System Security	3			
	Concentration III	3			
	Concentration IV	3			
	Total Credits	**18**		**Total Credits**	**9**

Concentration Area : Computing		
Code	**Course Title**	**Credits**
CMP 481	Python Programming	3
CMP 482	Advance Java	3
CMP 483	Compiler Design and Construction	3
CMP 484	Mobile Computing	3
CMP 485	Dot Net	3
CMP 486	Software Project Management	3
CMP 487	Open Source Technology	3

Concentration Area : Data Science		
Code	**Course Title**	**Credits**
DSC 481	Fundamentals of Data Science	3
DSC 482	Advance Database	3
DSC 483	Data Analysis and Modeling	3
DSC 484	Data Warehousing and Data Mining	3
DSC 485	Database Administration	3
DSC 486	Artificial Intelligence and Machine Learning	3
DSC 487	Distributed Database Management	3
DSC 488	Object Oriented Database Management	3

Concentration Area: Networking and Cyber Security		
Code	**Course Title**	**Credits**
NCS 481	Advance Networking with IPV6	3
NCS 482	Wireless Communication	3
NCS 483	Network Security	3
NCS 484	Embedded System	3
NCS 485	Routing and switching	3
NCS 486	System Admin	3
NCS 487	Distributed System	3
NCS 488	Ethical Hacking	3

Concentration Area: Management Science and Systems		
Code	**Course Title**	**Credits**
MSS 481	MIS and E-Business	3
MSS 482	E-Governance	3
MSS 483	Social Entrepreneurship	3
MSS 484	Financial Accounting	3
MSS 485	International Business	3
MSS 486	Knowledge Management	3
MSS 487	Managerial Accounting	3

Concentration Area: Multimedia Technology		
Code	**Course Title**	**Credits**
MMT 481	Fundamentals of Animations	3
MMT 482	3D Modeling	3
MMT 483	Moving Images and VFX	3
MMT 484	Multimedia Development Tools	3
MMT 485	Sound and Music Production	3
MMT 486	Advance Animation Techniques	3

COURSE DETAILS: BCSIT PROGRAM, SEMESTER V

Third Year, Fifth Semester

SN	Course Code	Course Title	Credit Hours
1.	MKT 351	Digital Marketing	3
2.	CMP 381	Operating Systems	3
3.	MGT 322	Organizational Behavior	3
4.	CMP 471	Artificial Intelligence	3
5.	LAW 422	Legal Aspects of Business and Technology	3
6.		Concentration I	3
		TOTAL CREDITS	**18**

Digital Marketing

Pokhara University
Faculty of Management Studies

Course code: MKT 351 — Full marks: 100
Course title: **Digital Marketing** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Year 3, Semester V — Total hours: 48
Level: Bachelor — Program: BCSIT

1. Course Description

This course introduces students to core digital marketing concepts and tools, emphasizing real world application and strategic thinking. It covers SEO, PPC advertising, email marketing, content strategy, social media marketing, analytics, influencer and affiliate marketing, mobile marketing, and ORM(Online Reputation Management). Hands-on labs and real tools like Google Ads, Mailchimp, and Canva are used.

2. General Objectives

The course is designed with the following general objectives:

- Understand digital marketing concepts, platforms, and strategies.
- Apply digital tools for SEO, SMM, content, and email marketing.
- Design and manage real-world marketing plans and campaigns.
- Evaluate online marketing performance using key metrics.
- Adopt ethical practices in digital marketing environments

3. Contents in Detail

Specific objectives	Content
• Define scope, compare digital vs traditional, understand customer journey and funnel	**Unit I: Introduction to Digital Marketing (5 Hours)** 1.1 Definition, Scope, and Significance of Digital Marketing 1.2 Digital vs Traditional Marketing: Cost, Reach, and Engagement 1.3 Tools used for successful marketing, SWOT analysis of Business for Digital Marketing. 1.4 Developing a digital marketing plan: SOSTAC model 1.5 Customer Value Journey: 5As Framework, 1.6 Marketing Funnel: Awareness to Conversion 1.7 Emerging trends

• Apply on-page, off-page, and technical SEO, use keyword and analytics tools	**Unit II: Search Engine Optimization (SEO) (7 Hours)** 2.1 Overview of SEO Process, Concept and Working of Search Engines (Crawling, Indexing, Ranking). SEO Techniques/Types 2.2 On-page Optimization techniques: Keyword Research, SEO Process- Site Structure, Content, Technical Mechanics, Headings, Image and Alt text, Social Sharing, Sitemaps, Meta Tags, Internal Linking, Alt Attributes 2.3 Technical Aspects- Compatibility, Structured Data Markup. 2.4 Off-page Optimization techniques: Link Format, Link Building, Content Marketing, Social Sharing; Black and White hat Techniques, Guest Blogging, Directory Submission 2.5 Technical SEO: Sitemap, Robots.txt, Mobile SEO, Page Speed, HTTPS 2.6 Keyword Research Tools and Analysis: - Google Keyword Planner, Ubersuggest, LSI, long-tail, intent-based - SEO Tools: Google Search Console
• Learn PPC models, run and optimize ad campaigns using Google Ads, Understand fraud detection, brand safety, and real-time bidding in the SEM ecosystem.	**Unit III: Search Engine Marketing (SEM) & Google Ads (8 Hours)** 3.1 Introduction of SEM: Working of Search Engine, SERP Positioning, online search behavior, DMI's 5P Customer Search Insights Model. 3.2 Search Advertising: Overview of PPC 3.3 Keyword Match Types: Broad, Phrase, Exact, Negative 3.4 Ad Copywriting: Headlines, Descriptions, Extensions 3.5 Ad Fraud detection, view ability and brand safety 3.6 Programmatic bidding: RTB, PMP, DMPs 3.7 Bidding Strategy, Quality Score, and Ad Rank 3.8 Conversion Tracking, A/B Testing 3.9 Performance Measurement
• Design strategies across platforms, use content tools, analyze SMM metrics, Build and implement effective social media strategies for businesses or personal branding,	**Unit IV: Social Media Marketing (SMM) (6 Hours)** 4.1 Social Media Marketing: Building 4.2 Successful Social Media Strategy 4.3 Major Platforms/Channels overview: Facebook, Instagram, Twitter, LinkedIn, YouTube 4.4 Understanding Ad words Algorithm 4.5 Algorithm decoding across platforms(Meta, LinkedIn, Tiktok, X, Threads) 4.6 Organic vs Paid Social Media Strategy 4.7 Audience Segmentation and Targeting Options 4.8 Content Creation and Scheduling: Tools (Canva, Buffer, Hootsuite) 4.9 SMM Metrics: Reach, Engagement, CTR,

	Impressions
• Plan and manage content strategy and email campaigns using modern tools	**Unit V: Email and Content Marketing (5 Hours)** 5.1 Content Marketing: Step-by-step Content Marketing, Developing a content marketing Strategy: Planning, Creation, Distribution 5.2 Blogging, Video Content, Podcasts, Infographics 5.3 Content Calendar and SEO Optimization 5.4 Email Campaign Planning, List Segmentation, Personalization 5.5 Types of Emails: Welcome, Newsletter, Promotion, Re-engagement 5.6 Tools: Mailchimp, Constant Contact, SendGrid.
• Understand influencer types, manage affiliate programs, ensure compliance	**Unit VI: Affiliate and Influencer Marketing (4 Hours)** 6.1 Affiliate Networks: Amazon, CJ Affiliate, ShareASale 6.2 Affiliate Program Setup and Management 6.3 Types of Influencers: Nano, Micro, Macro, Mega 6.4 Influencer Discovery, Outreach, and Performance Metrics 6.5 Disclosure, Compliance and Ethical Guidelines
• Use GA4 for tracking metrics, analyze KPIs and customer behavior	**Unit VII: Digital Analytics (5 Hours)** 7.1 Importance of Web Analytics and KPI Selection 7.2 Google Analytics 4(GA4) Interface and Configuration 7.3 Event Tracking, Goals, Funnels, Conversions 7.4 Traffic Sources, Audience Behavior, Bounce Rate 7.5 Reporting using Looker Studio 7.6 Dashboards and reports (Data Studio, Power BI)
• Run mobile campaigns, ASO, and manage brand reputation online, Understand mobile marketing channels and strategies including SMS, MMS, and mobile ads.	**Unit VIII: Mobile Marketing & ORM (4 Hours)** 8.1 SMS and MMS Marketing, Mobile App Ads 8.2 Basic app promotion 8.3 Online Reputation Management Strategies 8.4 Social Listening Tools: Brand24, Mention, Hootsuite Insights 8.5 Handling Negative Reviews and Crisis Communication
• Plan and execute a full campaign including reporting and presentation	**Unit IX: Ethics, Laws & Future Trends in Digital Marketing (4 Hours)** 9.1 GDPR, CCPA, PDPA, HIPPA and data privacy trends 9.2 Ethical marketing practices & green marketing 9.3 Marketing with AI: Risks and governance

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

4. **Method of Instructions**
   General Instructional Techniques: Lecture, Case Discussion, Guided Exercises, Industry Guest Sessions, online tutorials, and guided projects.
5. **Practical Activities**

Lab No.	Title	Description
Lab 1	Google Ads Setup	Create a full Google Ads search campaign including targeting and scheduling.
Lab 2	Keyword Match & Research Lab	Use Google Keyword Planner to find 5-10 keywords for a business data, segment, and assign keywords with proper match types.
Lab 3	SEP Audit(On-Page only)	Perform a simple audit on a given webpage (title tags, headings, meta, images).
Lab 4	Create Social Media post	Use **Canva** to design 2 social media posts for a product. Publish on dummy/real accounts.
Lab 5	Content Calendar & Post Creation	Design a weekly content calendar using Canva + Buffer for Facebook and Instagram. Include posts, hashtags, timing and format
Lab 6	Email Campaign via Mailchimp	Create a basic welcome or newsletter campaign and send it to a demo list.
Lab 7	Blog Post Writing	Write a blog post using keywords and optimize with headings/images. Use Grammarly/Yoast.
Lab 8	Google Analytics Walkthroug	Use demo account in **GA4**. Identify top pages, traffic sources, bounce rate.
Lab 9	YouTube Channel Optimization	Upload a video, add description, use tags, and observe performance (views, likes).
Lab 10	Campaign Final Report Presentation	Choose any one activity (Ads, SEO, Email, or Social), prepare a final report with results/insights.

6. Evaluation System and Student's Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows:

External Evaluation	Marks	Internal Evaluation	Weight	Marks
Semester-End examination	50	**Theory**		
		Attendance & Class Participation	10%	
		Assignments	20%	
		Presentations/Quizzes	10%	
		Internal Assessment	60%	50
Total External	**50**	**Total Internal**		**50**
Full Marks: 50 + 50 = 100				

Student's Responsibilities

Each Student must secure at least 45% marks separately in assessment and evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

6. Prescribed Books and References

Text Books:

- Chaffey, D. & Ellis-Chadwick, F. (2022). Digital Marketing (8th ed.), Pearson.

References

- Ryan, D. (2020). Understanding Digital Marketing. Kogan Page.
- Cutroni, J. (2021). Google Analytics. O'Reilly.
- Clifton, B. (2021). Advanced Web Mtrics with Google Analytics. Wiley.
- Charlesworth, A. (2018). Digital Marketing: A Practical Approach. Routledge.

Operating Systems

Pokhara University
Faculty of Management Studies

Course code: CMP 381 — Full marks: 100
Course title: **Operating Systems** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Year 3, Semester V — Total hours: 48
Level: Bachelor — Program: BCSIT

1. Course Description

The students will become familiar with the basics of operating systems and the feature controlling of modern operating system. The course contains Introduction to Operating System, process and Threads, Memory Management, Mass-storage structure & I/O systems, File System Interface and Case Studies of Unix, Linux, Windows, DOS, Amoeba Operating System.

2. General Objectives

The objective of the course is to provide basic concepts and interface of operating systems, to get familiarize with features and different functions of modern operating systems.

3. Contents in Detail

Specific Objectives	Course Contents
• Familiarize with basic concepts of Operating systems, and its architecture. • Understanding the successive evolution of operating system • Concept of Kernel and its role in system software	**Unit I: Introductions (7 Hours)** 1.1 Concept and function of operating systems 1.2 History and Evolution of operating systems 1.3 Types of Operating Systems: Batch Systems, Time-Sharing Systems, Personal-Computer Systems, Parallel Systems, Real-Time Systems, Distributed Systems 1.4 Operating System services: System calls, Shell commands, Shell programming 1.5 Operating System Structure: Monolithic System, Layered, Virtual Machines, Client-Server. 1.6 Kernel: Architecture and Types of Kernel
• Familiarize with Process and threads • Implement of resource allocation techniques and deadlock concepts • Understanding the mutual exclusion for resource utilization and process synchronization concepts	**Unit II: Process and Threads Management and Scheduling (16 Hours)** 2.1 **Processes** - Definition, states diagram, Process control block (PCB), Context switching, Operations on Processes, Cooperating Processes, Inter process Communication. 2.2 Threads - Overview, Benefits of Threads, User and Kernel Threads, Multithreading Models,

	Difference between Processes and Threads 2.3 Process Synchronization - Concurrent process, Critical region, Race condition, Solution of race condition: Mutual exclusion, Mutual exclusion algorithms: Locks, Test and Set Lock (TSL), Peterson's algorithms, Semaphore, Monitor, Process Synchronization, Classical problems of Process Synchronization: Readers-Writers Problem, Producer-Consumer Problem, Sleeping Barber Problem, Dining Philosopher Problems. 2.4 Processor Scheduling - Concepts, Scheduling Criteria, Scheduler and its types: Short term, Medium term and Long term, Scheduling and its types: preemptive and non-preemptive, Process Scheduling algorithms: FCFS, SJF, SRTF, RR, Priority, HRN, Multi-level, Multi-level Feedback 2.5 Deadlocks -Model of Deadlocks, Condition of Deadlock, Deadlock Handling, Prevention, Avoidance: Ostrich Algorithm, Banker's Algorithm, Detection, Recovery, Others issues: Database deadlock, Communication deadlock, Livelock, Starvation
• Conceptualize the role and working procedure of memory • Familiar with virtual memory management • Understand the page replacement algorithms	**Unit III: Memory Management (10 Hours)** 3.1 Memory: Concepts and its hierarchy, Memory address: Logical and Physical address, Swapping, Managing Free Memory Space: First Fit, Best Fit, Next Fit, and Worst Fit, Contiguous Memory Allocation, Coalescing and Compaction, Paging, Segmentation, Segmentation with Paging 3.2 Virtual Memory: Concept, Demand Paging, Page Replacement Algorithms: FIFO, LRU, Second Chance, Clock, Optimal, Thrashing
• Understand the role of input/output devices • Understand the different approaches for optimal output • Understand the concept of disk scheduling	**Unit IV: Input/output Management (6 Hours)** 4.1 Introduction, I/O Techniques: Programmed I/O, Interrupt-driven I/O, and Direct Memory Access (DMA), Principle I/O hardware: I/O devices, Device controllers, DMA, I/O software: Goals of I/O Software, Polled I/O verses Interrupt Driven I/O, Character User Interface and Graphical User Interface, Device Driver,

	User -space I/O Software 4.2 Disk Scheduling, Disk Arm scheduling algorithms: FCFS, SSTF, Elevator (Scan), C-Scan, Look, C-Look
• Understand the file mechanism • Familiar with directory and its management techniques	**Unit V: File Systems (5 Hours)** 5.1 File Concepts, File Descriptor, file Naming, File Structure, File Types, File Attributes, File Operations, File Access Methods 5.2 Directories Management (Single-level directory systems, Hierarchical Directory systems, Directory operation) 5.3 Methods of Allocation(Contiguous, Linked list, I-node)
• Compare, analyze, and understand how two dominant OS (Linux & Windows) implement OS concepts	**Unit VI: Case Study (4 Hours)** **Linux-** Design Principles, Inter-process communication, Security, Process management, File System **Windows-** Design principles, Programmer interface, System components, Security Level Process Management, File Systems

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

4. Learning Outcomes

By the end of the course you should be able to

- Describe, contrast and compare differing structures for operating systems;
- Understand and analyze theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files.

5. Practical Activities: Lab Works

Different lab works related to normal OS in Windows, and Linux OS.

6. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term-exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

Internal Evaluation	**Weight**	**Marks**	**External Evaluation**	**Marks**
Attendance & Class Participation	**10%**		**Semester End**	**50**
Assignments	20%			
Presentations/Quizzes	10%			
Internal Assessment	60%			
		50		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks in internal evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- Silbcrschatz A, G. P., & Gagne, G. Operating System Concepts. New York: John Wiley and Sons**.**

References

- Tanenbaum, A. S. Modern Operating Systems. New Delhi: Prentice Hall of India.
- William, S. Operating Systems. Delhi: Pearson Education.

Organizational Behavior

Pokhara University
Faculty of Management Studies

Course code: MGT 322 | Full marks: 100
Course title: **Organizational Behavior** | Pass marks: 45
Nature of the course: Theory and Practical | Credit hours: 3.0
Year 3, Semester V | Total hours: 48
Level: Bachelor | Program: BCSIT

1. Course Description

This course introduces students to the foundational principles and practices of organizational behavior (OB) within technological and interdisciplinary environments. It aims to help BCSIT students understand how individuals and groups behave within IT-based organizations, and how such behavior affects performance, innovation, and organizational culture.

2. General Objectives

The course is designed with the following general objectives:

- Understand the key theories of organizational behavior and their application in IT organizations.
- Analyze individual and group behavior in workplace settings.
- Apply motivational, leadership, and communication theories to enhance team productivity.
- Evaluate organizational structure and design from an OB perspective.
- Manage change, diversity, and conflict in a dynamic technological environment.

3. Contents in Detail

Specific Objectives	Contents
• Explain the scope and significance of OB, especially in tech firms; describe OB models and their relevance to IT industries.	**Unit I: Introduction to OB (6 Hours)** 1.1 Definition 1.2 Relevance in IT 1.3 OB models
• Analyze how personality, perception, learning, attitudes, and values influence behavior at the individual level in a tech-based organization.	**Unit II: Individual Behavior (6 Hours)** 2.1 Personality 2.2 Perception, 2.3 Learning, 2.4 Attitudes 2.5 Values
• Apply key motivation theories to understand how IT employees can be driven towards high performance and job satisfaction.	**Unit III: Motivation (6 Hours)** 3.1 Theories (Maslow, Herzberg, Vroom, McClelland) 3.2 Application in tech environments
• Examine group development, team processes, and dynamics within programming teams and project-based environments.	**Unit IV: Group Dynamics (6 Hours)** 4.1 Teams 4.2 Group formation 4.3 Norms

	4.4 Cohesion 4.5 Decision-making
• Evaluate different leadership styles and their application in software development and agile team leadership.	**Unit V: Leadership (6 Hours)** 5.1 Leadership theories (Trait, Behavioral, Contingency, Transformational), 5.2 Relevance in software teams
• Identify communication barriers and implement effective communication strategies in tech-based and virtual work settings.	**Unit VI: Communication (6 Hours)** 6.1 Barriers, 6.2 Effective IT communication 6.3 Virtual teams
• Recognize sources of workplace conflict in IT settings and use negotiation techniques to manage and resolve conflict effectively.	**Unit VII: Conflict and Negotiation (4 Hours)** 7.1 Types of conflict 7.2 Resolution techniques 7.3 Negotiation process
• Understand types of organizational culture and structures; assess their impact on performance, innovation, and job satisfaction in IT organizations.	**Unit VIII: Organizational Culture & Structure (4 Hours)** 8.1 Types 8.2 Role in innovation 8.3 Cultural change in IT firms
• Demonstrate understanding of change models and formulate strategies to manage resistance to change and implement change in tech startups or companies.	**Unit IX: Organizational Change & Development (4 Hours)** 9.1 Change models (Lewin, Kotter) 9.2 Resistance 9.3 Managing transitions

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

4. Methods of Instruction

- Interactive lectures
- Case studies (esp. tech/startup firms)
- Group discussions and presentations
- Games on Team and Group Dynamics, Role-playing and behavior simulations

5. Evaluation System and Students' Responsibilities

Evaluation System

The performance of a student in a course is evaluated on the basis of internal evaluation and semester-end examination. 50% weight is given to the internal evaluation and 50% weight to the Semester-end examination conducted by the Office of the Controller of Examinations, Pokhara University.

Internal Evaluation

The internal evaluation is based on continuous evaluation process. The internal evaluation components and their respective weights may vary according to the nature and objectives of the course. An evaluation plan should be prepared by the faculty and should share with the students in

the beginning of the course.

The internal evaluation components may consist of any combination of written test, quizzes and oral test, workshop, assignments, term paper, project work, case study analysis and discussion, open book test, class participation and any other test deemed to be suitable by the faculty.

Semester End Examination
There will be semester end examination at the end of the semester conducted by the Office of the Controller of Examinations, Pokhara University. It carries 50 % weight of total evaluation.

Students' Responsibilities
Each student must secure at least 45% marks in the internal evaluation with 80% attendance in the class to appear in the Semester End Examination. Failing to obtain such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear in the Semester End Examination. Students are advised to attend all the classes and complete all the assignments within the specified time period. If a student does not attend the class(es), it is his/her sole responsibility to cover the topic(s) taught during the period. If a student fails to attend a formal exam, quiz, test, etc. and there is not any provision for a re-exam.

6. Prescribed Books and References

Text Books

- Robbins, S.P. & Judge, T.A. (Organizational Behavior, Pearson).
- Nelson & Quick (Organizational Behavior, Cengage Learning).

References

- Stephen P. Robbins (Essentials of Organizational Behavior).
- Nepal-based case materials and articles from IT companies.

Artificial Intelligence

Pokhara University
Faculty of Management Studies

Course code: CMP 471 | Full marks: 100
Course title: **Artificial Intelligence** | Pass marks: 45
Nature of the course: Theory and Practical | Credit hours: 3.0
Year 3, Semester V | Total hours: 48
Level: Bachelor | Program: BCSIT

1. Course Description

The main objective of the course is to introduce concepts of Artificial Intelligence. It covers fundamental concepts such as artificial intelligence, approaches of artificial intelligence, problem solving, knowledge representation and reasoning, neural networks, machine learning, natural language processing, machine vision and expert systems.

2. General Objectives

The course is designed with the following general objectives:

- To learn about computer systems that exhibit intelligent behavior,
- To familiarize with intelligent agents and their characteristics,
- To identify different AI problems and solve the problems,
- To familiarize with knowledge representation systems and expert systems,
- To familiarize with neural networks for solving problems,
- To identify some machine learning paradigms and their applications.

3. Contents in Detail

Specific objectives	Contents
• Understand about the fundamental concepts of AI, Scope, types and Characteristics of AI Problems.	**Unit I: Introduction to Artificial Intelligence (6 Hours)** 1.1 Introduction to AI, AI Perspectives: Acting and thinking humanly, Acting and thinking rationally 1.2 Scope of AI 1.2.1. Game Playing 1.2.2. Problem Solving: 1.2.3. Natural Language Processing 1.2.4. Robotics 1.2.5. Computer Vision 1.2.6. Expert Systems 1.3 Turing Machine and Turing Test 1.4. Intelligent Agents, Structure of Intelligent agent, Properties of Intelligent Agents
• Familiar with different AI approaches for problem solving and searching techniques.	**Unit II: Approaches of Artificial Intelligence (12 Hours)** 2.1 Characteristics of AI Problems: Well Defined Problems, Constraint Satisfaction Problem 2.2 Problem Formulation

	2.2.1 Problem Specification 2.2.2 State Space Search with examples (8-puzzle, TSP, Water Jug Problem) 2.2.3 Problem Reduction 2.2.4 Production System 2.2 Searching Techniques 2.2.1 Types of Searching: Uninformed and Informed 2.2.2 Breadth First Search (BFS) 2.2.3 Depth First Search (DFS) 2.2.4 Bidirectional Search 2.2.5 Hill Climbing Search 2.2.6 Simulated Annealing Search 2.2.6 Greedy Search/Best First Search 2.2.7 A* Search 2.3 Min-Max Algorithm 2.4 Alpha-Beta Pruning (Cutoff)
• Familiar with Knowledge, Knowledge representation and Approaches and Reasoning.	**Unit III: Knowledge Representation and Reasoning (10 Hours)** 3.1 Definition and importance of Knowledge, Issues in Knowledge Representation 3.2. Knowledge Representation Systems: Semantic Nets, Frames, Conceptual Dependencies, Scripts, Rule Based Systems(Production System), Propositional Logic, Predicate Logic 3.3.Propositional Logic(PL): Syntax, Semantics, Formal logic-connectives, truth tables, tautology, validity, well-formed-formula, Inference using Resolution, 3.4 Backward Chaining and Forward Chaining 3.5 Predicate Logic: FOPL, Syntax, Semantics, Quantification, Inference with FOPL, Inference using resolution 3.6 Bayes' Rule and its use, Bayesian Networks 3.7 Fuzzy Logic
• Familiar with basic concept of Machine Learning and their applications	**Unit IV: Learning (10 Hours)** 4.1 Introduction 4.2 Concept of Learning 4.3 Types of Learning: Supervised, Unsupervised and Reinforcement Learning 4.4 Learning by Genetic Algorithms 4.5 Learning with Neural Networks 4.5.1 Introduction, Biological Neural Networks Vs. Artificial Neural Networks (ANN), 4.5.2 Mathematical Model of ANN, 4.5.3 Activation Functions: Linear, Step Sigmoid, 4.5.4 Types of ANN: Feed-forward, Recurrent, Single Layered, Multi-Layered,

	4.5.5 Application of Artificial Neural Networks, Learning by Training ANN, Perceptron Learning, Back-propagation Learning
• Familiar with Applications of AI	**Unit V: Applications of AI (8 Hours)** 5.1 Expert Systems, Components of Expert System, Steps in Development of Expert Systems 5.2.Natural Language Processing: 5.2.1 Natural Language Understanding and Natural Language Generation, 5.2.2 Steps of Natural Language Processing: Lexical Analysis (Segmentation, Morphological Analysis), Syntactic Analysis, Semantic Analysis, Pragmatic Analysis, 5.3 Machine Vision Concepts: 5.3.1 Machine vision and its applications, 5.3.2 Components of Machine Vision System 5.4 Robotics: Robot Hardware (Sensors and Effectors) , Robotic Perceptions
• Make familiarization with emerging trends of AI and its integration in different sectors nowadays.	**Unit VI: Emerging trends in AI (2 Hours)** 6.1 Generative AI 6.2 Explainable AI 6.3 Ethical AI 6.4 Multi-model AI 6.5 Integration of AI in different sectors: Health care, Cyber Security, IOT, Quantum Computing

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

4. Methods of Instruction

Lecture and Practical works should be conducted in parallel that covers all the concepts mentioned in the course contents.

5. Practical Activities

SN	Lists
1.	Write programs for implementing simple intelligent agents.
2.	Write programs for illustrating the concepts of Uninformed Search like DFS, BFS.
3.	Write programs for illustrating the concepts of Informed Search like Greedy Best First, A*.
4.	Write programs for illustrating the concepts of Game Search like MiniMax Search.
5.	Write programs for constraint satisfaction problems like water jug, n-queen problem.
6.	Write programs for illustrating the concepts knowledge representation systems, rule based (program with if then rules), predicate logic(using predicates like in Prolog)

6. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term-exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

Internal Evaluation	Weight	Marks	External Evaluation	Marks
Theory		**30**	**Semester End**	**50**
Attendance & Class Participation	10%			
Assignments	20%			
Presentations/Quizzes	10%			
Internal Assessment	60%			
Practical		**20**		
Attendance & Class Participation	10%			
Lab Report/Project Report	20%			
Practical Exam/Project Work	40%			
Viva	30%			
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- Stuart Russel and Peter Norvig, Artificial Intelligence A Modern Approach, Pearson

References

- George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Benjamin/Cummings Publication
- E. Rich, K. Knight, Shivashankar B. Nair, Artificial Intelligence, Tata McGraw Hill.
- D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall.

Legal Aspects of Business and Technology

Pokhara University
Faculty of Management Studies

Course code: LAW 422 — Full marks: 100
Course title: **Legal Aspects of Business and Technology** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Year 3, Semester V — Total hours: 48
Level: Bachelor — Program: BCSIT

1. Course Description

This crucial management course within the Bachelor of Computer System and Information Technology (BCSIT) curriculum provides students with a fundamental understanding of legal principles essential for the modern business and technological landscape. LAW 422 focuses on major concepts of business law, specifically tailored to the challenges and opportunities faced by professionals at the intersection of technology and commerce. The course aims to cultivate legal literacy, enabling BCSIT graduates to make informed decisions, mitigate risks, ensure compliance, protect intellectual property, and contribute ethically and legally to the development and deployment of computer systems and information technologies.

2. General Objectives

The course is designed with the following general objectives:

- To equip students with a fundamental understanding of the legal principles and regulations that govern business operations and technological advancements in an information-based society.
- To prepare students to identify and address the legal implications of emerging technologies, data management, cybersecurity, and intellectual property in their personal and professional activities.
- To empower students to make informed, ethical, and legally compliant decisions, ensuring their success and contribution to responsible innovation within the rapidly evolving technical landscape.

3. Contents in Detail

Specific Objectives	Contents
• Define the legal environment and identify the nature, types, and sources of law in Nepal, linking them to business relevance. • Apply civil law principles to IT-related contracts, intellectual property, and digital liabilities. • Outline the structure and functions of Nepal's court system and describe the essential steps in civil litigation.	**Unit I: Basics of Legal Environment and Court System (10 Hours)** Concept and importance of the legal environment; Rule of Law; Nature, types, and sources of Law; General principles of civil law; Meaning and sources of business law; The court system-structure, powers, organization, and jurisdiction; Civil procedures; Provisions in the Nepalese constitution about technology and business; Actus

• Examine the constitutional provisions that impact technology and business in Nepal, analyzing their practical implications. • Assess the dynamic shifts in Nepal's legal landscape, including the effects of federalism and the influence of technology on business law.	Reus, Mens Rea, and Modus Operendi for cybercrime; Changing dimensions of the Legal Environment due to the explanation of technologies.
• Analyze the fundamental elements required for a valid contract and differentiate between valid, void, voidable, and unenforceable agreements. • Evaluate the principles governing contract performance, termination, and the remedies available for breach of contract. • Distinguish between contracts of bailment and pledge, outlining the rights and duties of all involved parties. • Examine the concepts of indemnity and guarantee, detailing the rights and responsibilities of indemnifiers, indemnified parties, and sureties.	**Unit II: Provisions Relating to Contract and Some Specific Types (8 Hours)** Definition of contract; Interpretation of contract; Valid, void, voidable, and unenforceable contracts; Essentials of a valid contract; Offer and acceptance; Consideration; Free consent; Contingent contract; Performance of contract; Termination of contract; Breach of contract and remedies; Bailment and pledge; Rights and duties of bailor/bailee and pledgor/pledgee; Pledge by non-owner; Finder of lost goods; Discharge of liability; Contract of indemnity and guarantee; rights and duties of a surety.
• Explain the meaning and essential features of a contract for the sale of goods, distinguishing between conditions and warranties. • Evaluate the principles of ownership transfer in the sale of goods and evaluate the rights and remedies available to an unpaid seller upon breach of contract.	**Unit III: Provisions Relating to Contract of Sale of Goods (4 Hours)** Meaning and features of the contract of sale of goods; Types of goods; Conditions and warranties; Transfer of ownership; Unpaid seller; Suits for breach of contract; Performance of the contract of sale of goods.
• Explain the concept of agency, its various modes of creation, and the classification of different agent types. • Analyze the rights, duties, and liabilities of principals, agents, and sub-agents, including the methods of agency termination.	**Unit IV: Provisions Relating to Contracts of Agency (4 Hours)** Concept of agency; Creation and modes of agency; Classification of agents; Relation of principal and agent; Rights and duties of principals, agents, sub-agents, and substitute agents; Relation of principal with third party; Personal liability of agent; Termination of agency.

• Explain company formation, registration, and the significance of key constitutional documents. • Describe the Board of Directors' roles and distinguish between shares and debentures. • Outline company auditing, dissolution, and liquidation procedures, and define arbitration powers and duties.	**Unit V: Incorporation and Operation of Company (6 Hours)** Formation, incorporation, registration, and types of companies; Concept of legal personality; Memorandum, Articles of Association, and Prospectus; Shares and Debentures; Board of Directors, board meetings, and minutes; Auditing, dissolution, winding up, and liquidation; Arbitration - powers of arbitrator, duties of arbitrator, and revocation of arbitrator's authority.
• Define intellectual property, explain its importance and scope, and differentiate among various types such as copyrights, patents, and trademarks. • Scrutinize existing intellectual property laws in Nepal and evaluate the implications of the WTO's TRIPS Agreement on the national legal framework.	**Unit VI. Intellectual Property Rights (4 Hours)** Intellectual Property- Definition, scope, classification, importance, and types (e.g., copyrights, patents, design, trademark, geographical indication, industrial design, layout design, integrated circuit); Existing intellectual property laws in Nepal; WTO's agreement on Trade-Related Aspects of Intellectual Property Rights, 1995.
• Explain the major provisions of each act for a conducive business environment.	**Unit V. Major Provisions of the Acts Relating to Business and Technology (12 Hours)** 5.1 The Radio Act, 1957 5.2 Patent Design and Trademark Act, 1965 5.3 Communications Corporation Act, 1972 5.4 The National Broadcasting Act, 1993 5.5 Telecommunications Act, 1997 5.6 The Copyright Act, 2002 5.7 The Electronic Transactions Act, 2008 5.8 Foreign Investment and Technology Transfer Act, 2019 5.9 Radioactive Substances Act, 2020 5.10 The Industrial Enterprises Act, 2020 5.11 Security Printing Act, 2024 5.12 Electronic Business Act, 2025

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

4. Methods of Instruction

Instruction will be delivered through a blended approach, incorporating lectures, discussions, readings, and question-and-answer sessions. Specific instructional techniques will include practical work, project-based learning, self-directed learning, court visits, and case studies to foster a comprehensive and applied understanding of the subject matter.

5. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s) conducted by the Office of the Controller of Examinations at Pokhara University, the internal evaluation of a student may include class attendance, class participation, quizzes, assignments, presentations, written exams, and other relevant assessments. The tabular presentation of the evaluation system is as follows:

External Evaluation	Marks	Internal Evaluation	Marks
Semester-End Examination	50	Class attendance and participation	10
		Practical work and presentation	10
		Quizzes and assignments	5
		Internal exam	25
Total External	50	Total Internal	50
			Full Marks: 50+50 = 100

Students' Responsibilities

Each student must secure at least 45% marks separately in the internal assessment and practical evaluation, with a minimum of 80% attendance in the class, in order to appear in the Semester End Examination. Failing to get such a score will result given a NOT QUALIFIED (NQ) grade appearing on the Semester-End Examinations. Students are advised to attend all the classes, formal exams, tests, etc. and complete all the assignments within the specified period. Students are required to complete all the requirements defined for the completion of the course.

6. Prescribed Books and References

Text Books

References

- Government of Nepal. (2006). *Company Act.* Nepal Law Commission. Company Act, 2063 | Nepal Law Commission
- Government of Nepal. (2015). *Constitution of Nepal.* Nepal Law Commission. Constitution of Nepal | Nepal Law Commission
- Government of Nepal. (2017). *Civil Code.* Nepal Law Commission. Civil Code, 2074 | Nepal Law Commission
- Supreme Court of Nepal. (n.d.). *Supreme Court of Nepal*. https://supremecourt.gov.np/web/index.php/index
- Nepal Law Commission. (n.d.). *Nepal Law Commission.* https://www.lawcommission.gov.np

CONCENTRATION: ANY 4 COURSES FROM ANY ONE CONCENTRATION AREA

CONCENTRATION AREA: COMPUTING

Course Code	Course Title	Credits
CMP 481	Python Programming	3
CMP 482	Advance Java	3
CMP 483	Compiler Design and Construction	3
CMP 484	Mobile Computing	3
CMP 485	Dot Net	3
CMP 486	Software Project Management	3
CMP 487	Open-source Technology	3

Python Programming

Pokhara University
Faculty of Management Studies

Course code: CMP 481 — Full marks: 100
Course title: **Python Programming (Concentration)** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Level: Bachelor — Total hours: 48
Concentration area : Computing — Program: BCSIT

1. Course Description

This course provides a comprehensive introduction to Python programming, focusing on developing both foundational and intermediate-level coding skills. Students will learn Python syntax, data structures, control flow, and modular programming. The course also covers file handling, exception management, and basic object-oriented programming. In addition, students will be introduced to essential standard libraries and perform hands-on exercises with real-world applications such as business record management and simple data visualization.

2. General Objectives

The general objectives of this course are;

- Understand the fundamentals of Python and set up a programming environment.
- Use variables, data types, and operators to write effective Python programs.
- Apply conditional statements and loop structures for program control.
- Perform operations on strings, lists, tuples, sets, and dictionaries.
- Define and invoke functions and work with modular code using Python modules.
- Read and write data from files and handle business-related data using file I/O.
- Implement error handling using Python's exception mechanism.
- Apply object-oriented programming principles such as classes, objects, constructors, and inheritance.
- Utilize basic Python libraries for mathematical operations, randomness, dates, and plotting simple graphs.

3. Contents in Detail

Specific objectives	Contents
• Learn about Python's features and business applications. Set up Python with tools like IDLE, VS Code, and Jupyter, and write your first script using basic syntax and comments.	**Unit I: Introduction to Python and Setup (4 Hours)** 1.1 Introduction to Python, Features, and Applications in Business 1.2 Installing Python and setting up development environments (IDLE, VS Code, Jupyter) 1.3 Writing and executing your first Python script 1.4 Keywords, identifiers, indentation, and comments
• Understand Python's core data types and how to use variables.	**Unit II: Data Types, Variables, and Operators (4 Hours)** 2.1 Variables and Constants

Work with arithmetic, comparison, logical, assignment, and bitwise operators for basic computations	2.2 Data Types: Numeric, String, Boolean 2.3 Type Conversion (casting) 2.4 Operators: Arithmetic, Comparison, Logical, Assignment, Bitwise
• Use if, else, and loops (for, while) to control program flow. Practice nested loops and statements like break, continue, and pass	**Unit III: Decision Making and Control Structures (4 Hours)** 3.1 if, if-else, elif statements 3.2 for and while loops 3.3 break, continue, and pass 3.4 Range-based loops 3.5 Nested loops
• Manipulate strings using slicing and built-in methods. Learn List, Dictionary, Set and Tuples	**Unit IV: Strings, Lists, Tuples, Sets, and Dictionaries (6 Hours)** 4.1 String creation, indexing, slicing, and formatting 4.2 Common string methods: .lower(), .upper(), .strip(), .split(), .join(), .replace(), .find() 4.3 List creation, indexing, slicing, and modification using methods like .append(), .insert(), .remove(), .pop(), .sort(), .reverse() List functions: len(), sum(), min(), max(), sorted() 4.4 Tuples vs Lists: immutability, creation, and basic operations 4.5 Sets: storing unique data, set operations (add(), remove(), union(), intersection()) 4.6 Dictionaries: key-value pairs, creation, accessing, updating, deleting items
• Create reusable functions with arguments and return values. • Understand variable scope and import both built-in and custom modules. .	**Unit V: Functions and Modules (5 Hours)** 5.1 Creating and using functions 5.2 Arguments, return values, default and keyword arguments 5.3 Scope of variables (local/global) 5.4 import, from, as, dir(), help() 5.5 Creating and using modules
• Read from and write to text and CSV files using Python. • Apply file handling in real-life tasks like storing customer or sales records.	**Unit VI: File Handling and Data Persistence (3 Hours)** 6.1 Reading from and writing to text files 6.2 Business application:Saving customer records in file 6.3 Introduction to CSV files(read/write)using csv module
• Handle errors using try, except, else, and finally. • Learn to raise exceptions • Manage common issues like division by zero or invalid input.	**Unit VII: Exception Handling (5 Hours)** 7.1 Try, Except block 7.2 else, finally 7.3 Common built-in exceptions 7.4 Raising exceptions using raise
• Define classes and create objects with attributes and methods.	**Unit VIII: Object-Oriented Programming Basics(6 Hours)**

• Use constructors and inheritance to model real-world systems.	8.1 Defining Classes and Creating Objects 8.2 Attributes and Methods 8.3 Constructors (init) 8.4 Inheritance and method overriding
• Introduces the basics of SQL and relational databases, focusing on SQLite and Python's sqlite3 module. • Students will learn to connect to databases, execute SQL commands, and perform CRUD operations directly through Python.	**Unit IX: Python SQL Database Access (6 Hours)** 9.1 Basics of SQL and relational databases 9.2 Introduction to SQLite and sqlite3 module in Python 9.3 Connecting to a database, executing SQL commands 9.4 CRUD operations: INSERT, SELECT, UPDATE, DELETE using Python
• Get a basic overview of math, random, datetime, and popular libraries like NumPy, Pandas, and Matplotlib. Build a mini-project using learned concepts such as a sales report or data tracker	**Unit X: Introduction to Data Libraries and Mini Project (5 Hours)** 10.1 Introduction to math, random, datetime, and os modules 10.2 Overview of numpy, pandas, matplotlib (very basic) 10.3 Introduction to matplotlib (simple graphs – sales, profit trends)

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

4. Methods of Instruction

Lecture, Demonstration, Practical Lab, Discussion and Assignments

5. Practical Activities

Lab No.	Lab Title	Unit	Key Activities
1	Python Basics and Environment Setup	Unit I	Familiarize students with Python installation, environment setup, syntax, and script execution
2	Data Types, Variables, and Operators	Unit II	Assess understanding of variable declaration, data types, and use of various operators.
3	Conditional Statements and Decision Making	Unit III	Evaluate logical thinking and application of control flow using if, else, and elif.
4	Loops and Iteration Techniques	Unit IV	Focus on for and while loops, including nested loops and control keywords.
5	Working with Strings and Lists	Unit V	Practice common string methods and list operations like indexing, slicing, sorting, and iteration.
6	Tuples, Sets, and Dictionaries	Unit VI	Explore tuple immutability, set uniqueness, and dictionary key-value manipulation.
7	Functions and Modular Programming	Unit VII	Test the ability to define and use functions, manage scope, and organize code using modules.

8	File Handling and Data Storage	Unit VIII	Work with file input/output for text and CSV formats to simulate persistent data handling.
9	Exception Handling	Unit IX	Identify and manage runtime errors using Python's exception handling mechanisms.
10	OOP and Intro to Data Libraries	Unit X	Apply object-oriented concepts and demonstrate basic usage of data libraries like math, random, pandas, and matplotlib.

6. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term-exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

Internal Evaluation	**Weight**	**Marks**	**External Evaluation**	**Marks**
Theory		**30**	**Semester End**	**50**
Attendance & Class Participation	10%			
Assignments	20%			
Presentations/Quizzes	10%			
Internal Assessment	60%			
Practical		**20**		
Attendance & Class Participation	10%			
Lab Report/Project Report	20%			
Practical Exam/Project Work	40%			
Viva	30%			
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class to appear in the semester-end examination. Failing to get such a score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- Python Programming: An Introduction to Computer Science. Author: John Zelle Edition: 3rd Edition (or latest). Publisher: Franklin, Beedle & Associates

References

- Programming in Python 3: A Complete Introduction to the Python Language Author: Mark Summerfield Edition: 2nd Edition**.** Publisher: Addison-Wesley Professional, 2009
- Python Crash Course: A Hands-On, Project-Based Introduction to Programming Author: Eric Matthes Edition: 2nd Edition. Publisher: No Starch Press, 2019.

Advance Java

Pokhara University
Faculty of Management Studies

Course code: CMP 482	Full marks: 100
Course title: **Advance Java (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Computing	Program: BCSIT

1. Course Description

This course is designed for upper-semester BCSIT students to build advanced Java programming skills with a focus on real-world, market-relevant applications. It emphasizes project-based learning to develop enterprise-level applications, integrating modern Java frameworks, tools, and best practices used in the industry. The syllabus covers advanced object-oriented programming, web development with Spring Boot, RESTful API design, database integration, microservices architecture, and cloud deployment. Students will work on a capstone project, applying concepts to solve real-world problems, preparing them for careers in software development, backend engineering, and full-stack development.

2. General Objectives

The course is designed with the following general objectives:

- Master advanced Java programming concepts and frameworks for building scalable, enterprise-grade applications.
- Develop proficiency in designing and implementing RESTful APIs and understanding microservices using Spring Boot.
- Gain hands-on experience with database integration, ORM tools, and basic of cloud deployment.
- Build a market-ready capstone project that demonstrates problem-solving and industry-standard development practices.
- Prepare students for real-world software development roles by aligning skills with current market demands.

3. Contents in Detail

Specific Objectives	Contents
• Understand advanced OOP concepts like design patterns and SOLID principles. • Apply these concepts to create modular, maintainable code.	**Unit I: Advanced Object-Oriented Programming (5 Hours)** 1.1 Review of OOP Principles 1.2 SOLID Principles in Java 1.3 Common Design Patterns (Singleton, Factory, MVC, DOA) 1.4 Exception Handling Best Practices and Custom Exceptions
• Understand the Java web architecture	**Unit II: Web Development Fundamentals (7 Hours)**

• Create simple dynamic web pages • Knowledge how servlet and JSP works. • Learn modern web components	2.1 Web Architecture & HTTP 2.2 Understanding Servlet Technology (Life cycle, methods) 2.3 Session and JSP (HttpSession,JSP lifecycle and directives) 2.4 Modern Web Components (Template engine: Thymeleaf) 2.5 Request Handling (Form, File, request, errors)
• Understanding Java Web frameworks and its enterprise framework • Learn importance of Framework • Learn Spring Boot framework for rapid application development. • Configure and manage dependencies using Maven/Gradle.	**Unit III: Java Web Frameworks (10 Hours)** 3.1 Introduction to Java Web Frameworks (types, Enterprise Framework) 3.2 Introduction to Spring Framework Ecosystem 3.3 Core Spring Concepts (IoC, Dependency Injection, Bean Lifecycle) 3.4 Spring Boot Overview, Features, and Auto-configuration 3.5 Spring Boot Annotations 3.6 Configuration Management (application.properties, profiles, externalized config) 3.7 Setting up Spring Boot Projects with Maven/Gradle 3.8 Spring Boot Starters and DevTools
• Design and implement RESTful APIs. • Handle HTTP methods, status codes, and API security. • Basic Understanding of documentation of API	**Unit IV: RESTful Web Services with Spring Boot (7 Hours)** 4.1 REST Principles and HTTP Methods 4.2 Building REST APIs with Spring Web MVC/DOA 4.3 Request/Response Handling 4.4 Data Validation and Error Handling 4.5 Basic understanding of API Design & Documentation
• Integrate relational databases using Spring Data JPA. • Perform CRUD operations and manage transactions. • Implement database connectivity using ORM and relational DBs	**Unit V: Database Connectivity & ORM Implementation (6 Hours)** 5.1 JDBC Fundamentals 5.2 Introduction to ORM and Hibernate 5.3 Configuring Spring Data JPA 5.4 CRUD Operations with JPA Repositories 5.5 Entity Mapping & Relationships 5.6 Basic of Transaction Management ,Query 5.7 Methods, DB migrations
• Secure applications and understand modern development tools. • Web configurations CORS, CSRF, Filter	**Unit VI: Security & Testing (5 hrs.)** 6.1 Introduction to Spring Security (JWT, OAuth2 Basics, RBAC) 6.2 Web Security Configuration (Security

	Configuration, security filters) 6.3 Unit testing with Junit 6.4 Understanding Build tools
• Understand modern development tools and deployment concepts • Understand micro services architecture and its benefits.	**Unit VII: Deployment and Microservices Basics [3 hrs.]** 7.1 Deployment Fundamentals concepts (AWS, Azure) 7.2 Understanding Containerization (Docker) 7.3 CI/CD overview (version control: git) 7.4 Microservices vs. Monolithic Architecture 7.5 Application Monitoring and Logging
• Design and develop a capstone /Final project addressing a real-world problem. • Apply all learned concepts in a production-ready application.	**Unit VIII: Capstone Project (5 hrs)** 8.1 Project Planning and Requirement Analysis 8.2 Designing Application Architecture 8.3 Implementation Using Spring Boot, REST, and JPA 8.4 Testing, Documentation, and Deployment 8.5 Project Presentation

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

4. Methods of Instruction

- Lectures with real-world case studies.
- Hands-on coding sessions and lab work.
- Group discussions and peer code reviews.
- Project mentoring and agile development workshops.
- Guest lectures from industry professionals.
- Problem-based learning through mini-projects.
- Tutorials on modern tools (e.g., Docker, Postman, Git).

5. Practical Activities

- Developing Spring Boot-based projects to implement advanced Java concepts.
- Installation postman, popular iDE and necessary tools.
- Building and testing RESTfulAPIs using Postman.
- Database integration with Spring Data JPA and CRUD operations
- Implementing security mechanisms (OAuth2,JWT) in SpringBoot
- Writing unit and integration tests using JUnit and Mockito.
- Deploying applications to cloud platforms (AWS/Heroku) using Docker.
- Integrating RESTAPIs with a frontend framework (React/Angular).

Note: Doing necessary practical session for developing spring boot based project on Advance Java concepts

6. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

Internal Evaluation	**Weight**	**Marks**	**External Evaluation**	**Marks**
Theory		**20**	**Semester End**	**50**
Attendance & Class Participation	10%			
Assignments	50%			
Presentations/Quizzes	10%			
Internal Assessment	30%			
Practical		**30**		
Attendance & Class Participation	10%			
Lab Report/Project Report	20%			
Practical Exam/Project Work	60%			
Viva	20%			
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class to appear in the semester-end examination. Failing to get such a score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- Spring in Action (6th Edition) by Craig Walls - Manning Publications
- Spring Boot: Up and Running by Mark Heckler - O'Reilly Media
- Java: The Complete Reference (12th Edition) by Herbert Schildt - McGraw Hill

References

- RESTful Web Services by Leonard Richardson - O'Reilly Media
- Baeldung (https://www.baeldung.com) – Spring & Hibernate tutorials

Compiler Design and Construction

Pokhara University
Faculty of Management Studies

Course code: CMP 483 — Full marks: 100
Course title: **Compiler Design and Construction (Concentration)** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Level: Bachelor — Total hours: 48
Concentration area : Computing — Program: BCSIT

1. Course Description

This course is designed to develop acquaintance with fundamental concepts of compiler design. The course starts with the basic concepts and also includes different phases of compilers like lexical analysis, syntax analysis, syntax-directed translation, type checking etc. in detail.

2. General Objectives

The general objectives of this course are;

- To develop knowledge in compiler design
- To develop lexical analyzers, parsers, and small compilers using different tools
- To develop lexical analyzers, parsers, and small compilers by using general purpose programming languages.

3. Contents in Detail

Specific objectives	Contents
• Introduce about compiler and its basic concepts	**Unit I: Introduction to Compiler (4 Hours)** 1.1 Compiler Structure: Analysis and Synthesis Model of Compilation, different sub-phases within analysis and synthesis phases 1.2 Basic concepts related to Compiler such as interpreter, simple One-Pass Compiler, preprocessor, macros, symbol table and error handler.
• Familiarize the students with the concepts such as Lexical Analysis, Syntax Analysis, Syntax Directed Translation, Type Checking	**Unit II: Lexical Analyzer (20 Hours)** 2.1 Lexical Analysis: The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, Finite Automata, Regular Expression to an NFA, Design of a lexical analyzer generator 2.2 Syntax Analysis: The role of parser, Context free grammars, Writing a grammars, Top-down parsing, Bottom-up parsing, Operator-preceding parsing, LR parsing, Ambiguous grammar.

	2.3 Syntax Directed Translation: Syntax-directed definition, Syntax tree and its construction, Evaluation of S-attributed definitions, L-attributed, Top-down translation, Recursive evaluators. 2.4 Type Checking: Type systems, Specification of a simple type checker, Type conversions.
• Conceptualize on Symbol table design and Run–time storage management	**Unit III: Symbol Table Design and Runtime Storage Management (4 Hours)** 3.1 Symbol Table Design: Function of Symbol Table, Information provided by Symbol Table, Attributes and Data Structures for symbol table 3.2 Run–time storage management
• Understand about Intermediate Code Generator, Code Generator and Optimization	**Unit IV: Intermediate Code Generator, Code Generator, Optimization and Case studies (20 Hours)** 4.1 Intermediate Code Generator: High-level and Low-level Intermediate representation, Syntax tree & DAG representations, Three-address code, Quadruples, Triples, SDT for intermediate code, Intermediate code generation for Declarations, Assignments, Control Flow, Boolean Expressions and Procedure Calls; Back patching. 4.2 Code Generator: Factors affecting a code generator, Target Language, Basic blocks and flow graphs, Dynamic programming code-generation algorithm 4.3 Code Optimization: Need and criteria of Code Optimization, Basic optimization techniques 4.4 Case Studies of some compilers like C compiler, C++ complier

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

4. Methods of Instruction

- Lecture
- Demonstration
- Practical Lab
- Discussion
- Assignments

5. Practical Activities : Laboratory Works

The laboratory work develops practical knowledge on different concepts of compiler design. Students should

- Create a project by using lexical analyzer generator or any high-level language
- Create a parser by using parser generator or any high-level language
- Write programs for intermediate code generation and machine code generation
- Create front end of a compiler and using general purpose programming languages

6. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

Internal Evaluation	**Weight**	**Marks**	**External Evaluation**	**Marks**
Theory		**20**	**Semester End**	**50**
Attendance & Class Participation	10%			
Assignments	50%			
Presentations/Quizzes	10%			
Internal Assessment	30%			
Practical		**30**		
Attendance & Class Participation	10%			
Lab Report/Project Report	20%			
Practical Exam/Project Work	60%			
Viva	20%			
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class to appear in the semester-end examination. Failing to get such a score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- Compilers Principles, Techniques, and Tools, Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman; Pearson Education

References

- Introduction to Automata Theory, Languages, and Computation, Johne E. Hopcroft, Rajeev Motwani, Jeffrey D. Ulman, Pearson Education
- Advanced Compiler Design and Implementation, Steven Muchnick, Morgan Kaufman Publication

Dot Net

Pokhara University
Faculty of Management Studies

Course code: CMP 485 — Full marks: 100
Course title: **Dot Net (Concentration)** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Level: Bachelor — Total hours: 48
Concentration area : Computing — Program: BCSIT

1. Course Description

The course covers the concepts of cross-platform web application development using the ASP.NET Core MVC framework using C# programming Language.

2. General Objective

The objective of this course is to understand the theoretical foundation as well as its practical aspects of ASP.NET Core web application framework and C# language features.

3. Contents in Detail

Specific objectives	Contents
• Introduction to .Net framework and related issues.	**Unit I: Language Preliminaries (8 Hours)** Introduction to .Net framework, Compilation and execution of .Net applications, Basic Languages constructs, Constructor, Properties, Arrays and String, Indexers, Inheritance, use of "base" keyword, Method hiding and overriding, applying polymorphism in code extensibility, structs and enums, abstract class sealed class, interface, Delegate and Events, Partial class, Collections, Generics, File IO, LINQ (Language Integrated Query) Fundamentals: Lambda Expressions, Try statements and Exceptions, Attributes: Attribute Classes, Named and Positional Attribute Parameters, Attribute Targets, Specifying Multiple Attributes, Asynchronous Programming: Principle of Asynchrony, Async/Await patterns in C#
• Understand ASP.NET frameworks and related topics	**Unit II: Introduction to ASP.NET (4 Hours)** .NET and ASP.NET frameworks: .NET, .NET Core, Mono, ASP.NET Web Forms, ASP.NET MVC, ASP.NET Web API, ASP.NET Core, .NET Architecture and Design Principles, Compilation and Execution of .NET applications: CLI, MSIL and CLR, .NET Core in detail, .NET CLI: build, run, test and deploy .NET Core Applications.
• Conceptualize HTTP and ASP.NET Core issues	**Unit III: HTTP and ASP.NET Core (4 Hours)** HTTP, Request and Response Message Format, Common web application architectures, MVC Pattern, ASP.NET Core Architecture Overview, Projects, and Conventions, ASP.NET and ASP.NET MVC

• Able to create ASP.NET core MVC applications	**Unit IV: Creating ASP.NET core MVC applications (10 Hours)** Setting up the Environment, Controllers and Actions: Create Controllers, Create Actions and Action Results Types, Rendering HTML with Views: Razor Syntax, Understanding Tag Helpers, Models: Binding and Validations, URL Routing and features, Web API Applications: API Controllers, JSON, Dependency Injection and IOC containers
• Able to work with database such as ADO.NET basics and others	**Unit V: Working with Database (6 Hours)** ADO.NET basics: Connection, Command, Reader and Adapter classes, Entity Framework (EF) Core, Object-Relational Mapper (ORM), Adding EF Core to an application: Choosing database provider, data models and data context, Querying and Saving data to database: Create, read, update and delete records.
• Understand to State Management on ASP.NET Core Application	**Unit VI: State Management on ASP.NET Core Application (4 Hours)** State Management on stateless HTTP, Server-side strategies: Session State, TempData, Using HttpContext, Cache Client-side strategies: Cookies, Query Strings, Hidden Fields
• Understand Client-side Development in ASP.NET Core	**Unit VII: Client-side Development in ASP.NET Core (4 Hours)** Common client-side web technologies, JQuery, Forms and Validation, Single Page Application (SPA) Frameworks: Angular, React
• Know in Securing in ASP.NET Core Application	**Unit VIII: Securing in ASP.NET Core Application (5 Hours)** Authentication: ASP.NET Core Identity, Adding authentication to apps and identity service configurations, Authorization: Roles, Claims and Policies, Securing Controllers and Action Methods, Common Vulnerabilities: Cross-site Scripting attacks, SQL Injection attacks, Cross-site Request Forgery (CSRF), Open Redirect Attacks
• Able in Hosting and Deploying ASP.NET Core Application	**Unit IX: Hosting and Deploying ASP.NET Core Application (3 Hours)** App Servers and Hosting models: IIS, Nginx, Apache, ASP.NET Core Module, Kestrel, Docker and Containerization, Publish to Azure cloud

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

4. Methods of Instruction

- Lecture
- Demonstration
- Practical Lab
- Discussion
- Assignments

5. Practical Activities : Laboratory Works

The laboratory work includes writing programs covering most of the concepts of above units using C# and .NET core SDK (3.0 or above)

6. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

Internal Evaluation	**Weight**	**Marks**	**External Evaluation**	**Marks**
Theory		**20**	**Semester End**	**50**
Attendance & Class Participation	10%			
Assignments	50%			
Presentations/Quizzes	10%			
Internal Assessment	30%			
Practical		**30**		
Attendance & Class Participation	10%			
Lab Report/Project Report	20%			
Practical Exam/Project Work	60%			
Viva	20%			
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class to appear in the semester-end examination. Failing to get such a score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development, Fourth Edition, by Mark J. Price, 2019
- ASP.NET Core in Action, by Andrew Lock, 2018

References:

- Learning ASP.NET Core 2.0, Michel Bruchet, Jason De Oliveira, 2017
- Learn ASP.NET Core 3 - Second Edition, Kenneth Yamikani Fukizi, Jason De Oliveira, Michel Bruchet, 2019

Software Project Management

Pokhara University
Faculty of Management Studies

Course code: CMP 486	Full marks: 100
Course title: **Software Project Management (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Computing	Program: BCSIT

1. Course Description

The *Software Project Management* course is designed to equip students with both essential theoretical knowledge and practical skills needed to successfully plan, execute, and manage software development projects. It introduces students to core project management principles, including the software development lifecycle (SDLC), project planning, scheduling, resource allocation, and risk management. Students will learn and apply industry-standard estimation techniques such as COCOMO and Function Point Analysis, and utilize project tracking tools like Gantt charts, PERT, and CPM to monitor project progress.

The course emphasizes the importance of risk identification, analysis, and mitigation strategies to ensure project success. A strong focus is placed on Agile and Scrum methodologies, providing students with hands-on experience using tools like Jira, Trello, and MS Project. Students will also develop competencies in quality assurance, stakeholder management, and effective team collaboration.

Through real-world case studies and practical assignments, learners will explore both successful and failed software projects to identify critical success and failure factors. The course culminates in a capstone project, allowing students to integrate their learning and demonstrate their ability to manage a software project from inception to completion, preparing them for real-world challenges in the software industry.

2. General Objectives

The general objectives of this course are;

- To provide students with fundamental knowledge of software project management principles and practices.
- To enable students to effectively plan, execute, and manage software development projects using appropriate methodologies and tools.
- To develop students' ability to apply estimation techniques such as COCOMO and Function Point Analysis.
- To equip students with the skills to use project tracking and scheduling tools like Gantt charts, PERT, and CPM.
- To train students in identifying, analyzing, and mitigating risks in software projects.

- To introduce Agile and Scrum methodologies along with hands-on experience using tools like Jira, Trello, and MS Project.
- To enhance students' understanding of quality assurance processes, stakeholder management, and team collaboration.
- To implement analytical skills through case studies of successful and failed projects, highlighting key success and failure factors.
- To integrate students' learning through a capstone project demonstrating their proficiency in managing a complete software project lifecycle.

3. Contents in Detail

Specific Objectives	Contents
• Understand the nature and challenges of software projects. • Learn key differences between software and other projects. • Explore project life cycles and frameworks.	**Unit I: Foundations of Software Project Management (6 Hours)** 1.1 Introduction to Software Projects and SPM 1.2 Software Project vs Other Projects 1.3 Importance, Challenges, and Process of Software Project Management 1.4 Characteristics of Successful Software Project Managers 1.5 Software Project Life Cycle Models: Waterfall, Agile, Iterative 1.6 Overview of Software Process Frameworks and Planning
• Learn to define project scope and objectives. • Develop skills in feasibility analysis and project structuring.	**Unit II: Project Initiation, Scope, and Planning (8 Hours)** 2.1 Project Charter and Feasibility Study 2.2 Defining Project Scope and Objectives 2.3 Strategic and Technical Assessment 2.4 Work Breakdown Structure (WBS) 2.5 Project Approach: Choosing Technologies, Process Models 2.6 Cost-Benefit Analysis and Forecasting
• Apply estimation techniques for effort, time, and cost. • Use scheduling tools and optimize timelines.	**Unit III: Estimation, Scheduling and Budgeting (9 Hours)** 3.1 Software Effort Estimation Techniques: Expert Judgement, Analogy, Top-down, Bottom-up, Parametric (COCOMO, FP) 3.2 Activity Planning and WBS Refinement 3.3 Network Planning Models: CPM, PERT, PDM 3.4 Forward Pass & Backward Pass Calculations 3.5 Shortening Project Duration, Identifying Critical Paths 3.6 Budgeting and Resource Planning 3.7 Earned Value Management (EVM)
• Learn to identify and analyze software project risks.	**Unit IV: Risk and Change Management (6 Hours)** 3.1 Risk Identification, Categorization, and Planning

• Manage changes and project uncertainties effectively.	3.2 Risk Analysis and Mitigation Strategies 3.3 Risk Register and Schedule Risk Evaluation 3.4 Issue Tracking and Change Management 3.5 Framework for Dealing with Risks
• Understand quality planning and measurement in software projects. • Apply international standards and metrics.	**Unit V: Quality Management and Metrics (5 Hours)** 5.1 Introduction to Software Quality: Importance and Definition 5.2 TQM, Six Sigma, ISO 9126 5.3 Software Quality Assurance (SQA) and Control 5.4 Process Metrics vs Product Metrics 5.5 Quality Audits and Reviews
• Understand team structure, communication, and motivation. • Learn conflict management and stakeholder handling.	**Unit VI: Human Resource and Communication Management (5 Hours)** 6.1 Organizational Structure and Team Roles 6.2 Communication Planning and Reporting Mechanisms 6.3 Stakeholder Identification and Engagement 6.4 Conflict Resolution Strategies 6.5 Motivation Theories: Maslow, Herzberg
• Execute and control projects effectively using modern tools. • Learn project closure practices and tool-based tracking.	**Unit VII: Project Execution, Monitoring, Closure and Tools (9 Hours)** 7.1 Monitoring Tools and KPIs 7.2 Project Progress and Performance Tracking 7.3 Final Project Documentation and Handover 7.4 Lessons Learned and Post-Project Review 7.5 Configuration Management: Concepts, Baseline, Change Control 7.6 Case Study: Version Control Tools (Git, SVN, CVS) 7.7 Hands-on Tools: MS Project, Jira, Trello, Open Project 7.8 Task Assignment, Timeline, Tracking, Agile Boards

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

4. Method of Instructions

General Instructional Technique:
Lecture, Discussion, Reading, Question Answer, Group projects, industry insides
Specific Instructional Technique:
Practical works, Project Based Learning, Self-Directed Learning, Industry Insights, research papers and Case Study

5. Practical Activities: Laboratory Work

The laboratory work in Software Project Management aims to provide practical experience in applying project management tools and techniques across the full software project lifecycle. Students learn to plan, execute, monitor, and control projects by creating key documents (like project charters, risk plans, and cost estimates), using tools such as Gantt charts and Jira. Through

teamwork and role-play, they simulate real project environments, explore both traditional and agile methodologies, and develop critical skills in communication, problem-solving, and stakeholder management. The lab bridges theory and practice, preparing students for real-world software project roles.

6. Evaluation System and Student's Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

External Evaluation	Marks	Internal Evaluation	Weight	Marks
Semester-End Examination	50	**Theory**		
		Attendance & Class Participation	10%	30
		Assignments	20%	
		Presentations/Quizzes	10%	
		Internal Assessment	60%	
		Practical		
		Attendance & Class Participation	10%	20
		Lab Report/Project Report	20%	
		Practical Exam/Project Work	40%	
		Viva	30%	50
Total External	50	Total Internal		
Full Marks: 50 + 50 = 100				

Student's Responsibilities

Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such a score will be given NOT QUALIFIED (NQ) to appear in the Semester-End Examinations. Students are advised to attend all the classes, formal exams, tests, etc., and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books:

- Roger S. Pressman, Software Engineering (7 th Edition). Boston, Mass: McGraw Hill.

References:

- Sommerville, I. (2011). Software engineering (9th ed.). Boston: Pearson.
- Bob Hughes and Mike Cotterell (Latest Edition). Software Project Management (Latest
- Edition). Boston, Mass: McGraw Hill.
- Pressman, R. S. (2010). Software engineering: a practitioner's approach (7th ed.). Boston,
- Mass: McGraw Hill.
- Software engineering, Udit Agarwal
- Software Engineering Fundamentals, " Ali Behforooz and Frederick J. Hudson

Open Source Technology

Pokhara University
Faculty of Management Studies

Course code: CMP 487 — Full marks: 100
Course title: **Open Source Technology (Concentration)** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Level: Bachelor — Total hours: 48
Concentration area : Computing — Program: BCSIT

1. Course Descriptions

This course introduces students to the principles, tools, and applications of open-source technologies. It covers open-source operating systems, software development, web technologies, databases, cloud services, and collaboration tools. Emphasis is given on practical hands-on experience with popular open-source platforms and tools.

2. General Objectives

By the end of this course, students will be able to:

- Understand the philosophy and principles of open-source software.
- Install, configure, and use open-source operating systems and applications.
- Develop and manage open-source software projects.
- Utilize open-source databases, web servers, and development tools.
- Collaborate using version control systems like Git and GitHub.
- Evaluate the benefits and limitations of open-source solutions in real-world scenarios.

3. Contents in Detail

Specific objectives	Contents
▪ Define open source software and explain its core principles. ▪ Describe the history of open source and the role of the Open Source Initiative (OSI). ▪ Differentiate between free software and open-source software. ▪ Explain open source standards, methodologies, and philosophy. ▪ Identify and describe key open-source licenses (Apache, BSD, GPL, LGPL, MIT) and their implications. ▪ Discuss the need, benefits, and advantages of using open-source technologies in various contexts	**Unit I: Introduction to Open Source (4 Hours)** • Open source definition and principles • History, Open Source Initiative • Open Source Standards, Methodologies, Philosophy • Free source and open source system • Open source licensing system ○ Apache License, BSD license, GNU General Public License, GNU Lesser General Public License, and MIT License • Need and Advantages of Open sources
▪ Understand Linux history and its	**Unit II: Open Source Operating System: Linux (6**

relation to Unix. ▪ Compare Linux with Unix and Windows. ▪ Identify Linux features, advantages, and variants. ▪ Explain Linux architecture basics. ▪ Perform Linux installation, disk partitioning, and LVM setup. ▪ Install Linux in virtual machines and containers.	**Hours)** • Historical development of Linux and Unix • Comparison among Linux, Unix, and Windows operating system • Features and advantages of Linux • Variants of Linux OS • Overview of Linux architecture • Linux installation, disk partitioning, logical volume manager • Virtual machine and containers installation
▪ Understand Linux file structure and standard directories. ▪ Use basic commands for file and directory management. ▪ Manage file permissions and ownership. ▪ Execute essential Linux utility commands for system information and text processing.	**Unit III: Files, Directories And Basic Commands In Linux (4 Hours)** • Linux standard directories • File structure and hierarchy • Commands for files and directory handling(cd, ls, cp, rm, mkdir, rmdir, pwd, file, more, less, cat) • File permission, changing permission and ownership (chmod, chown) • Touch, pwd, finger, passwd, date, head, tail, cut, sort, grep
▪ Understand Linux boot process and kernel basics. ▪ Manage processes and background tasks. ▪ Edit files using Vi editor. ▪ Manage users, groups, and superuser privileges. ▪ Monitor disk usage and manage partitions. ▪ Install and remove software packages efficiently.	**Unit IV: System Administration Basics (9 Hours)** • Understanding Boot process and related System files • Linux Kernel fundamentals • Background processing • Process commands (kill, ps, who, top) • Creating and editing files with Vi-editor • Managing user accounts (add, delete, modify users) • Becoming super user • Creating and managing groups • Disk partition and sizes (df, du, dd,..) • Installing and removing packages (RPM, apt-get, yum..)

▪ Configure network interfaces and IP addressing.
▪ Set up and manage network services and servers.
▪ Monitor and control service daemons.
▪ Schedule tasks and transfer files remotely.
▪ Troubleshoot network issues and
	Unit V: Network Configuration Basics (10 Hours)
	• Adding/removing network interfaces
	• IP addressing basics
	• Setting IPv4 and IPv6 static addressing
	• Configuring and running servers
	  ○ DHCP, DNS, Squid,
	  ○ Apache-HTTP, and Samba
	• Service monitoring commands (uname,

analyze logs.	hostname, dnsip, nslookup, dig) • Creating, starting, stopping and restarting service daemons • Conjob (at, anacron) • Remote file transfer (sshscp, ftp) • Troubleshooting, log file analysis

▪ Understand basics of shell programming.
▪ Differentiate between types of Linux shells.
▪ Write simple Bash scripts using conditions, loops, and case statements.
▪ Use system shell commands and environment variables effectively.
	Unit VI: Fundamental of Shell Programming (4 Hours)
	• Basics of shell programming
	• various types of shell available in Linux
	• Comparisons between various shells
	• Shell programming in bash
	  ○ Statement (Conditional, looping, case)
	  ○ System shell and environment variables

▪ Understand open-source database fundamentals. ▪ Execute basic SQL commands (DDL, DML, DCL). ▪ Create and manage databases and tables. ▪ Set user privileges for database security. ▪ Use XAMPP and phpMyAdmin for web/database integration.	**Unit VII: Database Administration (4 Hours)** • Fundamentals of open source databases (MySQL- MariaDB, PostgreSQL, MangoDB • SQL commands (DDL, DML, DCL) • Creating databases and tables in MariaDB • User privilege setting on database and tables • Running integrated web/database system: XAMPP, PHPmyAdmin
▪ Understand basics of PHP web programming. ▪ Use PHP syntax, variables, operators, and control structures. ▪ Create and use PHP functions. ▪ Implement authentication and session management. ▪ Host web applications and manage document roots. ▪ Connect and program databases using PHP.	**Unit VIII: Open Source Web Programming (7 Hours)** • Basics of web programming using PHP (HTML post and get) • Syntax and variables, operators and flow control structure in PHP. • Built-in and user defined PHP function • Authentication and session management • Hosting web server, document root management • Programming databases in PHP

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

4. Method of Instructions

Lecture, Demonstration, Hands-on Lab, Project-based Learning and Group Discussion.

5. Practical Activities

- Installing and configuring Linux OS
- Basic shell scripting exercises

- Setting up Apache/Nginx and MySQL/PostgreSQL
- Developing a small project using open-source IDEs
- Version control exercises with Git and GitHub
- Deploying a basic website with WordPress or similar CMS
- Using open-source collaboration tools

6. Evaluation System and Student's Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

External Evaluation	Marks	Internal Evaluation	Weight	Marks
Semester-End Examination	50	**Theory**		
		Attendance & Class Participation	10%	30
		Assignments	20%	
		Presentations/Quizzes	10%	
		Internal Assessment	60%	
		Practical		
		Attendance & Class Participation	10%	20
		Lab Report/Project Report	20%	
		Practical Exam/Project Work	40%	
		Viva	30%	50
Total External	50	Total Internal		
Full Marks: 50 + 50 = 100				

Student's Responsibilities

Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such a score will be given NOT QUALIFIED (NQ) to appear in the Semester-End Examinations. Students are advised to attend all the classes, formal exams, tests, etc., and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- "Open Source for the Enterprise" by Dan Woods and Gautam Guliani

References

- "The Cathedral & the Bazaar" by Eric S. Raymond
- "Linux Bible" by Christopher Negus
- Official documentation of Linux, Apache, MySQL, WordPress, Git

CONCENTRATION AREA: DATA SCIENCE

Course Code	Course Title	Credits
DSC 481	Fundamentals of Data Science	3
DSC 482	Advance Database	3
DSC 483	Data Analysis and Modeling	3
DSC 484	Data Warehousing and Data Mining	3
DSC 485	Database Administration	3
DSC 486	Artificial Intelligence and Machine Learning	3
DSC 487	Distributed Database Management	3
DSC 488	Object Oriented Database Management	3

Fundamentals of Data Science

Pokhara University
Faculty of Management Studies

Course code: DSC 481	Full marks: 100
Course title: **Fundamentals of Data Science (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Data Science	Program: BCSIT

1. Course Description

This course introduces students to the fundamental concepts of Data Science using Python. It covers Python programming basics, data structures, data collection, cleaning, exploratory analysis, machine learning, and data visualization. Emphasis is given on hands-on exercises using Python libraries such as Pandas, NumPy, Matplotlib, Seaborn, and Scikit-learn. Students will develop practical skills to analyze real-world datasets, build machine learning models, and present insights through visualizations and dashboards.

2. General Objectives

The general objectives of this course are;

- Understand the fundamentals of Data Science and Python programming.
- Write efficient Python programs using basic syntax, control structures, functions, and modules.
- Utilize Python data structures for data storage, manipulation, and preprocessing.
- Apply statistical and exploratory data analysis techniques on datasets.
- Develop and evaluate basic machine learning models using Python.
- Build interactive data visualizations and dashboards to communicate insights.
- Apply Python skills to real-world datasets through practical lab projects.

3. Contents in Detail

Specific objectives	Contents
▪ Understand Data Science concepts; set up Python environment and write basic scripts	**Unit I: Introduction to Data Science and Python (3 Hours)** Overview of Data Science, applications, workflow; Python syntax, data types, variables, operators; Python environment setup (Anaconda, Jupyter Notebook, Google Colab)
▪ Understand Python syntax and use operators effectively; write basic Python programs	**Unit II: Python Programming Basics & Operators (3 Hours)** Python history, features, installation; IDEs; Variables, data types, operators, expressions, type conversion; first Python program
▪ Implement decision-making and iterative programming in Python	**Unit III: Control Structures (4 Hours)** Conditional statements (if, else, elif , loops (for, while), break & continue

▪ Write reusable Python functions and use modules	**Unit IV: Functions & Modules (4 Hours)** Defining functions, parameters, return values, recursion; importing modules and libraries
▪ Use Python data structures for data storage and manipulation	**Unit V: Data Structures in Python (5 Hours)** Lists, tuples, sets, dictionaries; operations and methods
▪ Perform file operations and handle errors in Python	**Unit VI: File Handling & Exception (4 Hours)** Reading/writing files, handling CSV/JSON, exception handling with try-except
▪ Import and preprocess datasets; clean and transform data for analysis	**Unit VII : Data Collection and Cleaning with Python (4 Hours)** Reading data from CSV, Excel, JSON, web APIs; Handling missing values, duplicates, outliers; Data transformation, normalization, type conversion using Pandas
▪ Perform statistical analysis; visualize data using charts and plots	**Unit VII : Exploratory Data Analysis (5 Hours)** Descriptive statistics using Pandas and NumPy; Data visualization using Matplotlib and Seaborn; Correlation and covariance analysis
▪ Understand ML concepts; build regression, classification, and clustering models	**Unit VIII : Introduction to Machine Learning with Python(6 Hours)** Supervised vs unsupervised learning; Regression, Classification, Clustering; Using Scikit-learn for model building
▪ Build advanced visualizations and dashboards; present data insights effectively	**Unit IX : Data Visualization and Reporting(4 Hours)** Advanced visualization (heatmaps, pair plots, interactive plots); Creating dashboards with Plotly Dash
▪ Apply Python skills to real-world datasets; build small data-driven projects	**Unit X : Practical Lab Work (6 Hours)** Hands-on exercises with Python: loops, conditions, functions, data structures, file handling; Data cleaning and preprocessing; Exploratory analysis; Basic ML projects; Dashboard creation

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

4. Methods of Instruction

Lecture, Demonstration, Hands-on Lab, Project-based Learning, Group Discussion to clarify teaching methods

5. Practical Activities : Laboratory Works:

- .Set up Python environment (Anaconda, Jupyter, Colab) and run first script.
- Work with variables, data types, and operators in small programs.
- Use if, for, while statements; apply break and continue.
- Write functions, use parameters/return values, and import modules.
- Manipulate lists, tuples, sets, and dictionaries with operations and methods.

- Read/write files (CSV, JSON) and handle exceptions using try-except.
- Import datasets, handle missing values, duplicates, outliers; transform data.
- Perform descriptive statistics and visualize data with Matplotlib/Seaborn.
- Build ML models (regression, classification, clustering) using Scikit-learn.
- Create dashboards and interactive plots with Plotly Dash or Streamlit.

6. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

External Evaluation	Marks	Internal Evaluation
Semester-End Examination	50	Class attendance & participation (5) Quizzes/Assignments/Presentations (10) Project Work (10) Internal Term Exam (25)
Total External	50	Total Internal: 50

Students' Responsibilities

Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- "Python Crash Course" – Eric Matthes
- "Learning Python" – Mark Lutz

References

- "Python for Data Analysis" – Wes McKinney
- "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" – Aurélien Géron
- "Data Science from Scratch" – Joel Grus
- Official documentation of Python, Pandas, NumPy, Matplotlib, Seaborn, Scikit-learn, Plotly, and Streamlit

Advance Database

Pokhara University
Faculty of Management Studies

Course code: DSC 482 — Full marks: 100
Course title: **Advance Database (Concentration)** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Level: Bachelor — Total hours: 48
Concentration area : Data Science — Program: BCSIT

1. Course Description

This course is meticulously designed for BCSIT students to cultivate advanced database management skills highly sought after in today's dynamic job market. It emphasizes hands-on, project based learning to design and implement scalable database systems using SQL, NoSQL, dis tributed, and cloud-based solutions. The syllabus covers advanced SQL techniques, proce dural languages, diverse NoSQL paradigms, distributed systems, big data, data warehousing, cloud databases, performance optimization, security, and emerging trends like graph databases, time-series databases, object-oriented databases, and AI-driven databases. The curriculum emphasizes practical application, preparing students to tackle real-world data management challenges and excel in roles such as database administrator, data engineer, and data architect in leading companies.

2. General Objectives

The general objectives of this course are;

- Master advanced database concepts for designing scalable, enterprise-grade systems.
- Develop proficiency in SQL, NoSQL, and cloud-based database technologies and and modern data warehousing techniques.
- Gain hands-on experience in database integration, optimization, and security.
- Understand how a market-ready or industry-standard scalable database practices.
- Prepare students for roles in data engineering, database administration, and cloud database management.

3. Contents in Detail

Specific objectives	Contents
• Revision of standard SQL • Implement Advanced SQL for complex data manipulation • Implement analytical queries and optimization techniques. • Apply SQL standards and best practices. • Learn Normalization and modern SQL features	**Unit I: Overview of SQL (8 Hours)** 1.1 SQL Syntax and Data Types 1.2 Database Constraints and Integrity Rules 1.3 Advanced Queries (Complex,Joins, Subqueries, CTEs, Window Functions) 1.4 Indexes, Views, and Materialized Views 1.5 SQL Standards and Best Practices 1.6 Modern SQL Features (JSON Support, Array Operations, UPSERT) 1.7 Normalizations

• Understand stored procedures and database programming in PL/pgSQL. • Apply procedural extensions to SQL in PL/pgSQL. • Implement triggers, functions, and database logic PL/pgSQL.	**Unit II: SQL with Procedure Language (8 Hours)** 2.1 Introduction to Procedural Extensions: PL/pgSQL, PL/SQL, T-SQL. 2.2 Stored Procedures, Functions (in PL/pgSQL) 2.3 Triggers: Types of Triggers (BEFORE, AFTER in PL/pgSQL) 2.4 Cursors: Implicit vs. Explicit Cursors, (in PL/pgSQL) 2.5 Packages and Modules (in PL/SQL).
• Understand various NoSQL database types and their use cases. • Implement MangoDB CRUD operations • Learn Basic/concept Column, key-value, and graph databases. • Compare NoSQL vs. SQL databases.	**Unit III: No/SQL Databases (6 Hours)** 3.1 Introduction to NoSQL (Types and Use Cases) 3.2 Document Databases (MongoDB) 3.3 MongoDB CRUD Operations and Schema Design 3.4 Key Value Stores (Redis, DynamoDB) 3.5 Column-Family (Cassandra) 3.6 Graph Databases (Neo4j) 3.6 NoSQL vs. SQL Comparison
• Understand distributed database architecture and concepts. • Learn basic about database replication, sharding, and consistency. • Analyze real-world distributed systems.	**Unit IV: Distributed Database Systems (5 Hours)** 4.1 Distributed Database Architecture 4.2 Database Replication and Sharding 4.3 Consistency Models (ACID vs. BASE) 4.4 CAP Theorem and Trade-offs 4.5 Discuss Case Studies on DDS.
• Understanding big data frameworks and data warehousing • Basic concept about ETL processes and advanced analytics • Learn ORM with relational databases.	**Unit V: Big Data and Data Warehousing (5 Hours)** 5.1 Big Data Concepts (Hadoop, Spark, Kafka) 5.2 Data Warehousing (Star Schema, Snow flake Schema, Data Lakes) 5.3 ETL Processes and Real-Time Analytics 5.4 ORM with Hibernate/JPA 5.5 Data Lake Concepts
• Deploy and manage cloud native databases. • Understand basic serverless and scalable solutions. • Basic cloud databases with applications.	**Unit VI: Cloud Database Technologies (5 Hours)** 6.1 Cloud Database Overview 6.2 Discuss Popular Cloud Databases Services providers (AWS, AZURE, Google Cloud) 6.3 Deployment and Configuration

	6.4 Serverless Databases 6.5 Cloud Integration and Scalability
• Understand database performance optimization techniques • Basic understanding Monitor and analyze performance metrics.	**Unit VII: Database Performance and Optimization Basic (4 Hours)** 7.1 Query Optimization 7.2 Query Performance Tuning 7.3 Memory and Storage Optimization 7.4 Load Balancing
• Learn database security fundamentals. • Understand authentication and authorization • Basic understanding Backup and Recovery	**Unit VIII: Database Security (4 Hours)** 8.1 Database Security Fundamentals 8.2 Authentication and Authorization 8.3 Data Encryption and Protection 8.4 Security Auditing and Compliance 8.5 Backup and Recovery Strategies
• Explore current trends in database technology. • Understand the concept AI/ML integration with databases. • Learn basic about vector databases and modern applications.	**Unit IX: Emerging Database Technologies (3 Hours)** 9.1 Vector Databases (Pinecone, Weaviate) 9.2 AI/ML Integration with Databases 9.3 Time-Series Databases 9.4 Blockchain and Database Integration 9.5 Future Trends in Database Technology

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

4. Methods of Instruction

- Lectures with real-world case studies (e.g., Netflix's use of Cassandra, Snowflake's data warehousing).
- Hands-on coding sessions and lab work using tools like PostgreSQL SQL Developer, MongoDB Atlas, and AWS/AZURE or any.
- Group discussions and peer reviews of database designs.
- Project mentoring and agile development workshops.
- Guest lectures from industry professionals in data engineering and cloud architecture.
- Problem-based learning through mini-projects (e.g., building a small data warehouse)

5. Practical Activities

- Developing advanced SQL queries and stored procedures in PostgreSQL/MySQL.
- Building NoSQL applications using MongoDB.
- Implementing distributed database solutions with replication and sharding.
- Creating data warehouses and ETL pipelines using modern tools.
- Simple Deploying databases any service providers (AWS, Azure, and Google Cloud platforms).

- Performance tuning and optimization of database systems.
- Implementing database security measures and backup strategies.
- Working with emerging technologies like vector databases.
- Developing comprehensive database projects integrating multiple technologies
- Do Certifications courses (e.g., AWS, Azure, MongoDB, Google Data Engineer)

Note: Practical sessions focus on developing advanced database projects using industry-standard tools and technologies.

6. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

Internal Evaluation	**Weight**	**Marks**	**External Evaluation**	**Marks**
Theory		**20**	**Semester End**	**50**
Attendance & Class Participation	10%			
Assignments	50%			
Presentations/Quizzes	10%			
Internal Assessment	30%			
Practical		**30**		
Attendance & Class Participation	10%			
Lab Report/Project Report	20%			
Practical Exam/Project Work	60%			
Viva	20%			
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class to appear in the semester-end examination. Failing to get such a score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- Silberschatz, A., Korth, H. F., & Sudarshan, S. (2020). Database System Concepts (7th ed.). McGraw-Hill.
- NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence by Pramod J. Sadalage, Martin Fowler – Addison-Wesley.
- Cloud Databases: Design and Implementation by Mark Heckler – O'Reily Media.

References

- Redmond, D., & Wilson, J. R. (2018). Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement (2nd ed.). Pragmatic Bookshelf.
- Sadala, P. (2019). NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. Addison-Wesley.
- Online documentation and tutorials for specific database systems (e.g., PostgreSQL, MongoDB, Redis, Cassandra, Neo4j).

Data Analysis and Modeling

Pokhara University
Faculty of Management Studies

Course code: DSC 483	Full marks: 100
Course title: **Data Analysis and Modeling (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Data Science	Program: BCSIT

1. Course Description

The emphasis of the course is to apply the **python program or any other software** to draw inferences from the data so that appropriate decisions can be recommended. This course consists of topics like Correlation, Regression, Time Series Analysis and Forecasting, Linear programming and Network Analysis. After studying these topics, students will be able to understand and analyze relationships between the variables. Linear Programming and Network Analysis will help them to choose the best alternative in order to maximize total profit and minimize total cost in different situations.

2. General Objectives

The general objectives of this course are:

- To enable the students in calculating and interpretation of the relationship between and among variables using simple correlation and regression analysis.
- To disseminate students with models for time series and forecasting.
- To provide students with a sound understanding of index numbers.
- To equip the students in generating and interpreting statistical finding using the softwares, such as **Python, R, Excel or any others**
- To introduce and formulate linear programming.
- To acquaint the students with the concepts of transpiration and assignment problems.
- To familiarize the students with network models.

3. Contents in Detail

Specific Objectives	Contents
• Describe the meaning of correlation and regression. • Use regression analysis to predict the value of a dependent variable based on an independent variable. • Interpret the meaning of regression coefficients. • Evaluate the assumptions of regression analysis and know	**Unit I: Simple Correlation and Regression Analysis (9 Hours)** 1.1 Correlation: Introduction 1.2 Types of correlation: Scatter plot and Karlpearsons' correlation coefficient. 1.3 Significance test of correlation coefficient. 1.4. Types of regression models 1.5 Determining the simple linear regression equation 1.5.1 The least square method

what to do if assumptions are violated. • Make inferences about the slope and correlation coefficient. • Generate excel output. • Use excel output for solving problems.	1.5.2 Visual exploration: exploring simple linear regression coefficients 1.5.3 Predictions in regression analysis: interpolation versus extrapolation 1.5.4 Computing the regression coefficients 1.6 Measures of variations 1.6.1 Computing the sum of squares 1.6.2 The coefficient of determination 1.6.3 Standard error of the estimate 1.7 Assumptions 1.8 Residual analysis: Evaluating the assumptions 1.9 Inferences about the slope and correlation coefficient 1.9.1 t-test for the slope and correlation coefficient 1.9.2 Confidence interval estimate of the slope
• Analyze the relationship between one dependent variable and two or more independent variables and estimate the value of the dependent variable based on the values of the independent variables. • Generate the excel output and interpret them	**Unit II: Multiple Regression (9 Hours)** 2.1 Definition and Reasons for using multiple regression equation, Estimating multiple regression equation (2 independent variables) 2.2 Confidence Interval and Prediction Interval of estimating equation and regression coefficient, regression equation with dummy independent variable Residual Analysis and Autocorrelation, Durbin Watson Statistic, Dummy variable, Multicollinearity, and Step wise regression
• Describe the various components of time Series. • Describe the trend, cyclical, seasonal and irregular components of the time series model. • Fit a linear trend equation to a time series. • Smooth a time series with the moving average and exponential smoothing techniques. • Forecast the data by various techniques. • Calculate and interpret measures of forecast accuracy • Use excel for solving problems.	**Unit III: Time Series Analysis and Forecasting (9 Hours)** 3.1 Introduction of time series data, Components of time series analysis (Trend, Cyclical, Seasonal, Irregular) 3.2 Trend analysis: Least square method, Second degree equation 3.3 Forecasting Models: Naive, Moving average, Simple exponential smoothing model, linear model. 3.4 Methods of measuring forecasting accuracy: MAD, MAPE, MSE, Cyclical Variation, Business cycle, Percent of trend, Relative cyclical residual, Seasonal Variation, Calculation of seasonal indices (Ratio to moving average), Deseasonalization.
• Explain the types of index number. • Describe notion and terminology of index number.	**Unit IV: Index Number (4 hours)** 4.1 Definition and uses of Index Number 4.2 Types of Index Number 4.3 Notation and Terminology

• Introduce with the methods of constructing index number. • Explain un-weighted and weighted method of index number. • Test of consistency of index number.	4.4 Method of constructing Index Number 4.5 Un-weighted method 4.5.1 Simple aggregative method 4.5.2 Simple average of price relative 4.6 Weighted Method 4.6.1 Laspeyre's index number 4.6.2 Paasche's index number 4.6.3 Fisher's index number 4.7 Cost of living index number 4.8 Method of constructing cost of living Index numbers 4.8.1 Aggregative expenditure method 4.8.2 Family budget method
• Introduce linear programming (LPP). • Explain the system of linear inequalities. • Formulate LPP Model of the given theoretical problem. • Identify the graphical solution of the LP Model. • Familiar with the special cases in LP model.	**Unit V: Linear Programming Problem (6 Hours)** 5.1 Introduction, Decision variable, objective function, constraints, slack and surplus variable. 5.2 Model formulation for Linear Programming active constraints, inactive constraints, Alternative optimum solution for Linear Programming Problem, Sensitivity Analysis, Primal, Dual Problems.
• Formulate transportation table of the given theoretical problem. • Identify the initial basic feasible solution of the transportation problem. • Identify the optimum solution of transportation problem.	**Unit 6: Transportation Model (4 Hours)** 6.1 Introduction 6.2 Mathematical Formulation of Transportation model 6.3 Types of transportation problem 6.3.1 Balanced transportation problem 6.3.2 Un-balanced transportation problem 6.4 Determination of initial solution by Vogel's Approximation Method (VAM) 6.5 Degeneracy in the Transportation Problem 6.6 Optimal Solution of Transportation Problem by Modified distribution method 6.7 Maximization of Transportation Problems
• Match the appropriate person with appropriate job. • Minimize the total cost/time/effort. • Maximize the total profit/output/efficiency.	**Unit 7: Assignment Model (3 Hours)** 7.1 Introduction 7.2 Mathematical formulation of assignment model 7.3 Types of assignment problem 7.3.1 Balanced assignment problem 7.3.2 Un-balanced assignment problem 7.4 Hungarian method of assignment problem 7.5 Maximization of assignment problem
• Plot the network diagram of the given project.	**Unit 8: Network Model (4 Hours)**

• Identify critical path, critical and non-critical activities. • Identify slack for non-critical activities. • Calculate the associated probability. • Plot time chart and identify scheduling flexibility.	8.1 Introduction, Activities, Events 8.2 Basic terminologies under project network 8.3 Network Construction (PERT/CPM) 8.4 Network Diagram 8.5 Probability in PERT Analysis

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

4. Methods of Instruction

The course will be taught by lecture method, group discussion, class work, assignments, project work, case studies. Students will require to utilize computer for computational works.

5. Evaluation System and Students' Responsibilities

Evaluation System

The performance of a student in a course is evaluated on the basis of internal evaluation and semester-end examination. 50% weight is given to the internal evaluation and 50% weight to the Semester-end examination conducted by the Office of the Controller of Examinations, Pokhara University.

Internal Evaluation

The internal evaluation is based on continuous evaluation process. The internal evaluation components and their respective weights may vary according to the nature and objectives of the course. An evaluation plan should be prepared by the faculty and should share with the students in the beginning of the course.

The internal evaluation components may consist of any combination of written test, quizzes and oral test, workshop, assignments, term paper, project work, case study analysis and discussion, open book test, class participation and any other test deemed to be suitable by the faculty.

Semester End Examination

There will be semester end examination at the end of the semester conducted by the Office of the Controller of Examinations, Pokhara University. It carries 50 % weight of total evaluation.

Students' Responsibilities

Each student must secure at least 45% marks in the internal evaluation with 80% attendance in the class to appear in the Semester End Examination. Failing to obtain such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear in the Semester End Examination. Students are advised to attend all the classes and complete all the assignments within the specified time period. If a student does not attend the class(es),

it is his/her sole responsibility to cover the topic(s) taught during the period. If a student fails to attend a formal exam, quiz, test, etc. and there is not any provision for a re-exam.

6. Prescribed Books and References

Text Books

- Levine, D. M., Krehbiel, T. C., Berenson, M. L., & Viswanathan, P. K. *Business Statistics: A First Course.* New Delhi: Pearson Education.
- Eppen, G. D., Gould, F. J., Schmidt, C. P., Schmidt, C., & Schwartz, R. *Introductory Management Science.* New Jersey: Prentice Hall.

References

- Levin, R. I. and Rubin, D. S., *Statistics for Management.* New Delhi: Prentice Hall
- Siegel, A. F. *Practical Business Statistics.* New York: Andrew F, Irwin.
- Anderson, D. R., Sweeney, D.J. and Williams, T. A. *Statistics for Business and Economics.* New Delhi: Thomson.
- Taha,H. M. *Operations Research.* Collier Macmillan.
- Vohra, N. D. *Quantitative Techniques in Management*. New Delhi: Tata McGraw Hill Education
- Levin, R. I., Rubin, D.S. & Stinson, J. P. *Quantitative Approaches to Management*. New Delhi : McGraw-Hill.

CONCENTRATION AREA: NETWORKING AND CYBER SECURITY

Course Code	Course Title	Credits
NCS 481	Advance Networking with IPV6	3
NCS 482	Wireless Communication	3
NCS 483	Network Security	3
NCS 484	Embedded System	3
NCS 485	Routing and switching	3
NCS 486	System Admin	3
NCS 487	Distributed System	3
NCS 488	Ethical Hacking	3

Advance Networking with IPV6

Pokhara University
Faculty of Management Studies

Course code: NCS 481	Full marks: 100
Course title: **Advance Networking with IPV6 (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Networking and Cyber Security	Program: BCSIT

1. Course Description

This course provides a comprehensive understanding of IPv6 networking and its applications in modern computer networks. It explores the limitations of IPv4, the need for IPv6 adoption, and how IPv6 addresses, headers, and routing work in enterprise and ISP networks. Students will learn to configure, manage, and troubleshoot IPv6 in LAN, WAN, and inter-networking environments. The course also emphasizes advanced topics such as IPv6 addressing schemes, subnetting, dual-stack networks, IPv6 routing protocols (OSPFv3, EIGRP for IPv6), transition mechanisms (tunneling, NAT64), and security features. Hands-on labs and simulation exercises using Cisco Packet Tracer, GNS3, or real devices will reinforce theoretical concepts. By the end of the course, students will gain the skills required to design, configure, and troubleshoot IPv6 networks, preparing them for real-world deployments and industry certifications.

2. General Objectives

The general objectives of this course are;

- Understand the limitations of IPv4 and the advantages of IPv6.
- Explain the structure, types, and notation of IPv6 addresses.
- Implement IPv6 addressing and subnetting in LANs and WANs.
- Configure and troubleshoot IPv6-enabled routers and switches.
- Implement dual-stack networks, tunneling, and transition mechanisms from IPv4 to IPv6.
- Configure IPv6 routing protocols such as OSPFv3 and EIGRP for IPv6.
- Apply security best practices in IPv6 networks using ACLs and other features.
- Gain hands-on experience in IPv6 network design, configuration, and troubleshooting through labs and projects.

3. Contents in Detail

Specific Objectives	Contents
• Explain the limitations of IPv4 and the need for IPv6 adoption. • Describe the features and benefits of IPv6 over IPv4. • Identify and explain different types of IPv6 addresses: unicast, multicast, and anycast.	**Unit I: Introduction to IPv6 (4 Hours)** 1.1 Limitations of IPv4 and need for IPv6 1.2 IPv6 features and benefits 1.3 IPv6 address types: Unicast, Multicast, Anycast 1.4 IPv6 header structure and differences from IPv4

Specific Objectives	Contents
• Analyze the IPv6 header structure and key differences from IPv4. • Gain familiarity with configuring IPv6 addresses on devices using Packet Tracer/GNS3.	1.5 IPv6 vs IPv4: comparison 1.6 **Lab:** Viewing and configuring IPv6 on devices in Packet Tracer/GNS3
• Explain IPv6 address notation, rules, and types (global unicast, link-local, unique local). • Design and implement IPv6 subnets with proper prefix planning. • Configure IPv6 address assignment methods: manual, SLAAC, and DHCPv6. • Apply IPv6 address summarization and aggregation techniques for efficient routing. • Verify connectivity between IPv6-enabled devices and troubleshoot address-related issues.	**Unit II: IPv6 Addressing and Subnetting (6 Hours)** 2.1 IPv6 addressing notation and rules 2.2 Global unicast, link-local, and unique local addresses 2.3 IPv6 subnetting and prefix planning 2.4 Address assignment methods: manual vs SLAAC vs DHCPv6 2.5 IPv6 address summarization and aggregation 2.6 **Lab:** Assigning IPV6 addresses, configuring link-local and global addresses, testing connectivity
• Explain IPv6 routing principles and how routing tables function in IPv6 networks. • Configure static IPv6 routes and default routes. • Understand and apply fragmentation, MTU, and ICMPv6 concepts, including path MTU discovery and "Packet Too Big" messages. • Verify routing configurations and ensure end-to-end connectivity using commands like ping and show ipv6 route. • Implement dual-stack configurations for compatibility with IPv4 networks.	**Unit III: IPv6 Routing Fundamentals (6 Hours)** 3.1 IPv6 routing overview 3.2 Configuring static IPV6 routes 3.3 Default routes and routing tables 3.4 Fragmentation, MTU, and ICMP in IPv6 3.5 Route verification and troubleshooting 3.6 **Lab:** Configuring IPv6 static routing and verifying with ping and show ipv6 route
• Describe the characteristics of IPv6-enabled dynamic routing protocols. • Configure OSPFv3 and EIGRP for IPv6 in single-area and multi-router networks. • Analyze routing tables and verify neighbor relationships in IPv6 routing protocols. • Compare dynamic routing protocols in terms of convergence, scalability, and suitability. • Troubleshoot IPv6 routing issues using commands like show ipv6 route and debug ipv6.	**Unit IV: Dynamic Routing Protocols for IPv6 (6 Hours)** 4.1 OSPFv3 fundamentals and configuration 4.2 EIGRP for IPv6 fundamentals and configuration 4.3 Routing protocols differences and considerations for IPv6 4.4 Route summarization and optimization in IPv6 4.5 Troubleshooting dynamic IPv6 routing 4.6 **Lab:** Configuring OSPFv3 and EIGRP for IPv6, verifying routing tables

Specific Objectives	Contents
• Explain the concept, advantages, and challenges of dual-stack networks. • Configure IPv4 and IPv6 simultaneously on routers, switches, and hosts. • Integrate dual-stack networks for gradual IPv6 deployment in IPv4 environments. • Verify end-to-end connectivity across both IPv4 and IPv6. • Troubleshoot common dual-stack deployment issues.	**Unit V: Dual-stack IPv4/IPv6 Networks (4 Hours)** 5.1 Concept of dual-stack networks 5.2 Configuring IPv4 and IPv6 simultaneously on routers and hosts 5.3 Advantages and challenges of dual-stack deployment 5.4 Transition planning from IPv4 to IPv6 5.5 **Lab:** Configuring a dual-stack network and testing end-to-end connectivity
• Explain different IPv6 transition mechanisms, including manual tunnels, 6to4, ISATAP, and NAT64. • Configure and implement tunneling techniques to enable IPv6 communication over IPv4 networks. • Apply NAT64 and DNS64 for IPv6-IPv4 interoperability. • Plan and implement transition strategies for gradual migration from IPv4 to IPv6. • Troubleshoot transition mechanisms and verify end-to-end connectivity.	**Unit VI: IPv6 Transition Mechanisms (6 Hours)** 6.1 Tunneling techniques: manual tunnels, 6to4, ISATAP 6.2 NAT64 and DNS64 for IPv6 transition 6.3 Dual-stack migration strategies 6.4 Compatibility and interoperability issues 6.5 **Lab:** Implementing manual tunnels and NAT64 for IPv6 connectivity
• Identify security challenges and considerations specific to IPv6 networks. • Configure IPv6 Access Control Lists (ACLs) to filter traffic and secure network segments. • Apply basic router and firewall security principles in IPv6 networks. • Recognize IPv6-specific threats and mitigation strategies. • Test and verify security configurations in lab environments.	**Unit VII: IPv6 Security (4 Hours)** 7.1 IPv6 security features and considerations 7.2 Configuring IPv6 ACLs for traffic filtering 7.3 IPv6 firewall basics and router security 7.4 Threats specific to IPv6 networks 7.5 **Lab:** Configuring IPv6 ACLs and testing traffic control
• Explain Neighbor Discovery Protocol (NDP) and its role in IPv6 networks. • Configure IPv6 multicast and anycast addresses for network optimization. • Understand and apply **fragmentation, MTU, and ICMPv6** concepts in advanced scenarios. • Optimize IPv6 routing and summarization for enterprise networks.	**Unit VIII: IPv6 Advanced Features (5 Hours)** 8.1 Neighbor Discovery Protocol (NDP) 8.2 IPv6 multicast and anycast configurations 8.3 IPv6 routing optimizations and summarization 8.4 IPv6 in enterprise network design 8.5 **Lab:** Configuring NDP, multicast, and testing advanced IPv6 features

Specific Objectives	Contents
• Implement and verify advanced IPv6 features through lab exercises.	
• Design a complete IPv6-enabled network incorporating VLANs, routing, ACLs, and dual-stack deployment. • Implement the network design using Packet Tracer, GNS3, or real devices. • Configure, verify, and troubleshoot all network components and connectivity. • Apply IPv6 security best practices in the implemented network. • Demonstrate and present the network design, implementation steps, and verification results. • Integrate cumulative knowledge from previous units into a real-world networking scenario.	**Unit IX: IPv6 Final Project and Review (5 Hours)** 9.1 Designing a complete IPv6-enabled network 9.2 Implementing addressing, routing, and dual-stack deployment 9.3 Configuring security and ACLs 9.4 Testing and troubleshooting the network 9.5 Presenting project design, implementation, and verification 9.6 **Project:** Full IPv6 network implementation in Packet Tracer/GNS3

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

4. Method of Instructions

*General Instructional Technique***:** Lecture, Discussion, Readings, Question Answer
*Specific Instructional Technique***:** Practical works, Project Based Learning, Self-Directed Learning, Industry Insights and Case Study

5. Practical Activities: Laboratory Work

1. **Lab:** Viewing and configuring IPv6 on devices in Packet Tracer/GNS3
2. **Lab:** Assigning IPv6 addresses, configuring link-local and global addresses, testing connectivity
3. **Lab:** Configuring IPv6 static routing and verifying with ping and show ipv6 route
4. **Lab:** Configuring OSPFv3 and EIGRP for IPv6, verifying routing tables
5. **Lab:** Configuring a dual-stack network and testing end-to-end connectivity
6. **Lab:** Implementing manual tunnels and NAT64 for IPv6 connectivity
7. **Lab:** Configuring IPv6 ACLs and testing traffic control
8. **Lab:** Configuring NDP, multicast, and testing advanced IPv6 features
9. **Project:** Full IPv6 network implementation in Packet Tracer/GNS3
10. Lab Exam, Report and VIVA

List of Tutorials

- **Unit II –** Ipv6 address summarization and aggregation
- **Unit III-** IPv6 route verification and troubleshooting
- **UNIT IV –** Route summarization and optimization in IPv6
- **Unit VI – N**AT64 and DNS64 for IPv6 transition
- **Unit VIII -** IPv6 multicast and anycast configurations

6. Evaluation System and Students' Responsibility

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

Internal Evaluation	Weight	Marks	External Evaluation	Marks
Theory		**30**	**Semester End**	**50**
Attendance & Class Participation	10%	3		
Assignments	20%	6		
Presentations/Quizzes	10%	3		
Internal Assessment	60%	18		
Practical		**20**		
Attendance & Class Participation	10%	2		
Lab Report/Project Report	20%	4		
Practical Exam/Project Work	40%	8		
Viva	30%	6		
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. ***Students are required to complete all the requirements defined for the completion of the course.***

7. Prescribed Books and References

Text Books

- Cisco Networking Academy, *IPv6 Essentials*, Cisco Press.
- Silvia Hagen, *IPv6 Essentials*, 3rd Edition, O'Reilly.
- Todd Lammle, *CCNA Routing and Switching Complete Study Guide*, Sybex.

References

- Allan Johnson, *CCNA Routing and Switching v6 Companion Guide*, Cisco Press.
- William Stallings, *Data and Computer Communications*, 10th Edition, Pearson.
- RFCs and Technical Documentation:
    - RFC 2460 – Internet Protocol, Version 6 (IPv6) Specification
    - RFC 4291 – IPv6 Addressing Architecture

Online Resources:

- Cisco Packet Tracer Labs and Tutorials
- GNS3 Official Documentation
- IPv6 Deployment Guides and YouTube Lab Tutorials

Wireless Communication

Pokhara University
Faculty of Management Studies

Course code: NCS 482	Full marks: 100
Course title: **Wireless Communication (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Networking and Cyber Security	Program: BCSIT

1. Course Description

This course provides an in-depth study of mobile and wireless communication systems, covering their evolution, architectures, and emerging technologies. Students will explore the progression from 2G to 5G networks, gaining insight into the principles of GSM, CDMA, UMTS, LTE, 5G NR and Satellites. The course also covers wireless LAN and PAN technologies such as Wi-Fi, Bluetooth, and Zigbee, along with essential concepts like multiple access techniques, mobility management, and handoff strategies.

Emphasis is placed on both theoretical understanding and practical skills through hands-on labs and simulations using tools like MATLAB, NS3, Wireshark, and OpenAirInterface. Students will learn to analyze wireless protocols, evaluate network performance, and conduct planning and optimization tasks with professional tools. In addition, the course highlights current and future trends, including 6G, IoT, network slicing, and mobile edge computing, preparing students for careers in wireless communication and network engineering.

By the end of the course, students will have developed strong analytical and technical skills, enabling them to design, evaluate, and optimize modern wireless networks and contribute to advancements in next-generation mobile communication systems.

2. General Objectives

The general objectives of this course are;

- Understand the fundamentals of mobile and wireless communication systems.
- Analyze the architecture and evolution of 2G, 3G, 4G (LTE), and 5G networks.
- Explore wireless LAN technologies including Wi-Fi and Bluetooth.
- To provide students with fundamental knowledge of satellite communication principles, system components, link analysis, and emerging applications for modern telecommunication networks.
- Understand multiple access techniques and mobility management.
- Gain practical knowledge of network planning, optimization, and testing tools.

3. Contents in Detail

Specific Objectives	Contents
• Explain the evolution of wireless systems from 1G to 5G and their key features. • Analyze applications of wireless technologies in healthcare, transport, and IoT. • Interpret the electromagnetic spectrum and frequency allocation methods. • Evaluate technical challenges such as mobility, interference, fading, and security. • Apply concepts of frequency reuse, handoff, and capacity in cellular systems. • Demonstrate wireless transmission using MATLAB/NS-3 simulations.	**Unit I: Introduction to Wireless Communication (4 Hours)** 1.7 Overview of wireless communication systems and generations 1.8 Applications and services of wireless systems 1.9 Electromagnetic spectrum and frequency allocation 1.10 Wireless communication challenges (mobility, interference, etc.) 1.11 Cellular concepts: frequency reuse, handoff, and capacity 1.12 Lab: Basic simulation of wireless transmission in MATLAB/NS3
• Describe the architecture of GSM, including BSS, NSS, and OSS. • Explain GSM call setup, mobility management, and handoff procedures. • Understand the GSM air interface and channel structure. • Analyze CDMA fundamentals: spread spectrum, PN sequences, and rake receiver. • Summarize the IS-95 CDMA standard. • Simulate and analyze GSM call flow in the lab.	**Unit II: 2G- GSM and CDMA (6 Hours)** 2.7 GSM Architecture: BSS, NSS, OSS 2.8 GSM call setup, handoff, and mobility management 2.9 GSM air interface and channels 2.10 CDMA: Spread spectrum, PN sequences, Rake receiver 2.11 IS-95 standards overview 2.12 Lab: Call flow simulation and analysis in GSM
• Explain the architecture and interfaces of UMTS. • Describe the WCDMA air interface and channel structure. • Differentiate between handover types in 3G (soft, hard, softer). • Analyze power control mechanisms and QoS in UMTS. • Identify 3G data services including HSPA and HSPA+. • Perform WCDMA system simulation using NS3 or MATLAB.	**Unit III: UMTS and WCDMA (6 Hours)** 3.7 UMTS architecture and interfaces 3.8 WCDMA air interface and channel structure 3.9 Handover types in 3G (soft, hard, softer) 3.10 Power control and QoS in UMTS 3.11 3G data services: HSPA, HSPA+ 3.12 Lab: WCDMA system simulation using NS3 or MATLAB

Specific Objectives	Contents
• Describe the LTE architecture including eNodeB, EPC, and IMS. • Explain OFDM and SC-FDMA modulation techniques. • Analyze resource blocks and scheduling in LTE. • Understand RRC states, bearer setup, and handover procedures. • Explore VoLTE, LTE-Advanced, and LTE-A Pro enhancements. • Conduct LTE downlink/uplink simulation using OpenAirInterface or MATLAB.	**Unit IV: 4G - LTE (5 Hours)** 4.7 LTE architecture: eNodeB, EPC, IMS 4.8 OFDM and SC-FDMA modulation 4.9 Resource blocks and scheduling 4.10 RRC states, bearer setup, and handover 4.11 VoLTE, LTE-A and LTE-A Pro enhancements 4.12 Lab: LTE downlink/uplink simulation using OPenAirInt3erface or MATLAB.
• Identify 5G requirements and use cases (eMBB, URLLC, mMTC). • Explain the 5G NR architecture including gNodeB, NG-RAN, and 5GC. • Compare 5G spectrum bands: sub-6GHz and mmWave. • Understand beamforming, Massive MIMO, and network slicing techniques. • Describe the 5G protocol stack and interfaces. • Perform 5G channel simulation and beamforming in MATLAB.	**Unit V: 5G Mobile Networks (5 Hours)** 5.6 5G requirements and use cases (eMBB, URLLC, mMTC) 5.7 5G NR architecture: gNodeB, NG-RAN, 5GC 5.8 5G spectrum: sub-6GHz and mmWave 5.9 Beamforming, Massive MIMO, Network Slicing 5.10 5G protocol stack and interfaces 5.11 Lab: 5G channel simulation and beamforming in MATLAB
• Explain IEEE 802.11 standards (a/b/g/n/ac/ax). • Describe Wi-Fi architecture including APs, SSIDs, and BSS. • Analyze MAC protocols such as CSMA/CA and RTS/CTS. • Summarize Bluetooth and Zigbee technologies. • Evaluate security mechanisms in WLANs (WEP, WPA, WPA2). • Perform Wi-Fi packet analysis using Wireshark and packet sniffers.	**Unit VI: Wireless LAN and PAN (5 Hours)** 6.6 IEEE 802.11 standards (a/b/g/n/ac/ax) 6.7 Wi-Fi architecture: APs, SSIDs, BSS 6.8 MAC protocols: CSMA/CA, RTS/CTS 6.9 Bluetooth and Zigbee overview 6.10 Security in wireless LANs (WEP, WPA, WPA2) 6.11 Lab: Wi-Fi packet analysis using Wireshark and packet sniffers
• Explain the principles of FDMA, TDMA, CDMA, and OFDMA. • Compare multiple access techniques using performance metrics. • Analyze spectral efficiency and channel reuse concepts.	**Unit VII: Multiple Access Techniques (5 Hours)** 7.1 FDMA, TDMA, CDMA OFDMA 7.2 Comparison and performance metrics 7.3 Spectral efficiency and channel reuse 7.4 Applications in different generations of mobile networks

Specific Objectives	Contents
• Identify applications of multiple access methods in different generations of mobile networks.	
• Explain location and handoff management in GSM, UMTS, LTE, and 5G. • Compare different handoff strategies and algorithms. • Describe paging and call delivery procedures in mobile networks. • Simulate handoff between different network nodes in a lab environment.	**Unit VIII: Mobility management and Handoff (3 Hours)** 8.1 Location and handoff management in GSM, UMTS, LTE, and 5G 8.2 Handoff strategies and algorithms 8.3 Paging and call delivery procedures 8.4 Lab: Handoff simulation between different network nodes
• Understand the fundamentals of designing a cellular network to achieve desired coverage and capacity. • Analyze the signal power and quality to ensure reliable communication. • Learn methods to validate network performance in the field. • Introduce popular software tools used in wireless network planning, testing, and simulation.	**Unit IX: Wireless Network Planning and Optimization (3 Hours)** 9.1 Cell Planning and Coverage Estimation 9.2 Link budget and interference analysis 9.3 Drive testing and key performance indicators (KPIs) 9.4 Tools: Atoll, TEMS, and NS3 overview
• Understand the principles of satellite communication and classify satellites based on orbital characteristics. • Describe the key components of a satellite link and their roles in uplink and downlink transmission. • Calculate basic link budgets and analyze the impact of propagation impairments on satellite signals. • Explore current applications and assess future advancements in satellite communication technologies.	**Unit X: Introduction to Satellite Communication (4 Hours)** 11.1 Concepts and Satellite Orbits 10.2 Satellite Communication Link and Components 10.3 Link Budget and Propagation Effects 10.4 Satellite Communication Applications and Future Trends
• Understand the future of wireless communication beyond 5G. • Explore how IoT and edge computing enhance wireless network applications. • Learn about specialized network architectures for enterprise and innovation.	**Unit XI: Emerging Trends and Applications (2 Hours)** 11.1 6G vision and roadmap 11.2 IoT and Mobile Edge Computing 11.3 Private 5G and Open RAN 11.4 Case Studies: Smart cities, connected vehicles, industrial automation

Specific Objectives	Contents
• Apply knowledge of emerging trends to real-world scenarios.	

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

4. Method of Instructions

General Instructional Technique: Lecture, Discussion, Readings, Question Answer
Specific Instructional Technique: Practical works, Project Based Learning, Self-Directed Learning, Industry Insights and Case Study

5. Practical Activities: Laboratory Work

- Lab: Basic simulation of wireless transmission in MATLAB/NS3
- Lab: Call flow simulation and analysis in GSM
- Lab: WCDMA system simulation using NS3 or MATLAB
- Lab: LTE downlink/uplink simulation using OPenAirInt3erface or MATLAB.
- Lab: 5G channel simulation and beamforming in MATLAB
- Lab: Wi-Fi packet analysis using Wireshark and packet sniffers
- Applications in different generations of mobile networks
- Lab: Handoff simulation between different network nodes
- Tools: Atoll, TEMS, and NS3 overview
- Case Studies: Smart cities, connected vehicles, industrial automation
- Lab Exam, Report and VIVA

List of Tutorials

- **Unit I –** Cell Reuse, GSM frame architecture, GSM throughput calculation
- **Unit V-** 5G Resource Blocks, UL and DL Calculation
- **Unit IX –** Link Budget Calculation

6. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

Internal Evaluation	Weight	Marks	External Evaluation	Marks
Theory		**30**	**Semester End**	**50**
Attendance & Class Participation	10%	3		
Assignments	20%	6		
Presentations/Quizzes	10%	3		
Internal Assessment	60%	18		
Practical		**20**		
Attendance & Class Participation	10%	2		

Lab Report/Project Report	20%	4		
Practical Exam/Project Work	40%	8		
Viva	30%	6		
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. ***Students are required to complete all the requirements defined for the completion of the course.***

7. Prescribed Books and References

Text Books

- Rappaport, T. S. (2014). *Wireless communications: Principles and practice* (2nd ed.). Upper Saddle River, NJ: Pearson Education. (Module I, II & III)
- Tse, D., & Viswanath, P. (2005). *Fundamentals of wireless communication*. Cambridge: Cambridge University Press. (Module II & IV)

References

- Goldsmith, A. (2005). *Wireless communications*. Cambridge: Cambridge University Press. (Module I & III)
- Ballantine, J. H., Hammack, F. M., & Stuber, J. (2017). *The sociology of education: A systematic analysis* (8th ed.). New York: Routledge. (Unit I, II & III)

Network Security

Pokhara University
Faculty of Management Studies

Course code: NCS 483 — Full marks: 100
Course title: **Network Security (Concentration)** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Level: Bachelor — Total hours: 48
Concentration area : Networking and Cyber Security — Program: BCSIT

1. Course Description

This course offers foundational to intermediate knowledge in network security principles, mechanisms, and protocols. Topics include cryptography, key management, secure communication, authentication systems, and real-world security applications. Students will learn the security threats faced by modern networks and how to design systems to counteract them.

2. General Objectives

The general objectives of this course are;

- Understand the goals and fundamental principles of network security.
- Learn about symmetric and asymmetric cryptography.
- Explore security protocols like SSL/TLS, IPsec, and wireless security standards.
- Understand key management, authentication, and digital signatures.
- Learn basic system security concepts including firewalls and intrusion detection.

3. Contents in Detail

Specific objectives	Contents
• Understand CIA triad and security threats. • Analyze access control models and cyber laws.	**Unit I: Foundations of Security (6 Hours)** **1.1** Security Fundamentals, Threats and Attacks and its types, Security Assurance. **1.2** CIA triad, Security threats (DoS, spoofing, replay). **1.2** Security policies, Access control (MAC, DAC, RBAC). Design Principle **1.3** OSI Security Architecture, Bell-LaPadula/Biba models. **1.4** Cybercrime categories, Digital forensics overview.
• Compare symmetric/asymmetric encryption techniques. • Apply hashing and digital signatures.	**Unit II: Cryptography Basics (8 Hours)** **2.1** Introduction to Classical and Modern Cryptography, Feistel Cipher, SPN architecture **2.2** Symmetric encryption (DES, 3DES, AES), **2.2** Asymmetric encryption (RSA, Diffie-Hellman), OpenSSL commands for algorithms

	2.3 Hash functions (MD5, SHA-2), Hash one-way functions, and avalanche effect, HMAC, **2.4** Digital Signatures (DSS vs RSA), Signing and Verification Process for Private/public key roles
• Design firewall and VPN architectures. • Evaluate wireless security protocols.	**Unit III: Network Security Mechanisms (6 Hours)** **3.1** Module of Security (DMZ). Firewalls (packet filtering, proxy, stateful), firewall rules. **3.2** IPSec, VPNs, Security Associations and key negotiation. **3.3** Overview of 802.11 Standards, Wireless security (WEP, WPA, WPA2). **3.4** Design a secure network with DMZ + VPN + wireless**.**
• Implement PKI and multifactor authentication. • Critique password/biometric systems.	**Unit IV : Authentication & Key Management (6 Hours)** **4.1** Authentication Basics **4.1.1** Password systems, Authentication: strength, storage (salting & hashing), brute-force attacks, **4.1.2** Biometrics, Biometric Authentication: fingerprint, face, retina, voice, Multifactor authentication. **4.2** Key management and infrastructure, Kerberos, X.509 certificates, PKI. **4.3** Authentication protocols (CHAP, mutual/one-way).
• Configure SSL/TLS for secure communication. • Mitigate web/database threats.	**Unit V: Transport & Application Security (6 Hours)** **5.1 SSL vs. TLS**: protocol overview, SSL/TLS handshake, HTTPS, role of certificates and Cas **5.2** SSH, encryption, authentication, key-based login **5.2** Email security (PGP, S/MIME), Web threats. **5.3** Database security (access control, inference), sensitive data. **5.3.1** Database Access Control: user roles, privileges, views **5.3.2** Secure DB Configurations: disable remote access, enforce strong auth, audit logs
• Classify malware types and IDS techniques. • Develop incident response strategies.	**Unit VI: Malware & Intrusion Detection (4 Hours)** **6.1** Malware Classification (type) & Containment, Viruses, worms, ransomware, sandboxing. **6.2** IDS 6.1.1 **IDS Overview**: purpose, capabilities, and limitations 6.1.2 Types(host based, neetwork , hybrid, agent) 6.3 Intrusion Prevention & Incident Response, Lifecycle, IPS (anomaly/misuse detection), response phases.
• Relate IT policies to college cyberbullying cases. • Debate digital rights vs. privacy.	**Unit VII: Cyber Laws & Ethics (7 Hours)** **7.1** Cyber Law, IT Policy & Digital Rights **7.1.1** Introduction to Cybercrime: categories (financial fraud, defamation, identity theft, hacking) **7.1.2** Cyber Law Framework in Nepal: Electronic Transaction Act (ETA) 2063, IT Policy, cyber tribunal structure

	7.1.3 Digital Rights vs. National Security: privacy, surveillance, censorship **7.1.4** International Cyber Standards: NIST, GDPR (brief), UN digital principles **7.2** Cyber Ethics & Legal Responsibilities **7.2.1** Intellectual Property (IP): plagiarism, software piracy, copyright, patents, trademarks 7.2.2 Cyberbullying and Harassment **7.2.3** Data Privacy and Consent: handling student data, biometrics, tracking **7.2.4** Professional Ethics in IT: ACM/IEEE codes of conduct, whistleblowing
• Assess Zero Trust and AI-driven security. • Analyze cloud/blockchain case studies.	**Unit VIII: Emerging Trends (5 Hours)** **8.1** Zero Trust, **Cloud Security Fundamentals**: shared responsibility model, VM/container risks, multi-tenancy, **Blockchain**. **8.2** Case studies (real-world breaches), **8.2.1** AI in Cybersecurity: threat detection, user behavior analytics, predictive analytics. 8.3 Digital Citizenship, Digital Footprint, Public and private Online Life. **8.3** Cloud security fundamentals

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

4. Methods of Instructions

Lecture, Demonstration, Practical Lab, Discussion, Assignments, and Case Studies

5. Practical Activities: Lab Work

SN	Lab Title	Unit	Tools/Environment	Key Activities	Expected Outcomes
1	Simulating Attacks & CIA Triad Analysis	Unit 1	Kali Linux, Wireshark	DoS, spoofing, replay attacks, packet capture and analysis	Identify attacks that violate Confidentiality, Integrity, Availability
2	Access Control Models & Security Architecture	Unit 1	Linux VM (SELinux), User role tools	Configure MAC, DAC, RBAC; study Bell-LaPadula and Biba models	Demonstrate and compare access control implementations

3	Implementing Feistel Cipher & SPN	Unit 2	Python or Java	Code a 4-round Feistel cipher; implement basic SPN structure	Understand block cipher construction mechanisms
4	DES, 3DES & AES Symmetric Encryption	Unit 2	OpenSSL, Python (pycryptodome)	Encrypt/decrypt files; compare DES, 3DES, AES in execution and key strength	Evaluate performance and security of symmetric encryption algorithms
5	RSA & Diffie-Hellman Key Exchange	Unit 2	OpenSSL, Python	Generate RSA keys, encrypt/decrypt messages, simulate Diffie-Hellman key exchange	Understand public-key encryption and secure key sharing
6	Hashing & Digital Signatures	Unit 2	OpenSSL, Python	Create MD5, SHA-2 hashes; implement digital signatures using RSA and DSA	Ensure message integrity and non-repudiation
7	Configuring Firewalls & VPN	Unit 3	pfSense, GNS3/VirtualBox, OpenVPN	Packet filtering, DMZ setup, implement OpenVPN between 2 networks	Deploy firewall rules and VPN for secure network access
8	Wireless Security Protocol Evaluation	Unit 3	Kali Linux, aircrack-ng, Wireshark	Capture WPA2 handshake, attempt WEP cracking with wordlists	Analyze weaknesses in wireless protocols
9	Authentication & PKI Demonstration	Unit 4	OpenSSL, Kerberos, Linux tools	Simulate Kerberos, create X.509 certs, discuss biometric and multi-factor authentication	Implement and verify strong authentication techniques
10	SSL/TLS, HTTPS & Application Security	Unit 5	Apache/NGINX, OpenSSL, Browser DevTools, DVWA	SSL/TLS handshake, setup HTTPS on server, explore SQL injection with DVWA	Configure secure web and transport protocols
11	Malware Analysis & Intrusion Detection	Unit 6	Snort, Suricata, Cuckoo Sandbox	Detect malware in sandbox, simulate anomaly detection with Snort	Classify malware and analyze IDS alerts
12	Case Study: Cyber Laws, Ethics & Emerging Trends	Units 7 & 8	Web, Docs, Zoom/Meet	Research and present a real-world breach (blockchain/cloud/AI), debate privacy vs. security	Relate cyber threats with legal and ethical perspectives

	Suggestions: • Each lab is approx. 1.5–2 hours of simulations. • Labs are arranged progressively from foundational to emerging topics. • For cloud/blockchain case in Lab 12, let students explore real-world scenarios from 2020–2024. • Choose and six labs as Lab 1,3,4 is mandatory.

6. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term-exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

Internal Evaluation	**Weight**	**Marks**	**External Evaluation**	**Marks**
Theory		**30**	**Semester End**	**50**
Attendance & Class Participation	10%			
Assignments	20%			
Presentations/Quizzes	10%			
Internal Assessment	60%			
Practical		**20**		
Attendance & Class Participation	10%			
Lab Report/Project Report	20%			
Practical Exam/Project Work	40%			
Viva	30%			
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- William Stallings, *Network Security Essentials: Applications and Standards*, 4th edition, Pearson

References

- Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, *Security in Computing*, Fifth Edition, Prentice Hall.
- Matt Bishop, *Introduction to Computer Security*, Addison-Wesley.
- Behrouz Forouzan, *Cryptography and Network Security*, McGraw-Hill
- Charlie Kaufman, *Network Security: Private Communication in a Public World*, Prentice Hall
- NIST Publications, OWASP.org Resources

Embedded System

Pokhara University
Faculty of Management Studies

Course code: NCS 484	Full marks: 100
Course title: **Embedded System (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Networking and Cyber Security	Program: BCSIT

1. Course Description

Specially the course focuses on the design, implementation, and analysis of computer systems that are integrated into larger systems or devices to perform particular tasks. These systems are designed to efficiently complete certain tasks and often operate in real- time environments. Microcontrollers, Real-Time Operating Systems (RTOS), Embedded Systems Programming, Input/Output(I/O) Devices, Timers and Interrupts, Hardware & Software in Embedded Systems, Embedded Software Development Tools, Microcontrollers and Internet of Things Driven Embedded Systems are the main topics of the course.

2. General Objectives

The general objectives of this course are:

- To introduce the students with the knowledge and skills to design, develop, and implement efficient hardware-software systems for specific, real-time applications
- To familiarize students with the concepts of interfacing, managing real-time operations, and physical circuits for various embedded applications like IoT, automotive, and robotics.

3. Contents in Detail

Specific Objectives	Contents
• Understand the basics of an embedded system. • Understand the typical components of an embedded system.	**Unit I: Basics of Embedded System (5 Hours)** 1.1. Introduction to Embedded System Architecture 1.2. Categories of embedded systems 1.3. Embedded System Design and Development Life Cycle 1.4. The Embedded Systems Model 1.5. Approaches to Embedded Systems 1.6. Embedded System Vs General System 1.7. Application areas of Embedded System: Automotive, Consumer Electronics, IoT 1.8. Embedded system development and debugging Tools.
• Understand the data storage, processing in memory	**Unit II: Typical Embedded System (5 Hours)** 2.1 General purpose and domain specific processors 2.2 Memory-ROM, RAM, memory according to the type of interface 2.3 Memory selection for embedded systems

• Be familiar with the I/O components associated with Embedded systems	2.4 I/O components: seven segment LED, relay, Buzzer, push button switch, 2.5 Other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock
• Design, analyze, and debug embedded hardware and software systems • Understand the basic hardware, software architecture	**Unit III: Hardware & Software in Embedded System (8 Hours)** 3.1 Hardware description languages: VHDL, VERILOG and their features 3.2 Hardware System Design: Sensors, Actuators, Peripheral devices 3.3 Basics of Combination & Sequential logics 3.4 Basic architecture of software 3.5 Software development environment 3.6 General Purpose Processor Design basics
• Understand different communication interfaces • Learn the types of peripherals commonly used in embedded systems, including sensors, switches, displays, actuators and serial interfaces	**Unit IV: Communication Interface (8 Hours)** 4.1 Communication basics 4.2 ADC and DAC Interfacing 4.3 Onboard communication interfaces-I2C, SPI, CAN, parallel interface 4.4 External communication interfaces-RS232 and RS485, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM. 4.5 Advanced communication principles 4.6 Serial Communication using UART 4.7 Basics of DMA & Interrupt handling
• Understand multi-tasking and concurrency in embedded systems. • Understands the RTOS and inter-process communication. • Learn the Implementation of real-time systems and understand RTOS concepts.	**Unit V: RTOS Based Embedded System Design (8 Hours)** 5.1 Operating system basics 5.2 Types of operating systems, 5.3 Tasks, process and threads 5.4 Multiprocessing and multitasking, 5.5 Task scheduling: non-pre-emptive and pre-emptive scheduling 5.6 Remote Procedure Call and Sockets 5.7 Task Synchronization: Task Communication/ Synchronization Issues & Techniques 5.8 Examples and application areas of RTOS 5.9 Deadlock conditions & deadlock handling
• Understand the OS based approach for Embedded system development • Be familiar with programing languages for development	**Unit VI: Programming for Embedded System (8 Hours)** 6.1 Assembly language based development 6.2 High level language based development 6.3 Operating system based approach for development 6.4 Programming in Assembly Language 6.5 A simple interfacing example with 7 segment display
• Understand the fundamentals and	**Unit VII: Microcontrollers in Embedded Systems (6 Hours)** • Microcontroller Vs Microprocessors

architecture of embedded systems • Familiarize the basic architecture of 8051 micro-controller • Understand industry applications of embedded systems and emerging trends	• Intel 8051 microcontroller family, its architecture and instruction sets • 8051 interrupts • 8051 timers and serial port • Overview of PCB design and simulation tools • Emerging trends in Embedded system (AI & Cloud Computing)

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

4. Methods of Instruction

Lecture, Tutorials & Discussions, Projects and Case Study

5. Practical Activities

- Introduction of VHDL for simulation of digital logic circuits and its components.
- Design and simulate basic logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR)
- Perform interfacing of LEDs & 7-segment display,
- Interfacing of Keyboard & LCD using simulators.
- Implement and test combinational circuits such as multiplexers, demultiplexers, encoders, and decoders.
- Design and simulate basic arithmetic circuits, including half adders, full adders, and subtractor.
- Create and analyze sequential circuits like flip-flops (D, JK, T), counters (binary, decade), and shift registers.

6. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term-exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

Internal Evaluation	**Weight**	**Marks**	**External Evaluation**	**Marks**
Theory		**30**	**Semester End**	**50**
Attendance & Class Participation	10%			
Assignments	20%			
Presentations/Quizzes	10%			
Internal Assessment	60%			
Practical		**20**		
Attendance & Class Participation	10%			
Lab Report/Project Report	20%			
Practical Exam/Project Work	40%			
Viva	30%			
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- David E. Simon, "An Embedded Software Primer", Addison-Wesley, 2005
- Muhammad Ali Mazidi, "8051 Microcontroller and Embedded Systems", Prentice Hall, 2006
- Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley & Sons, 2008
- Shibu K V, "Introduction to Embedded Systems", Mc Graw Hill Education.

References

- Peckol, J. (2019). Embedded systems: A contemporary design tool (2nd ed.). Wiley
- Simon, D. E. (1999). An embedded software primer (Vol. 1). Addison-Wesley Professional
- Perry, D. L. (2002). VHDL: programming by example (Vol. 4). New York: McGraw-Hill

Routing and Switching

Pokhara University
Faculty of Management Studies

Course code: NCS 485	Full marks: 100
Course title: **Routing and Switching (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Networking and Cyber Security	Program: BCSIT

1. Course Description

This course provides a comprehensive understanding of the fundamental and advanced concepts of routing and switching in computer networks. It emphasizes the design, configuration, management, and troubleshooting of LAN and WAN infrastructures using routers and switches. Students will begin by learning the essential roles of routing and switching devices in modern networks, gradually progressing towards advanced topics such as VLANs, inter-VLAN routing, Spanning Tree Protocol (STP), EtherChannel, and security mechanisms.

The course also covers both static and dynamic routing protocols, including RIP, OSPF, and EIGRP, with a focus on their operations, advantages, limitations, and real-world applications. Students will be introduced to WAN connectivity methods and security through the implementation of Access Control Lists (ACLs) and Network Address Translation (NAT).

A hands-on, lab-based approach is followed throughout the course to help students gain practical skills in configuring, verifying, and troubleshooting routers and switches. Simulation tools (Cisco Packet Tracer/GNS3) and real devices (if available) will be used to reinforce theoretical knowledge. By the end of the course, students will have developed the ability to design, configure, and secure a small-to-medium enterprise network and will be better prepared for industry certifications like Cisco CCNA.

2. General Objectives

The general objectives of this course are ;

- Build foundational knowledge of switching and routing concepts, including their functions, operations, and roles within computer networks.
- Develop configuration skills in routers and switches to manage LANs and WANs effectively, including device initialization, interface setup, and remote access.
- Introduce VLANs and inter-VLAN routing, enabling students to implement logical segmentation of networks and improve efficiency and security.
- Explore routing techniques, including static routing and dynamic routing protocols such as RIP, OSPF, and EIGRP, and analyze their comparative performance in various scenarios.
- Understand advanced switching features, such as Spanning Tree Protocol (STP), port security, and EtherChannel, to provide redundancy, loop avoidance, and secure switching operations.

- Implement WAN connectivity and security features, such as PPP/HDLC encapsulation, ACLs, and NAT, to simulate real-world enterprise network environments.
- Enhance problem-solving and troubleshooting skills by using networking commands, debugging techniques, and structured approaches to identify and fix connectivity issues.
- Encourage teamwork and project-based learning by designing, implementing, and presenting a complete enterprise network project that integrates all learned concepts.
- Prepare students for professional careers and certifications (e.g., Cisco CCNA, network technician roles) by combining strong theoretical knowledge with practical networking experience.

3. Contents in Detail

Specific Objectives	Contents
• Explain the role of routers and switches in computer networks and their importance in LAN and WAN communication. • Differentiate between the OSI and TCP/IP models with emphasis on the functions of Layer 2 (switching) and Layer 3 (routing). • Compare switching and routing operations, identifying scenarios where each is used in real-world networking. • Describe the process of packet/frame forwarding in both LAN and WAN environments. • Navigate and operate the Cisco IOS CLI, including moving between user and privileged modes, and using basic configuration commands. • Build and test a simple LAN topology in Packet Tracer/GNS3, assign IP addresses, and verify connectivity using ping and traceroute.	**Unit 1: Introduction to Routing and Switching (4 Hours)** 1.1 Role of routers and switches in computer networks 1.2 OSI and TCP/IP model review (Layer 2 vs Layer 3 devices) 1.3 Switching vs Routing – comparison and use cases 1.4 Packet/frame forwarding in LANs and WANs 1.5 Introduction to Cisco IOS, CLI basics 1.6 **Lab:** Introduction to Packet Tracer/GNS3, building a simple LAN
• Describe the booting process of a switch and explain how it initializes before forwarding frames. • Explain different switching methods (store-and-forward, cut-through, fragment-free) and their use cases. • Illustrate how a MAC address table (CAM table) is built and maintained in a switch. • Configure basic switch settings, including hostname, IP address, console and VTY passwords, and SSH access. • Apply fundamental security measures to secure switch management access.	**Unit 2: Switching Concepts and Basic Configuration (6 Hours)** 2.1 Switch booting process and initialization 2.2 Switching methods (store-and-forward, cut-through, fragment-free) 2.3 MAC address table and frame forwarding process 2.4 Basic switch setup (hostname, IP, console/VTY passwords, SSH) 2.5 Managing and verifying switch configuration (show, ping) 2.6 **Lab:** Initial switch configuration, remote access setup, testing connectivity

Specific Objectives	Contents
• Verify switch configuration and connectivity using IOS commands such as show mac-address-table, show running-config, and ping. • Perform initial switch configuration in Packet Tracer/GNS3 and test communication between end devices connected through a switch.	
• Explain the purpose and benefits of VLANs in a switched network. • Configure VLANs and assign switch ports to different VLANs. • Set up trunk links using IEEE 802.1Q encapsulation. • Implement inter-VLAN routing using router-on-a-stick and Layer 3 switches. • Verify and troubleshoot VLAN and inter-VLAN configurations.	**Unit 3: VLANs and Inter-VLAN Routing (6 Hours)** 3.1 Concepts and purpose of VLANs 3.2 VLAN configuration and VLAN membership 3.3 VLAN trunking and 802.1Q encapsulation 3.4 Inter-VLAN routing using router-on-a-stick 3.5 Inter-VLAN routing using Layer 3 switches 3.6 **Lab:** VLAN creation, trunk configuration, router-on-a-stick implementation
• Explain the fundamental principles of routing and describe how routing tables are maintained and used by routers. • Configure static routes on routers and understand the concept of administrative distance in route selection. • Implement default routes and recognize the role of stub networks in small and medium-sized network topologies. • Discuss the advantages and limitations of using static routing in different networking scenarios. • Use network troubleshooting commands such as ping, traceroute, and show ip route to verify and diagnose static routing configurations. • Apply theoretical knowledge to practical scenarios by configuring static and default routes in a multi-router network and verifying connectivity in a lab environment.	**Unit 4: Static Routing (4 Hours)** 4.1 Routing principles and routing tables 4.2 Static routes and administrative distance 4.3 Default routes and stub networks 4.4 Advantages and disadvantages of static routing 4.5 Troubleshooting static routing with ping, traceroute, show ip route 4.6 **Lab:** Configuring static and default routes in multi-router topology
• Explain the characteristics of distance vector routing protocols and how they differ from static and link-state routing. • Describe the operation of RIP v1 and RIP v2, including routing updates, timers, and convergence processes.	**Unit 5: Dynamic Routing – Distance Vector Protocols (6 Hours)** 5.1 Characteristics of distance vector protocols 5.2 Routing Information Protocols (RIP v1 and v2)

Specific Objectives	Contents
• Understand common issues in distance vector routing, such as the split horizon rule and count-to-infinity problem, and methods to mitigate them. • Compare the advantages and limitations of RIP in small and medium-sized networks. • Configure RIP v2 on routers in a multi-router topology and verify routing table updates and connectivity. • Troubleshoot RIP configurations using commands such as show ip route and debug ip rip to analyze routing behavior and resolve network issues.	5.3 RIP timers and updates mechanism 5.4 Split horizon and count-to-infinity problem 5.5 Limitations of RIP in large networks 5.6 **Lab:** Configuring RIP v2, verifying updates, debugging RIP routing
• Explain the characteristics of link-state routing protocols and how they differ from distance vector protocols. • Describe the operation of OSPF, including link-state advertisements, cost metrics, and the formation of neighbor relationships. • Configure OSPF in a single-area network and verify routing tables and adjacency using appropriate IOS commands. • Introduce the fundamentals of EIGRP, including its hybrid routing approach, metric calculation, and advantages over other protocols. • Compare RIP, OSPF, and EIGRP in terms of convergence speed, scalability, and suitability for different network sizes. • Apply practical skills by configuring OSPF and basic EIGRP in multi-router topologies and troubleshooting routing issues using show and debug commands.	**Unit 6: Dynamic Routing- Link State and Hybrid Protocols (6 Hours)** 6.1 Characteristics of link-state protocols 6.2 OSPF fundamentals (link-state advertisements, cost metric) 6.3 OSPF single-area configuration and verification 6.4 Introduction to Enhanced Interior Gateway Routing Protocol (EIGRP) 6.5 Comparing RIP, OSPF, and EIGRP 6.6 **Lab:** Configuring OSPF in multi router topology, basic EIGRP setup
• Explain the need for redundancy in switched networks and how loops can affect network performance. • Describe the operation of the Spanning Tree Protocol (STP), including root bridge election, port states, and loop prevention. • Configure switch port security features such as sticky MAC addresses, violation modes, and aging time to secure network access. • Implement link aggregation using EtherChannel (PAgP and LACP) to increase bandwidth and provide redundancy between switches.	**Unit 7: Advanced Switching Concepts (6 Hours)** 7.1 Redundancy issues in switched networks 7.2 Spanning Tree Protocol (STP) operation and election of root bridge 7.3 Switch port security (sticky MAC,, aging, violation modes) 7.4 Link aggregation with EtherChannel (PAgP, LACP) 7.5 Troubleshooting switching issues (show spanning-tree, show mac-address-table)

Specific Objectives	Contents
• Verify and troubleshoot advanced switching features using commands like show spanning-tree, show etherchannel summary, and show mac-address-table. • Apply practical skills by configuring STP, port security, and EtherChannel in lab environments to ensure secure and reliable switched networks.	7.6 **Lab:** Configuring STP, enabling port security, creating EtherChannel links
• Explain the concepts of WAN connectivity and different encapsulation methods such as PPP and HDLC. • Configure point-to-point WAN links and understand their role in connecting remote networks. • Describe the purpose and types of Access Control Lists (ACLs) and how they are used to control network traffic. • Implement standard and extended ACLs to filter and secure network traffic effectively. • Understand the purpose and configuration of Network Address Translation (NAT), including static NAT, dynamic NAT, and PAT for Internet access. • Apply practical skills by configuring WAN links, ACLs, and NAT in lab simulations to secure and manage network connectivity.	**Unit 8: WAN Connectivity, ACLs, and NAT (6 Hours)** 8.1 Router WAN interfaces and encapsulations (PPP, HDLC) 8.2 Point-to-Point WAN configuration 8.3 Access Control Lists (standard and extended ACLs) 8.4 NAT (static NAT, PAT) 8.5 Security considerations for WAN networks 8.6 **Lab:** Configuring PPP/HDLC in simulation, ACLs for filtering traffic, NAT for internet simulation
• Design a small-to-medium enterprise network that integrates VLANs, routing protocols, ACLs, and NAT. • Implement the network design using Packet Tracer, GNS3, or real devices. • Configure and verify all network components, including switches, routers, and end devices. • Troubleshoot and resolve configuration and connectivity issues in the implemented network. • Present the network design, configuration steps, and verification results effectively. • Demonstrate the ability to apply cumulative knowledge from previous units in a real-world scenario.	**Unit 9: Final Project and Review (4 Hours)** 9.1 Project guidelines and requirements 9.2 Designing a small enterprise network with VLANs, routing, ACLs, and NAT 9.3 Implementing the design using Packet Tracer/GNS3 9.4 Verifying and troubleshooting the network design 9.5 Project presentation and viva 9.6 **Project:** Full enterprise network configuration and demonstration

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

4. Method of Instructions

General Instructional Technique: Lecture, Discussion, Readings, Question Answer
Specific Instructional Technique: Practical works, Project Based Learning, Self-Directed Learning, Industry Insights and Case Study

5. Practical Activities : Laboratory Work

- **Lab:** Introduction to Packet Tracer/GNS3, building a simple LAN
- **Lab:** Initial switch configuration, remote access setup, testing connectivity
- **Lab:** VLAN creation, trunk configuration, router-on-a-stick implementation
- **Lab:** Configuring static and default routes in multi-router topology
- **Lab:** Configuring RIP v2, verifying updates, debugging RIP routing
- **Lab:** Configuring OSPF in multi-router topology, basic EIGRP setup
- **Lab:** Configuring STP, enabling port security, creating EtherChannel links
- **Lab:** Configuring PPP/HDLC in simulation, ACLs for filtering traffic, NAT for internet simulation
- **Project:** Full enterprise network configuration and demonstration
- Lab Exam, Report and VIVA

List of Tutorials

- **Unit I –** GNS3 installation and switch module integration
- **Unit III-** VLAN Trunking
- **UNIT VI –** OSPF and EIGRP configuration
- **Unit VIII –** ACLs configuration to filter traffic and NAT for internet simulation

6. Evaluation System and Students' Responsibilities

Evaluation System
In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

Internal Evaluation	Weight	Marks	External Evaluation	Marks
Theory		**30**	**Semester End**	**50**
Attendance & Class Participation	10%	3		
Assignments	20%	6		
Presentations/Quizzes	10%	3		
Internal Assessment	60%	18		
Practical		**20**		
Attendance & Class Participation	10%	2		
Lab Report/Project Report	20%	4		
Practical Exam/Project Work	40%	8		
Viva	30%	6		
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. ***Students are required to complete all the requirements defined for the completion of the course.***

7. Prescribed Books and References

Text Books

- Cisco Networking Academy, *Routing and Switching Essentials*, Cisco Press.
- Todd Lammle, *CCNA Routing and Switching Complete Study Guide*, Sybex.

References

- Behrouz A. Forouzan, *Data Communications and Networking*, 5th Edition, McGraw-Hill.
- Allan Johnson, *CCNA Routing and Switching v6 Companion Guide*, Cisco Press.
- William Stallings, *Data and Computer Communications*, 10th Edition, Pearson.
- Online resources:
    - Cisco Packet Tracer Tutorials (Cisco Networking Academy website)
    - GNS3 Official Documentation and Labs
    - CCNA Lab Guides and Video Tutorials

System Admin

Pokhara University
Faculty of Management Studies

Course code: NCS 486 — Full marks: 100
Course title: **System Admin** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Level: Bachelor — Total hours: 48
Concentration area : Networking and Cyber Security — Program: BCSIT

1. Course Description

The course covers different concepts of network and system administration including subjects ranging from initial installation of OS to day-to-day administrative tasks such as Network and Server Configurations, management of user accounts and disk space, and even imparting the trouble-shooting skills future system administrators will need to cope with unexpected behavior.

2. General Objectives

The main objective of this course is to provide knowledge of different concepts of network and system administration, configuration, and management.

3. Contents in Detail

Specific objectives	Contents
▪ Understand OSI and TCP/IP reference models. ▪ Explain IPv4 and IPv6 addressing schemes. ▪ Identify basic networking features in Windows and Linux. ▪ Describe switching and routing fundamentals. ▪ Recognize SDN concepts and Open Flow architecture.	**Unit I: Networking Overview (4 Hours)** 1.1 Overview of Reference Model (OSI, TCP/IP) 1.2 Overview of IPv4 and IPv6 addressing 1.3 Windows and Linux Networking Basics 1.4 Switching and Routing basics 1.5 Overview of SDN and OpenFlow
▪ Install and configure open-source server and client systems. ▪ Perform Linux installation and disk management. ▪ Explain the boot process and manage startup services. ▪ Manage user accounts, groups, and permissions. ▪ Handle file systems and disk quotas. ▪ Schedule jobs and analyze system logs.	**Unit II: Server Administration Basics (8 Hours)** 2.1 Open Source Server and Client Installation 2.2 Linux installation, disk partitioning, logical volume manager 2.3 Boot Process and Startup Services: Xinetd/Inetd 2.4 Managing accounts: users, groups and other privileges 2.5 File Systems and Quota Management

▪ Control and monitor system processes. ▪ Update and upgrade server software. ▪ Administer database, web, and proxy servers. ▪ Write basic shell scripts for administration tasks	2.6 Job Scheduling with cron, crontab, anacron and system log analysis 2.7 Process controlling and management 2.8 Online Server upgrade/update process 2.9 Administering Database, web, and proxy server 2.10 Shell programming fundamentals
• Configure and manage network interfaces. • Diagnose and fix network startup issues. • Configure firewalls in Linux and Windows. • Use network troubleshooting commands effectively. • Understand basic network programming using Mininet. • Explain SDN controller and dataplane communication. • Configure routing in SDN environments. • Use open-source tools for network monitoring.	**Unit III: Network Configuration Basics (7 Hours)** 3.1 Network Interface Configuration 3.2 Diagnosing Network startup issues 3.3 Linux and Windows Firewall configuration 3.4 Network troubleshooting commands 3.5 Introduction to network programming with Mininet 3.6 SDN controller and dataplane communication 3.7 Routing configuration in SDN 3.8 Open source networking monitoring (e.g. Nagios)
▪ Explain the basic principles and operation of DHCP. ▪ Configure DHCP options, scopes, reservations, and relays. ▪ Diagnose and troubleshoot DHCP-related issues.	**Unit IV: Dynamic Host Configuration Protocol (DHCP) (3 Hours)** 4.1 DHCP Principle 4.2 DHCP Options, Scope, Reservation and Relaying 4.3 DHCP Troubleshooting
• Explain the principles and operations of DNS. • Configure basic name servers and clients. • Set up caching-only, primary, and slave name servers. • Manage DNS zones, transfers, and dynamic updates. • Implement DNS delegation and enhance server security. • Troubleshoot common DNS issues effectively.	**Unit V: Name Server and Configuration (7 Hours)** 5.1 DNS principles and Operations 5.2 Basic Name Server and Client Configuration 5.3 Caching Only name server 5.4 Primary and Slave Name Server 5.5 DNS Zone Transfers 5.6 DNS Dynamic Updates 5.7 DNS Delegation 5.8 DNS Server Security 5.9 Troubleshooting
• Configure and manage basic HTTP servers. • Set up and manage virtual hosting. • Implement HTTP and proxy caching mechanisms.	**Unit VI: Web and Proxy Server Configuration (7 Hours)** 6.1 HTTP Server Configuration Basics 6.2 Virtual Hosting 6.3 HTTP Caching

• Configure proxy servers with ACLs and authentication. • Troubleshoot web and proxy server issues effectively.	6.4 Proxy Caching Server Configuration 6.5 Proxy ACL 6.6 Proxy-Authentication Mechanisms 6.7 Troubleshooting
• Configure Samba for file sharing in a network. • Set up and manage print services using CUPS. • Explain FTP principles and server configuration. • Configure and manage an anonymous FTP server. • Troubleshoot file, print, and FTP server issues.	**Unit VII: FTP, File, and Print Server (4 Hours)** 7.1 General Samba Configuration 7.2 CUPS configuration basics 7.3 FTP Principles 7.4 Anonymous FTP Server 7.5 Troubleshooting
▪ Explain the principles of SMTP, POP, and IMAP protocols. ▪ Understand and configure SMTP relaying. ▪ Perform basic mail domain administration. ▪ Configure and manage mail servers (Sendmail, Postfix, Qmail, Exim). ▪ Implement SPAM control and filtering techniques. ▪ Troubleshoot common mail server issues.	**Unit VIII: Mail Server basics (5 Hours)** 8.1 SMTP, POP and IMAP principles 8.2 SMTP Relaying Principles 8.3 Mail Domain Administration 8.4 Basic Mail Server Configuration (Sendmail, postfix, qmail, exim..) 8.5 SPAM control and Filtering 8.6 Troubleshooting

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

4. Methods of Instruction

Lecture, Demonstration, Hands-on Lab, Project-based Learning, Group Discussion.

5. Practical Activities: Laboratory Works

The laboratory work includes all the features mentioned in the course.

Samples

- Server/Client Installation over VMware Environment
- Packet Analysis by using TCPDUMP and WIRESHARK 149
- Network Practice with Packet Tracer
- System Administration: User/Group management, File System Management ….
- Network Configuration: Start/Stop network Service, network interface configuration
- Firewall Configuration
- DNS and DHCP Configuration and Troubleshooting
- Web and Proxy Server Configuration and Troubleshooting
- Basic Mail Server Configuration and Troubleshooting
- SAMBA, NFS, CUPS and FTP configuration and Troubleshooting

- SDN controller installation and client network implementation (OpenDaylight)
- Network topology programming with Mininet and visualization

6. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

Internal Evaluation	Weight	Marks	External Evaluation	Marks
Theory		**30**	**Semester End**	**50**
Attendance & Class Participation	10%	3		
Assignments	20%	6		
Presentations/Quizzes	10%	3		
Internal Assessment	60%	18		
Practical		**20**		
Attendance & Class Participation	10%	2		
Lab Report/Project Report	20%	4		
Practical Exam/Project Work	40%	8		
Viva	30%	6		
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. ***Students are required to complete all the requirements defined for the completion of the course.***

7. Prescribed Books and References

Text Books

- The Practice of System and Network Administration, Second Edition Thomas A. Limoncelli, Christina J. Hogan, Strata R. Chalup

References

- Advanced Linux Networking, Roderick W. Smith, Addison-Wesley Professional (Pearson Education), 2002.
- Linux Network Administrator’s Guide, Tony Bautts, Terry Dawson, Gregor N. Purdy, O’Reilly, Third Edition, 2005

- *UNIX and Linux System Administration Handbook*, 5th Edition, Evi Nemeth et al., Pearson, 2018.
- *Linux Network Administrator's Guide*, Tony Bautts, Terry Dawson, Gregor N. Purdy, O'Reilly, 2005.
- *Linux Command Line and Shell Scripting Bible*, Richard Blum, 4th Edition, Wiley, 2021.
- Official Documentation:
  - Ubuntu Server Guide (https://help.ubuntu.com)
  - Red Hat Enterprise Linux Docs (https://docs.redhat.com)
  - Mininet & OpenDaylight Tutorials (https://opendaylight.org)

Distributed System

Pokhara University
Faculty of Management Studies

Course code: NCS 487 — Full marks: 100
Course title: **Distributed System (Concentration)** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Level: Bachelor — Total hours: 48
Concentration area : Networking and Cyber Security — Program: BCSIT

1. **Course Descriptions**
   Distributed System is often described as a collection of logically related data that is distributed over different processing nodes of computer network. It's collection of independent computers that appear to the users of the system as a single computer. A distributed system is one in which hardware or software components located at networked computers communicate and coordinate their actions only by message passing. Design Challenges of Distributed Systems:
2. **General Objectives**

   The objective of the course is to be familiar with different aspect of the distributed system, middleware, system level support and different issues in designing distributed algorithms.

3. **Contents in Detail**

Specific objectives	Contents
• Define Distributed Systems, and its characteristics • Discuss advantages and disadvantages, issues and need • Know about challenges, design issues and types	**Unit I : Introduction (4 Hours)** 1.1 Introduction to Distributed Systems 1.2 Examples of Distributed Systems 1.3 Main Characteristics 1.4 Advantages and Disadvantages of Distributed System 1.5 Design Goals 1.6 Main Problems 1.7 Models of Distributed System 1.8 Resource Sharing and the Web Challenges 1.9 Types of Distributed System: Grid, Cluster, Cloud
• Know about distributed objects, message passing or communication method in Distributed System • Familiarize with Different file systems in Distributed System • Familiarize with naming services and discovery	**Unit II : Distributed Objects and File System (7 Hours)** 2.1 Introduction 2.2 Communication between distributed objects 2.3 Remote Procedure Call 2.4 Events And Notifications 2.5 Java RMI Case Study 2.6 Introduction to DFS 2.7 File Service Architecture 2.8 Sun Network File System 2.9 Introduction to Name Services

services to locate objects in Distributed System	2.10 Name Services and DNS 2.11 Directory and Discovery Services 2.12 Comparison of Different Distributed File Systems
• Familiarize with Distributed architectures • Familiarize with distributed and coordinating processes in Distributed architectures	**Unit III: Operating System Support (3 Hours)** 3.1 The operating system layer 3.2 Protection 3.3 Process and threads 3.4 Communication and invocation 3.5 Operating system architecture
• Describe how to deal with heterogeneous distributed object model using CORBA • Describe model, and different services provided by CORBA	**Unit IV : Distributed Heterogeneous Applications and CORBA (3 Hours)** 4.1 Heterogeneity in Distributed Systems 4.2 Middleware 4.3 Objects in Distributed Systems 4.4 The CORBA approach 4.5 CORBA services
• Familiarize with time need of time synchronization in Distributed System • Familiarize with different time synchronization algorithms and approach	**Unit V : Time and State in Distributed Systems (5 Hours)** 5.1 Time in Distributed Systems, 5.1.1 Physical Clocks 5.1.2 Logical Clocks 5.1.3 Vector Clocks 5.1.4 Clock Synchronization 5.2 Causal Ordering of Messages 5.3 Global State and State Recording 5.4 Distributed debugging
• Familiarize with need of mutual exclusion and remote process synchronization in Distributed Systems • Familiarize with coordination and agreement approaches	**Unit VI : Coordination and Agreement (4 hours)** 6.1 Mutual Exclusion in Distributed Systems 6.2 Algorithms for Mutual Exclusion 6.3 Distributed Elections 6.4 Multicast communication 6.5 Consensus
• Familiarize with replication, need of replication • Identify how replication is implemented in Distributed System	**Unit VII : Replication (4 Hours)** 7.1 Reasons for Replication 7.2 Object Replication 7.3 Replication as Scaling Technique 7.4 Fault Tolerant Services 7.5 High Available Services 7.6 Transaction with Replicated Data
• Familiarize with concurrency, Locks, timestamp, and need of	**Unit VIII: Transaction and Concurrency Control (6 Hours)** 8.1 Transactions 8.2 Nested Transaction 8.3 Locks

concurrency control in Distributed System • Study how concurrency can be controlled in Distributed System	8.4 Optimistic Concurrency Control 8.5 Timestamp Ordering 8.6 Comparison of Methods For Concurrency Control 8.7 Introduction to Distributed Transactions 8.8 Flat and Nested Distributed Transactions 8.9 Atomic Commit Protocols 8.10 Concurrency Control in Distributed Transactions 8.11 Distributed Deadlocks 8.12 Transaction Recovery
• Define fault tolerance, and its importance • Study how fault tolerance is maintained in Distributed Systems	**Unit IX : Fault Tolerance (4 Hours)** 9.1 Introduction to Fault Tolerance 9.2 Process Resilience 9.3 Reliable Client Server Communication 9.4 Distributed Commit 9.5 Recovery
• Study different Distributed Operating systems and Middleware Architectures and its features	**Unit X : Case Studies (5 Hours)** 10.1 CORBA 10.2 Mach 10.3 JINI 10.4 TIB/Rendezvous

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

4. Methods of Instructions

Lecture, Demonstration, Hands-on Lab, Project-based Learning and Group Discussion.

5. Practical Activities

- Implementation of Election Algorithm.
- Simulation for Clock Synchronization in Distributed System using Lamport's Algorithm.
- Implementation of RMI in Distributed Systems
- Implementation of Banker's Algorithm for avoiding Deadlock
- Experiment on DFS
- Case Study – CORBA,JINI, Mach, TIB/Rendezvous

6. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

Internal Evaluation	Weight	Marks	External Evaluation	Marks
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Internal Assessment	60%	18		
Practical		**20**		
Attendance & Class Participation	10%	2		
Lab Report/Project Report	20%	4		
Practical Exam/Project Work	40%	8		
Viva	30%	6		
Total Internal		**50**		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. *Students are required to complete all the requirements defined for the completion of the course.*

7. Prescribed Books and References

Text Books

- George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Third Edition, Pearson Education.

References

- A.S. Tanenbaum, M. VanSteen, “Distributed Systems”, Pearson Education.
- Mukesh Singhal, “Advanced Concepts in Operating Systems”, McGraw-Hill Series in Computer Science.

CONCENTRATION AREA: MANAGEMENT SCIENCE AND SYSTEMS

Course Code	Course Title	Credits
MSS 481	MIS and E-Business	3
MSS 482	E-governance	3
MSS 483	Social Entrepreneurship	3
MSS 484	Financial Accounting	3
MSS 485	International Business	3
MSS 486	Knowledge Management	3
MSS 487	Managerial Accounting	3

MIS and E-Business

Pokhara University
Faculty of Management Studies

Course code: MSS 481	Full marks: 100
Course title: **MIS and E-Business (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Management Science and Systems	Program: BCSIT

1. Course Description

This course provides an integrated view of Management Information Systems (MIS) and E-Business. Students explore how information systems support business processes, decision-making, and digital transformation. The course also covers e-business models, technologies, and digital marketing tactics, empowering students to design and manage technology-enabled organizations.

2. General Objectives

The general objectives of this course are;

- Explain key MIS concepts and categories of information systems.
- · Model core business processes and map them to suitable MIS solutions.
- · Design basic data structures and apply BI/analytics for decision support.
- · Evaluate enterprise systems (ERP/CRM/SCM) for business integration.
- · Diagnose cyber security risks and propose security policies.
- · Develop and pitch a viable e-business model with digital marketing tactics.
- · Prototype a small e-commerce site/app and interpret analytics.

3. Contents in Detail

Specific Objectives	Contents
• Learn to differentiate between MIS, IT, and CS roles and gain knowledge to apply Porter's Five Forces to analyze how MIS supports competitive advantage in real business scenarios.	**Unit I: Foundations of MIS (6 Hours)** • MIS Fundamentals, Definition & Scope of MIS • MIS vs. IT (infrastructure) vs. CS (technical) • Organizational roles: MIS manager, network admin, software developer, Data Hierarchy • Data-collection methods , Information-processing techniques • Knowledge-management systemsMIS Architecture • Hardware (servers, IoT devices) • Software (ERP, CRM) , Network infrastructure needs • Strategic Alignment• Porter's Five Forces • Balanced Scorecard , Tech–business strategy mapping
• Develop skills to model core business processes	**Unit II: Business Processes & Enterprise Systems (6 Hours)**

using BPMN notation and understand ERP implementation challenges through practical case studies.	• Process Modelling, BPMN symbols & conventions • Process-flow documentation • Swimlane diagrams Functional Systems • HRIS • Financial management, Marketing automation • Inventory control Enterprise Systems • ERP core modules • CRM lifecycle management • SCM logistics coordination Change Management • Implementation roadblocks • User-adoption strategies • Training methodologies
• Master creating interactive KPI dashboards using Power BI/Tableau and learn to interpret predictive analytics outputs for data-driven decision making.	**Unit III: Decision Support & Analytics (6 Hours)** • Decision Support Systems • DSS architecture • Executive & group DSS tools • Data Infrastructure • Data-warehouse design • OLAP cube operations • ETL processes Visual Analytics • KPI selection • Dashboard design • Data storytelling Advanced Analytics • Data-mining algorithms • Predictive modelling • Prescriptive analytics
• Acquire knowledge to compare B2B/B2C revenue models and develop customer journey maps to optimize e-commerce experiences	**Unit IV: E-Commerce Fundamentals (6 Hours)** • Business Models • B2B, B2C, C2C, G2C flows Revenue Strategies • Subscription & freemium • Dynamic pricing algorithms Digital Experience • UX frameworks • Conversion-funnel optimisation • Mobile-first design Customer Journey • Touchpoint mapping • Pain-point identification • Experience optimisation
• Learn practical SEO optimization techniques and gain skills to analyze A/B test results for continuous website improvement.	**Unit V: Digital Marketing Analytics (6 Hours)** • Search Optimisation • Keyword research • On-page SEO • Technical SEO, Social Marketing • Influencer models • Community engagement • Viral-content strategies Automation

	• E-mail workflows • Content personalization • Behavioural triggers Performance Measurement • Google Analytics implementation • Attribution modelling • A/B-testing protocols
• Understand how to integrate secure payment gateways and configure scalable cloud solutions for e-business operations.	**Unit VI: E-Business Infrastructure (6 Hours)** • Technical Foundations • Web-server configs • CDN implementation • SSL/TLS encryptionPayment Systems • Gateway integration • API security • Fraud detection System Architecture • Microservices design • REST API development • Service orchestration Cloud Solutions • IaaS/PaaS/SaaS comparison • Auto-scaling • Load balancing
• Develop ability to assess risks using CIA triad and implement GDPR/PCI-DSS compliance measures in digital business.	**Unit VII: Security & Compliance (6 Hours)** • Risk Management • Vulnerability assessment • Threat modelling • Incident response planning. Legal Frameworks • Data-protection regulations • Industry standards • Jurisdictional issues Ethical Considerations • Privacy by design • AI-ethics guidelines • Dark-pattern identification
• Apply agile methodologies to develop a functional prototype while evaluating emerging technologies like AI and blockchain for business potential.	**Unit VIII: Capstone & Emerging Tech (6 Hours)** • Project Management • Agile methodology • User stories • Sprint planning, Prototyping • Usability testing. Emerging Technologies • Conversational AI • Recommendation engines • Blockchain technology and apps • IoT integration , Sustainable tech

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

4. Methods of Instruction

- · Lectures and interactive discussions
- · Case studies of local and global organizations
- · Hands-on labs (DBMS, BI dashboards, ERP demo, e-commerce setup)
- · Group project and presentations
- · Guest speaker sessions

5. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

External Evaluation	Marks	Internal Evaluation
Semester-End Examination	50	Class attendance & participation (5) Quizzes/Assignments/Presentations (10) Project Work (10) Internal Term Exam (25)
Total External	50	Total Internal: 50

Students' Responsibilities

Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

6. Prescribed Books and References

Text Books

- Laudon, K. C., Laudon, J. P., & Traver, C. G. (2025). Management Information Systems: Managing the Digital Firm. Pearson.
- Chaffey, D. (2025). Digital Business and E-Commerce Management. Pearson.

References

- Turban, E., et al. (2025). Electronic Commerce: A Managerial Perspective. Springer.
- Stair, R., & Reynolds, G. (2025). Fundamentals of Information Systems. Cengage.

E-Governance

Pokhara University
Faculty of Management Studies

Course code: MSS 482 — Full marks: 100
Course title: **E-Governance (Concentration)** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Level: Bachelor — Total hours: 48
Concentration area : Management Science and Systems — Program: BCSIT

1. 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, and data warehousing and data mining for e-governance.

2. General Objectives

The general objectives of this course are;

- To develop knowledge of e-governance and e-government
- To know different e-governance models and infrastructure development
- To implement security and use data warehousing and mining in e-governance

3. Contents in Detail

Specific objectives	Contents
▪ Define E-Government and E-Governance and explain their differences. ▪ Describe E-Government as an information system. ▪ Identify the benefits of E-Government for citizens and administration. ▪ Explain the E-Government life cycle and its stages service delivery models, scope, and current trends.	**Unit I: Introduction to E-Government and E-Governance (6 Hours)** 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
▪ Introduce the concept of E-Governance models and their purpose and their analysis ▪ Explain the Interactive Service Model (G2C2G) and its significance. ▪ Outline the evolution of E-Governance and its maturity models. ▪ Discuss how E-Governance models contribute to good governance.	**Unit II: Models of E-Governance (10 Hours)** 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 and Maturity Models: Five Maturity Levels; Characteristics of Maturity Levels; Towards Good Governance through E-Governance Models

▪ Identify key components of network and computing infrastructure for E-Government. ▪ Describe the role of data centers and E-Government architecture. ▪ Explain the importance of interoperability frameworks and cloud governance. ▪ Assess E-readiness of government institutions and evaluate legal, institutional, human, and technological preparedness for E-Government implementation	**Unit III: E-Government Infrastructure Development (10 Hours)** 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
▪ Identify the main challenges in E-Government security. ▪ Explain security management models and their application. ▪ Describe E-Government security architecture and relevant security standards	**Unit IV: Security for e-Government (6 Hours)** Challenges and Approach of E-government Security; Security Management Model; E-Government Security Architecture; Security Standards
▪ Understand the concept of data warehousing and data mining in government. ▪ Explore national data warehouses (e.g., census data, essential commodity prices) and applications of data warehousing and mining in different sectors.	**Unit V: Applications of Data Warehousing and Data Mining in Government (6 Hours)** 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.
▪ Review major E-Government initiatives in Nepal and their impact. ▪ Understand the role of cyber laws in E-Governance. ▪ Examine case studies of government software and services (e.g., Land Reform, HR Management, NICNET, CARD, Smart Nagarpalika).	**Unit VI: Case Studies (10 Hours)** 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 Seva Kendra, Sachivalaya Vahini, Bhoomi, IT in Judiciary, E-Khazana , DGFT, PRAJA, E-Seva, E-Panchyat, General Information Services of National Informatics, Centre E-Governance initiative in USA, E-Governance in China, E-Governance in Brazil and Sri Lanka

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

4. Methods of Instruction

Lecture, Demonstration, Hands-on Lab, Project-based Learning and Group Discussion.

5. Practical Activities: Case study

- Implementing Digital HR Management in Nepalese Government Departments – focusing on workflow automation, employee data management, and challenges in system integration.
- Mobile Applications for Citizen-Centric E-Governance in Nepal – focusing on online service delivery, user adoption, digital literacy, and app design
- Automation of Municipal Services: Smart Nagarpalika as a Model – focusing on tax collection, complaint management, urban governance, and smart city initiatives.

6. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

External Evaluation	Marks	Internal Evaluation
Semester-End Examination	50	Class attendance & participation (5) Quizzes/Assignments/Presentations (10) Project Work (10) Internal Term Exam (25)
Total External	50	Total Internal: 50

Students' Responsibilities

Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- Richard Heeks, Implementing and managing e-Government

References

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

Social Entrepreneurship

Pokhara University
Faculty of Management Studies

Course code: MSS 483	Full marks: 100
Course title: **Social Entrepreneurship (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Management Science and Systems	Program: BCSIT

1. Course Descriptions

The intent of this course is to make enough capable students with the skills for identifying the social problems and recognizing the opportunity to address these problems. The course is designed to provide students with a strong foundation in fostering innovation, developing the business model, establishing and operating social enterprises, and handling the challenges that may arise at any point of the entrepreneurial journey. This course deals with entrepreneurial mindset, competencies, tendencies, creativity, and pitching startup ideas that equip students to become change agents and contribute to community development.

2. General Objectives

The course aims for students to gain knowledge of social entrepreneurship and apply it to drive social change. The general objectives of this course are:

- To make the students familiar with key concepts of social entrepreneurship.
- To encourage students to explore the opportunity of social enterprise.
- To equip the students with the entrepreneurial skills, innovation, startup opportunity identification, preparing a social business plan, tapping the available support services, and leading/ managing the operation, marketing, financial, and human resources, controlling, and networking of a social enterprise.
- To facilitate the students tackling the social and environmental challenges while achieving the sustainable financial goal of social enterprise.

3. Contents in Detail

Specific objectives	Contents
• To make familiar with concepts and features of social entrepreneurship, entrepreneurial tendencies, the creativity process and social innovation. • To make aware of the challenges of social entrepreneurship and tackle them by tapping the	**Unit I: Understanding Social Entrepreneurship (10 Hours)** 1.1 Introduction of social entrepreneurship and its evolution 1.2 Features and importance of social entrepreneurship 1.3 Competencies and tendencies of social entrepreneurs 1.4 Creativity process, its nature and establishing the creative climate 1.5 Meaning and importance of social innovation, innovation vs. invention, disruptive and incremental innovation, social innovation and designing thinking, social innovation and social change

available support services and heuristic approach.	1.6 Differentiate between social entrepreneurship and other entrepreneurship 1.7 Possible challenges to social entrepreneurs and preparing the plan to overcome the challenges 1.8 Self-help group, micro finance services and social entrepreneurship support environment in Nepal
• To make able students for assessing the social context and identifying and prioritizing the major social issues. • To make students' understand the social entrepreneurship ecosystem, sustainable development goals and the triple bottom line.	**Unit II: Identification of Social Issues (8 Hours)** 1.1 Understanding the social context, PESTLE analysis 1.2 Investigating the key social issues and problems (desk resources, observation, interview) 1.3 Need identification and prioritizing the key issues 1.4 Community assets mapping 1.5 Understanding the social entrepreneurship ecosystem 1.6 Sustainable development goal and poverty alleviation 1.7 Triple bottom line (people, planet and profit) 1.8 Some examples of social entrepreneurs and their contribution
• To support students generating social enterprise ideas, and developing skills for recognizing and evaluating the opportunity. • To impart the concept of the social business model, prepare the lean canvas model and draft the value proposition canvas.	**Unit III: Generating Idea and Opportunity Recognition for Social Business Model (8 Hours)** 3.1 Idea generation and validation of social enterprise 3.2 Techniques and sources of ideas generation 3.3 Recognition the best opportunity for social enterprise, setting the evaluation criteria and selection of best opportunity 3.4 Concept, feature, components and process of Social Business Model (SBM) 3.5 Introduction of Lean Canvas Model and its components 3.6 Lean startup cycle (build, measure and learn), and phases of startup loops (vision, steer and accelerate) 3.7 Value proposition canvas
• To prepare the social enterprise plan, including the introduction, strategic plan, human resource management, operation and production plan, entrepreneurial marketing strategy and financial plan. • To assess the risk and prepare risk reduction strategy with a sustainable plan.	**Unit IV: Writing the Social Enterprise Plan (8 Hours)** 4.1 Introduction of social enterprise, description of its products/ services, types of enterprise and governing team 4.2 Business strategy with vision, mission, values, objectives and planning the departmental activities 4.3 Required raw materials and their procurement 4.4 Required human resources and their expected skills, techniques and sources for their appointment 4.5 Description of required infrastructure, energy, utilities and machinery tools 4.6 Target market, promotional plan, geographical coverage, pricing strategy, delivery plan, and defining unique value propositions to win the competition

	4.7 Capital structure, collection and allocation of fund, financial analysis 4.8 Assessment of risk and risk reduction strategy, scarcity of resources and their alternative sources, social and environmental sustainability
• To prepare the students for establishing and leading the social enterprise by managing human resources, operational, marketing and financial activities. • To make students aware of being connected with the business community and become a contributing member of the society.	**Unit V: Establishment & Managing Operation (10 Hours)** 5.1 Registration, licensing, getting permits, protecting intellectual property rights (patent, trademark, copy right), and formation of governing team and their meeting and minutes 5.2 Entrepreneurial leader vs. manager, motivating the employee, staff training and development, 5.3 Introduction of operations management, layout and physical arrangement, logistic management, capacity utilization, quality assurance and recording the transaction 5.4 Concept of entrepreneurial marketing and its components, customer need identification, estimation of total demand and supply gap, market segmentation, product/service positioning, branding, marketing mix strategy, and digital marketing 5.5 Identification of financial sources, application of fund, revenue stream, cost structure and profitability scenario 5.6 Establishment of network with stakeholders, business communities, GOs, and NGOs 5.7 Monitoring, evaluating and controlling the activities 5.8 Consideration of ethical issues and social responsibilities
• To reflect students' improved learning and skills by preparing a Social Business Model (SBM) and improve self-confidence through SBM presentation.	**Unit VI: Preparing and Pitching the Social Business Model (SBM) (4 Hours)** 6.1 Students will visit the field, conduct survey and prepare the Social Business Model (SBM) for case project and make its presentation (group work)

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

4. Methods of Instruction

Lecture, discussion, group work, self-assessment test (entrepreneurial competencies and tendencies), individual assignment, case analysis, interaction with social entrepreneurs, field visit, etc.

5. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s) conducted by the Office of the Controller of Examination of Pokhara University, the internal evaluation of a student may consist of class attendance, class participation, quizzes, assignments, presentations, written exams, etc. The tabular presentation of the evaluation system is as follows.

Evaluation plan	Marks	Internal Evaluation	Marks
Internal evaluation	50	Class attendance and participation	10
		Individual assignment and report presentation	10
		Quizzes, group work, and presentations	10
		Internal exam	20
Total External	50	Term end Exam	50
Full Marks 50+50 = 100			

Students' Responsibilities

Each student must secure at least 45% marks in the internal evaluation with 80% attendance in the class to appear in the semester-end Examination. Failing to obtain such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear in the End-Term examinations. Students are advised to attend all the classes and complete all the assignments within the specified time period. If a student does not attend the class(es), it is his/her sole responsibility to cover the topic(s) taught during the period. If a student fails to attend a formal exam, quiz, test, etc. there won't be any provision for a re-exam.

6. Prescribed Books and References

Text Books

- Collavo, T. *Foundations of Social Entrepreneurship: Theory, Practical Tools and Skills.* Taylor and Francis.
- Muhammad, Y. *Building Social Business: The New Kinds of Capitalism that Serves the Humanity's Most Pressing Needs*. NY: Public Affairs.

References/Resources

- Osterwalder, A. and Pigneur, Y.: *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers,* John Wiley and Sons, USA
- Ries, E. *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses.* Crown Currency.

Financial Accounting

Pokhara University
Faculty of Management Studies

Course code: MSS 484	Full marks: 100
Course title: **Financial Accounting (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Management Science and Systems	Program: BCSIT

1. Course Description

This course covers the nature, scope and function of accounting; basic fundamental concepts and generally accepted accounting principles and practices; the accounting cycle; journalizing adjusting entries; and preparation of financial statements. It also deals with recording, valuating and presenting different items of balance sheet including cash and cash equivalents; inventory; and property, plant and equipment.

2. General Objective

The general objectives of this course are:

- To provide students with an understanding of the basic concepts, principles, procedures and techniques underlying the accounting process.
- To prepare financial statements of an organization and analyze different items of balance sheet.

3. Contents in Detail

Specific Objectives	Contents
• Distinguish among the forms of organization • Identify the users of accounting information and their needs • Describe the qualitative characteristics of accounting information • Explain the primary assumptions made in preparing financial statements, • Describe the various roles played by accountants in organizations	**Unit I: The Conceptual Foundation of Accounting (8 Hours)** 1.1 Accounting as a language of business, 1.2 Forms of business organizations, 1.3 Types of activities performed by business organization 1.4 Users of accounting information: internal and external 1.5 Qualitative characteristics of accounting information; the accounting profession, role and activities of an accountant; 1.6 The accounting framework - basic accounting assumptions, concepts, gap, definitions and terminology 1.7 Accounting information system in modern business organizations 1.8 Role of IT in accounting 1.9 Overview of accounting software 1.10 Cloud-based accounting 1.11 Security and backup of accounting data.

• Explain the difference between an external and internal event • Explain the role of source documents in an accounting system • Analyze the effects of transactions on the accounting equation • Explain the rules of debits and credits • Explain the purposes of a journal and the posting process • Explain the purpose of a trial balance	**Unit II: Processing and Recording Business Transactions (8 Hours)** 2.1.The basis for recording transactions: External and internal events; sources of accounting information; accounting transaction, the accounting equation and analysis of transactions, the role of source documents. 2.2.The double entry system: Rules for debit and credit; journal entry; t account; general ledger; objectives and preparation of trial balance. 2.3 Concept and advantages of computerized accounting.
• Explain the differences between the cash and accrual bases of accounting • Identify the four major types of adjusting entries • Develop the ability to prepare a worksheet	**Unit III: Accrual Accounting and Adjustments (5 Hours)** 1.1 Basis of accounting (cash vs. accrual) 1.2 Accrual and deferrals 1.3 Adjusting entries 1.4 Effects of adjusting entries, preparation of adjusted trial balance.
• Explain the concept and purpose of financial statements • Analyze a components of financial statements • Explain the concept and purpose of cash flow statement • Describe operating, investing, and financing activities, Prepare a statement of cash flows, • Describe the difference between the direct and indirect methods of preparing cash flows from operation activities	**Unit IV: Preparation of Financial Statements as per NFRS (13 Hours)** 4.1.Profit or loss statement Concepts and major components; preparation of profit or loss statement as per NFRS 4.2.Statement of balance sheet concepts and major components; preparation of statement of financial position/balance sheet as per NFRS 4.3.Cash flow statements Concepts and major components; preparation of statement of cash flows (direct and indirect methods) as per NFRS 4.4 Preparation of financial statements through accounting software
• Develop the skills necessary to prepare a bank reconciliation statement • Enable students to record the necessary adjustments • Identify the forms of inventory • Apply the different inventory costing methods using a periodic system and apply different method in certain situations	**Unit V: Accounting for Current Assets (7 Hours)** 5.1.Cash and the bank reconciliation statement Components of cash and cash equivalents; preparation of the bank reconciliation statement and the need for adjustments to accounting records 5.2.Inventories and cost of goods sold The nature of inventory; perpetual and periodic inventory accounting system, inventory valuation and income measurement; inventory costing methods: FIFO, LIFO,

	Weighted average & Specific identification; choice of an inventory costing method.
• Determine the acquisition cost of an operating asset • Compare different depreciation methods • Analyze the effect of the disposal of an asset at gain or loss	**Unit VI: Accounting for Property, Plant and Equipment (7 Hours)** 6.1 Nature of operating assets (property, plant and equipment); acquisition costs of operating assets; concepts of capital and revenue expenditure; the capitalization process. 6.2 Depreciation: concepts, methods and accounting (straight line method, double declining balance method and units of production method), disposal of assets and accounting for gains and losses.

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

4. Methods of Instruction and Learning Outcomes

Methods of Instruction

The course will be taught by lecture method, problem solving and group discussion. Students will require to utilize computer for computational works.

Learning Outcomes

After completing the course, students will be able to:

- Understand and apply financial accounting principles in business.
- Record and summarize business transactions both manually and using software.
- Use computerized tools for accounting and reporting.
- Analyze financial performance using various financial ratios and reports.

5. Practical Activities

Students should perform the following using Tally or other accounting software

- Create a company
- Create ledgers and groups
- Entry daily business transactions
- Generate Trial Balance
- Prepare Trading Account, Profit and Loss Account or Income Statement, and Balance Sheet

6. Evaluation System and Students' Responsibilities

Evaluation System

The performance of a student in a course is evaluated on the basis of internal evaluation and semester-end examination. Fifty percent weight is given to the internal evaluation and fifty percent

weight to the Semester-end examination conducted by the Office of the Controller of Examinations, Pokhara University.

Internal Evaluation

The internal evaluation is based on continuous evaluation process. The internal evaluation components and their respective weights may vary according to the nature and objectives of the course. An evaluation plan should be prepared by the faculty and should share with the students in the beginning of the course.

The internal evaluation components may consist of any combination of written test, quizzes and oral test, workshop, assignments, term paper, project work, case study analysis and discussion, open book test, class participation and any other test deemed to be suitable by the faculty.

Semester End Examinations

There will be semester end examination at the end of the semester conducted by the Office of the Controller of Examinations, Pokhara University. It carries 50 percent weight of total evaluation.

Students' Responsibilities

Each student must secure at least 45 percent marks in the internal evaluation with 80 percent attendance in the class to appear in the Semester End Examination. Failing to obtain such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear in the Semester End Examination. Students are advised to attend all the classes and complete all the assignments within the specified time period. If a student does not attend the class(es), it is his/her sole responsibility to cover the topic(s) taught during the period. If a student fails to attend a formal exam, quiz, test, etc. and there is not any provision for a re-exam.

6. Prescribed Books and References

Text Books

- Porter, G. A., & Norton, C. L. *Financial Accounting: The impact on decision makers*. The Dryden Press.

References

- Hermanson, H. R. and Edwards, D. J. *Financial accounting: A business perspective*. Von Hoffmann Press.
- Kimmel, P. D., Weygandt, J. J., & Kieso, D. E. *Financial accounting*. Wiley India Pvt. Ltd.
- Narayanswamy, R. *Financial Accounting: A Managerial perspective.* Prentice Hall of India.
- Nepal Financial Reporting Standards, 2018, Accounting Standards Board, Nepal.
- International Accounting Standards (IASs) / International Financial Reporting Standards (IFRS).

Knowledge Management

Pokhara University
Faculty of Management Studies

Course code: MSS 486	Full marks: 100
Course title: **Knowledge Management (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Management Science and Systems	Program: BCSIT

1. Course Description

This course introduces students to the foundational concepts, theories, and practices of Knowledge Management (KM) with a strong emphasis on its application in the field of computer systems and information technology. It explores the processes of knowledge creation, storage, sharing, and utilization within organizations, and examines how information and communication technologies (ICTs) support these processes.

2. General Objectives

The objectives of this course are;

- Introduce fundamental concepts of knowledge, knowledge types, and knowledge management in the context of computer systems and information technology.
- Explore key KM processes such as knowledge creation, storage, sharing, and utilization within organizations.
- Examine knowledge management models and frameworks**,** including their relevance to organizational learning and innovation.
- Analyze the role of information and communication technologies (ICTs) in supporting KM systems and practices.
- Enable students to design and implement knowledge management systems using appropriate tools, technologies, and strategies.
- Develop critical thinking and problem-solving skills by applying KM concepts in real-world scenarios through case studies and projects.
- Promote an understanding of organizational culture, leadership, and change management in successful KM adoption.
- Prepare students to leverage knowledge **assets** for enhancing efficiency, innovation, and competitive advantage in IT-based organizations.

3. Contents in Detail

Specific Objectives	Contents
• Recognize the differences between data, information, organizational knowledge, and intelligent organizations. • Identify the tacit and explicit knowledge.	**Unit I: Introduction of Knowledge Management (6 Hours)** 1.1 Definitions: Data, Information, Knowledge, Wisdom 1.2 History and evolution of KM 1.3 Types of Knowledge: Explicit vs. Tacit 1.4 Importance of KM in organizations

Specific Objectives	Contents
• Know the importance of KM.	
• Recognize knowledge management processes within learning organizations and in relation to their environment.	**Unit II: Knowledge Management Processes (6 Hours)** 2.1 Knowledge creation and acquisition 2.2 Knowledge capture and codification 2.3 Knowledge sharing and dissemination 2.4 Knowledge utilization and application
• Know and apply all the techniques and tools that allow identifying, capturing, processing, and disseminating knowledge within organizations.	**Unit III: KM Models and Theories (6 Hours)** 3.1 Nonaka & Takeuchi SECI Model 3.2 Wiig KM Cycle 3.2 Zack's KM Model 3.4 Organizational learning theories
• To know about KMS • To design and evaluate the KMS system for the institution.	**Unit IV: Knowledge Management Systems (6 Hours)** 4.1 Components of a KMS 4.2 KM architecture and infrastructure 4.3 Integration with IT systems 4.4 Case studies of KMS in business
• To know and use the Technological tools of KM.	**Unit V: Technologies for Knowledge Management (6 Hours)** 5.1 Databases and Data Warehousing 5.2 Decision Support Systems (DSS) 5.3 Artificial Intelligence and Machine Learning in KM 5.4 Collaboration Tools, Groupware, Intranets/Extranets
• To identify the gap between knowledge sharing culture in organization. • To identify the basics of CoPs. • To know KM leadership.	**Unit VI: Knowledge Sharing and Organizational Culture (6 Hours)** 6.1 Barriers to knowledge sharing 6.2 Incentives and trust 6.3 Communities of Practice (CoPs) 6.4 Leadership and KM
• To know KM metrics used by the organization. • To know challenges faced by the organization.	**Unit VII: KM Strategy and Implementation (6 Hrs.)** 7.1 KM strategy formulation 7.2 KM metrics and measurement 7.3. Implementation challenges 7.4 Change management in KM projects
• To recognize the need for, and an ability to engage in independent and life-long learning in the broadest context of technological change.	**Unit VIII: KM Applications and Recent Trends (6 Hours)** 8.1 KM in IT companies, healthcare, education, government 8.2 Social Media and KM 8.3 Future trends in KM (e.g., Blockchain, IoT) 8.4 Case studies and project presentations

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

4. Methods of Instruction and Field/Case Studies

Methods of Instruction

Teachers can use diverse methods of instruction to deliver this course. They are as follows:

- Lecture
- Group discussion
- Case study analysis
- Quiz
- Role-play
- Problem-solving exercises
- Videotapes
- Flipped classroom
- Home assignment and feedback
- Article review and presentation
- Field visit
- Project work
- Collaborative learning
- Guest lecture
- Self-assessment exercises

Field/Case Studies

Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life -cycles of an organization

5. Practical Activities: Laboratory Work

- Use of KM Tools
- Develop KM Application (Social Network Analysis, Document Management).
- Design and develop enterprise applications (Aggregation, E-Learning).

6. Evaluation System and Students' Responsibilities

Evaluation System

The evaluation scheme consists of both internal and external. The external evaluation shall be done through the semester-end examination held by the university, and it carries 50% weightage of the total. The internal evaluation shall be done by the teacher who delivers the course. The internal evaluation carries the remaining 50% of the total. The internal evaluation of students includes individual as well as group work and on-the-classroom as well as off-the-classroom activities. The tabular presentation of the internal evaluation is as follows:

S. N.	Internal evaluation components (Marks)	Weightage
1	Attendance and class participation (5 Marks)	10%
2	Home assignments including case studies (5 Marks)	10%
3	Quizzes (5 Marks)	10%
4	Presentations (10 Marks)	20%
5	Group Project work/term paper (field-visit or review based) (10 Marks)	20%
6	Internal assessment/exam (15 Marks)	30%

Students' Responsibilities

Each student must secure at least 45% marks separately in internal evaluation with minimum of 80% attendance in the class to appear in the Semester End Examination. Failing to get such a score will be given NOT QUALIFIED (NQ) to appear in the Semester-End Examinations. Students are advised to attend all the classes, formal exams, tests, etc., and complete all the assignments within the specified period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- Nonaka, I., Takeuchi, H., "The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation", Oxford University Press, 1995.
- Knowledge Management in Theory and Practice, Kimiz Dalkir, 2005.

References

- Srikantaiah. T. K., Koenig, M., "Knowledge Management for the Information Professional" Information Today, Inc., 2000.
- **Dalkir, K.** (2017). *Knowledge Management in Theory and Practice*. MIT Press.
- Relevant research papers and online case studies.

Managerial Accounting

Pokhara University
Faculty of Management Studies

Course code: MSS 487	Full marks: 100
Course title: **Managerial Accounting (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Management Science and Systems	Program: BCSIT

1. Course Description

This course helps students understand the basic ideas and methods used in management accounting. It covers managerial accounting in the information age, analysis of cost behavior and cost -volume -profit analysis, use of cost information in management decision making process, budgeting for planning and control, inventory valuation and inventory management and management control system. The course also uses short case studies and practical exercises to show how these applications are used in real life.

2. General Objectives

This course introduces the key concepts and methods of management accounting used to provide performance information to managers and internal users. It emphasizes how accounting information, supported by computer systems, is used for effective decision-making, planning, and control within an organization. The course is designed with the following general objectives.

- To familiarize students with the basic concepts and practices of managerial accounting.
- To help students understand and illustrate the nature of cost behavior.
- To enable students to demonstrate the managerial applications of cost-volume-profit analysis for profit planning.
- To help students analyze the relationship between accounting information and decision-making processes.
- To equip students with the knowledge to establish the functions and types of budgets and performance reports for planning and control.
- To provide students with a basic understanding of inventory evaluation and management.
- To enable students to explain the purpose of management control systems and evaluate organizational performance.

3. Contents in Detail

Specific objectives	Contents
• Explain the concept and goal of management accounting • Describe the management process and identify the role of management • Compare and contrast managerial accounting with financial accounting	**Unit I: Managerial Accounting in the Information Age (6 Hours)** Concept and goal of management accounting; The management process and the role of management accounting; Accounting and decision making; Users of accounting

• Discuss the impact of the information age on managerial accounting	information; A comparison of managerial and financial accounting; The information age and managerial accounting, Management accounting as a career; Ethical considerations in managerial decision making.
• Explain the concept of cost behavior and differentiate between variable, fixed, and mixed costs. • Apply the high-low method to separate mixed costs into fixed and variable components. • Analyze the relationship between cost, volume, and profit in managerial decision-making. • Perform break-even analysis and calculate the break-even point for single and multiple products. • Understand the concept of operating leverage.	**Unit II: Analysis of Cost Behavior and Cost -Volume -Profit Analysis (10 Hours)** Cost drivers, Cost center and cost behavior; Management influence on cost behavior; Variable, fixed and mixed-cost, Controllable and non-controllable cost. Segregation of mixed cost into variable and fixed cost using high low method; Relevant range of activity; Relationship of cost volume and profit; Contribution margin ratio and analysis; Break-even analysis; target profit and effect of income tax; The margin of safety; Break-even-analysis for multiple products; Operating leverage.
• Explain the concept of relevance in managerial decision-making. • Differentiate between relevant costs and variable or fixed costs. • Distinguish among opportunity costs, differential costs, and outlay costs, and explain their role in evaluating alternatives. • Evaluate both quantitative and qualitative factors in decision-making processes. • Calculate and make informed decisions in make-or-buy situations, strategic impact of special sales orders and product line discontinuation.	**Unit III: The Use of Cost Information in Management Decision Making Process (9 Hours)** Concept of relevance; Relevance vs. variable and fixed costs; Opportunity, differential and outlay costs; Quantitative vs. qualitative considerations in decision analysis; Types of decision situations: Make or buy; The special sales order; and dropping a product line; General influences on pricing in practice.
• Explain the purpose and importance of planning and budgeting in organizational management. • Identify the main reasons for using budgets and how they support planning, coordination, and control. • Describe the steps involved in developing a budget and distinguish between different types of budgets. • Prepare the different components of a master budget	**Unit IV: Budgeting for Planning and Control (12 Hours)** Planning and budgeting; Reasons to use budget; Developing the budget; Types of budgets; Preparing the master budget: sales budget, purchase budget, cash budget, budgeted income statement, budgeted income and balance sheet Static and flexible budget; Preparing the flexible budget; The performance report; Use of computer in the budget planning process and E-budgeting.

• Prepare a flexible budget and interpret a performance report to evaluate actual results against budgeted figures. • Understand the role of computers and e-budgeting in effective budget planning.	
• Describe the relationship between inventories and the cost of goods sold. • Apply different inventory costing methods under a periodic system and analyze their effect on reported income and taxes. • Calculate the EOQ to determine the optimal inventory purchase level. • Understand the concepts of JIT inventory and supply chain management.	**Unit V: Inventory Valuation and Inventory Management (7 Hours)** The nature of inventory; Inventories and Cost of Goods Sold; inventory errors; inventory costing methods (FIFO, LIFO and WAC) under a periodic inventory system, and its effect on income and taxes; Calculation of economic order quantity; Activity based costing; Just in-Time concept; Supply chain management.
• Explain the role of management control systems. • Develop and apply appropriate performance measures. • Describe the concept of responsibility accounting. • Evaluate the performance of investment centers using ROI, EVA, and the balanced scorecard approach.	**Unit VI: Management Control System and Performance Evaluation (4 Hours)** Management control systems and organizational goals; Development of measures of performance; Responsibility accounting and centers; Evaluation investments centers with ROI and EVA; The balanced scorecard.

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

4. Methods of Instruction

To effectively deliver the course objectives, lectures and interactive discussion; case study; group project-work; quizzes; exam; and continuous feedback and support pedagogical methods will be employed.

5. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s) conducted by the Office of the Controller of Examination of Pokhara University, the internal evaluation of a student may consist of class attendance, class participation, quizzes, assignments, presentations, written exams, etc. The tabular presentation of the evaluation system is as follows.

External Evaluation	Marks	Internal Evaluation	Marks
Semester-End Examination	50	Class attendance and participation	5
		Group work	5
		Quizzes/assignments	10
		Internal Term Exam	30
Total External	50	Total Internal	50
Full Marks 50+50 = 100			

Students' Responsibilities:
Each student must secure at least 50% marks in the internal evaluation with 80% attendance in the class to appear in the Semester End Examination. Failing to obtain such score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear in the End-Term examinations. Students are advised to attend all the classes and complete all the assignments within the specified time period. If a student does not attend the class(es), it is his/her sole responsibility to cover the topic(s) taught during the period. If a student fails to attend a formal exam, quiz, test, etc. there won't be any provision for a re-exam.

6. Prescribed Books and References

Text Books

- Horngren, Charles T., Sundem, Gary L and Stratton William O. Jeff Schatzberg, Dave
- Burgstahler, *Introduction to Management Accounting*, Prentice Hall.

References

- Parajuli, D. Sharma, G., Panthi S., Mahato, B., Mahara, MS., *Accounting for Managerial Decisions*, Advance Saraswati's Publication Pvt. Ltd., Kathmandu.
- Lo, C., Accounting *for Management Decision*, Learn Now Publication.
- Brewer, P.C., Garrison, R. H. & Noreen, E.W., *Introduction to Managerial Accounting*. McGraw Hill.

CONCENTRATION AREA: MULTIMEDIA TECHNOLOGY

Course Code	Course Title	Credits
MMT 481	Fundamentals of Animations	3
MMT 482	3D Modeling	3
MMT 483	Moving Images and VFX	3
MMT 484	Multimedia Development Tools	3
MMT 485	Sound and Music Production	3
MMT 486	Advance Animation Techniques	3

Fundamentals of Animation

Pokhara University
Faculty of Management Studies

Course code: MMT 481	Full marks: 100
Course title: **Fundamentals of Animation (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Multimedia Technology	Program: BCSIT

1. Course Description

This course provides an introduction to the art and science of animation, focusing on both creative expression and technical skills. Students will explore the history and evolution of animation, understand key animation principles, and learn hands-on techniques such as frame-by-frame animation and tweening. Through practical exercises and project-based learning, students will gain experience using industry-relevant tools like Pencil2D, Krita, Adobe Animate, and Canva. The course also emphasizes storytelling, visual design, and audio-visual synchronization, preparing students to apply animation in diverse fields such as user interface design, advertising, gaming, and multimedia presentations. By the end of the course, students will produce a complete animated project and develop a basic portfolio suitable for academic, freelance, or industry purposes.

2. General Objectives

- To introduce students to the history, evolution, and significance of animation in modern media.
- To develop an understanding of core animation principles and their practical applications.
- To provide hands-on experience with 2D animation techniques using both free and professional tools.
- To enable students to conceptualize and plan animation projects through storyboarding and scripting.
- To empower students to create and present animated content integrated with sound and motion for diverse platforms such as advertising, games, UI/UX, and education.

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3. Contents in Detail

Specific objectives	Contents
▪ Describe the evolution of animation from traditional to digital. ▪ Distinguish between 2D, 3D, stop-motion, and motion graphics. ▪ Identify animation applications across industries. ▪ Recognize career paths and necessary skills in animation.	**Unit I: Introduction to Animation (5 Hours)** 1.1 History and evolution of animation 1.2 Types of animation: 2D, 3D, stop-motion, motion graphics 1.3 Applications: Entertainment, education, advertising, UI/UX 1.4 Career opportunities in animation and multimedia
▪ Explain Disney's 12 animation principles	**Unit II: Principles of Animation (6 Hours)** 2.1 Disney's 12 principles of animation 2.2 Core techniques: timing, spacing, squash &

▪ Apply core techniques like squash/stretch, timing, anticipation ▪ Analyze examples using these principles	stretch, follow-through 2.3 Real-world examples and case studies
▪ Describe steps in the animation pipeline ▪ Write scripts and create storyboards ▪ Use digital tools to create animatics	**Unit III: Animation Pipeline & Storyboarding (6 Hours)** 3.1 Animation pipeline: ▪ Ideation ▪ script ▪ storyboard ▪ animatic 3.2 Writing scripts and creating visual sequences 3.3Tools for animatics (Canva/PowerPoint/Krita)
▪ Understand key concepts: keyframes, in-betweens, onion skinning ▪ Use Pencil2D or Krita for hand-drawn animation ▪ Practice basic sequencing and movement techniques	**Unit IV: Frame-by-Frame Animation (6 Hours)** 4.1 Concepts: Keyframes, in between, onion skinning 4.2. Software: Pencil2D/Krita 4.3Drawing and sequencing basics
▪ Identify and apply different tween types: shape, motion, and classic. ▪ Implement easing and timing transitions in animations. ▪ Create text animations, banners, and simple animated intros	**Unit V: Motion Graphics & Tweening (8 Hours)** 5.1 Tween types: Shape, motion, classic (Adobe Animate/Canva) 5.2 Easing, timing transitions, and text-based animations 5.3 Design of animated banners and intros
▪ Understand basic rigging techniques for character animation. ▪ Apply lip-sync methods and animate facial expressions. ▪ Create simple walk cycles and gesture animations.	**Unit VI: Character Animation Basic (6 Hours)** 6.1 Basic rigging concepts (puppet/rig) 6.2Lip-sync techniques and facial expressions 6.3Walk cycles and gestures
▪ Integrate background music, sound effects, and voice-overs into animations. ▪ Synchronize audio with visual elements using layering techniques. ▪ Operate tools like Audacity, Adobe Animate, and OpenToonz for audio-visual editing.	**Unit VII: Audio-Visual Synchronization (6 Hours)** 7. 1 Add and manage background music, sound effects, and voice-overs. 7.2Apply audio syncing and layering techniques in animation. 7.3 Use tools like Audacity, Adobe Animate, or OpenToonz for sound integration

▪ Plan and create a 30–60 second animated project individually or in a team. ▪ Apply animation techniques in the development and execution of the final project. ▪ Present the project, receive feedback, and compile it into a personal portfolio	**Unit VIII: Final Project & Review (6 Hours)** 8.1 30–60 sec animated project: Ad, UI demo, scene, explainer, etc. 8.2Planning, development, and execution in teams or individually 8.3 Final presentation, critique, and portfolio development

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

4. Method of Instructions

General Instructional Technique: Lecture, Discussion, Readings, Question Answer

Specific Instructional Technique: Practical works, Project Based Learning, Self-Directed Learning, Industry Insights and Case Study

5. Practical Activities: Laboratory Work

Software & Tools to be Used

- Pencil2D, Krita
- Adobe Animate / Flash
- OpenToonz, Canva
- Audacity (Audio editing)
- Web Weaver / HTML5 tools
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Some important contents that should be included in lab exercises are as follows:

1. Create a Short Timeline Showcasing Animation Evolution
2. Design a Comparative Demo of 2D, 3D, Stop-Motion, and Motion Graphics
3. Apply Disney's 12 Principles Using Simple Animated Sequences
4. Scriptwriting and Storyboarding for a Short Animation Concept.
5. Create a Basic Animatic
6. Frame-by-Frame Animation Practice
7. Design Animated Text and Banners Using Tweening Techniques
8. Character Animation Basics (Walk Cycle and Lip Sync)
9. Add and Sync Audio with Animation
10. Final Animation Project (30–60 Seconds)

Note:

- ***Motivate students to create small project work integrating all of the above concepts***.
- ***Each of the above lab session should cover more than 2 hours of practical work.***

6. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

External Evaluation	Marks	Internal Evaluation	Weight	Marks
Semester-End examination	40	**Theory**		40
		Attendance & Class Participation	10%	
		Assignments	20%	
		Presentations/Quizzes	10%	
		Internal Assessment	60%	
		Practical		
		Attendance & Class Participation	10%	20
		Lab Report/Project Report	20%	
		Practical Exam/Project Work	40%	
		Viva	30%	
Total External	40	Total Internal		60
Full Marks: 40 + 60 = 100				

Students' Requirements
Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. ***Students are required to complete all the requirements defined for the completion of the course.***

7. Prescribed Books and References

Text Books

- Williams, R. (2009). *The animator's survival kit: A manual of methods, principles and formulas for classical, computer, games, stop motion and internet animators* (Expanded ed.). Faber & Faber.
  ISBN: 9780571238330
- Thomas, F., & Johnston, O. (1995). *Disney animation: The illusion of life*. Disney Editions.
  ISBN: 9780786860708
- Webster, C. (2005). *Animation: The mechanics of motion*. Focal Press.
  ISBN: 9780240516660

References

- Whitaker, H., & Halas, J. (2002). *Timing for animation* (2nd ed.). Focal Press. ISBN: 9780240517148
- Avgerakis, G. (2005). *Digital animation Bible: Creating professional animation with 3ds Max, LightWave, and Maya*. McGraw-Hill Education. ISBN: 9780071414944
- White, T. (2006). *Animation from pencils to pixels: Classical techniques for the digital animator*. Focal Press. ISBN: 9780240806709

Online Resources

- Pencil2D. (n.d.). *Pencil2D tutorials*. https://www.pencil2d.org/learn/
- Krita Foundation. (n.d.). *Krita animation documentation*. https://docs.krita.org/en/user_manual/animation.html
- Canva. (n.d.). *Design School: Motion graphics*. https://designschool.canva.com/
- Adobe. (n.d.). *Animate tutorials*. https://helpx.adobe.com/animate/tutorials.html
- Animator Guild. (n.d.). *YouTube Channel*. https://www.youtube.com/@AnimatorGuild
  Becker, A. (n.d.). *YouTube Channel*. https://www.youtube.com/@alanbecker

Moving Image and VFX

Pokhara University
Faculty of Management Studies

Course code: MMT 483	Full marks: 100
Course title: **Moving Image and VFX (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Multimedia Technology	Program: BCSIT

1. Course Description

This course introduces students to the creative and technical aspects of moving image design and visual effects (VFX) production. It combines film and digital media theory with practical skills in cinematography, editing, compositing, and animation. The course enables students to plan, shoot, and edit video sequences and enhance them with computer-generated effects using industry-standard tools such as Adobe After Effects, Premiere Pro, and Blender. Through hands-on projects and case studies, students will explore topics including visual storytelling, keying, tracking, rotoscoping, motion graphics, and post-production workflows. The course prepares students to create professional short films, promotional videos, and integrated VFX sequences.

2. General Objectives

The general objectives of this course are;

- To develop foundational knowledge in moving image and VFX principles.
- To learn camera operation, video shooting, and editing techniques.
- To gain hands-on experience with motion graphics and compositing tools.
- To understand the principles of animation, masking, tracking, and green-screen keying.
- To plan and execute full post-production pipelines including color correction and sound syncing.
- To create engaging and professional-level video content integrating VFX elements.
- To foster creativity, collaboration, and storytelling using digital media.

3. Contents in Detail

Specific Objectives	Contents
• Understand the evolution and relevance of moving images in multimedia. • Learn the fundamentals of visual effects and its categories. • Identify key terms and concepts related to frame rate, resolution, and codecs.	**Unit I: Introduction to Moving Image and VFX (6 Hours)** 1.1 History of Moving Images and VFX 1.2 Frame Rate, Resolution, Aspect Ratio 1.3 Introduction to VFX: Types and Use Cases 1.4 Video Formats and Compression
• Understand how to operate DSLR and mobile cameras.	**Unit II: Cinematography and Video Shooting (7 Hours)** 2.1 Camera Operation: ISO, Aperture, Shutter Speed

• Learn to control exposure, focus, white balance, and depth of field. • Develop skills in framing, storyboarding, and shot planning.	2.2 Shot Composition and Framing Techniques 2.3 Lighting, Audio and Video 2.4 Storyboarding and Scene Planning
• Explore 2D motion graphics using Adobe After Effects or Blender. • Learn basic animation techniques and keyframing. • Apply motion design in title sequences, lower thirds, and transitions.	**Unit III: Motion Graphics and Animation (8 Hours**) 3.1 Principles of Animation (Timing, Easing, Squash & Stretch) 3.2 Creating Titles and Animated Graphics 3.3 Working with Keyframes, Effects, and Presets 3.4 Expressions and Basic Scripting
• Understand compositing layers and channels. • Learn green screen (chroma key), masking, and rotoscoping. • Track motion and apply stabilization techniques.	**Unit IV: VFX and Compositing Techniques (10 Hours)** 3.1 Introduction to Compositing and Layering 3.2 Green Screen and Chroma Keying 3.3 Rotoscoping and Masking 3.4 Motion Tracking and Stabilization 3.5 Particle Systems and 3D Integration
• Learn basic audio enhancement and synchronization. • Understand principles of color correction and grading. • Explore how visual and auditory elements affect storytelling.	**Unit V: Audio and Color Correction (5 Hours)** 5.1 Syncing Dialogue and Sound Effects 5.2 Audio Editing and Noise Reduction 5.3 Color Correction Tools (Lumetri, Scopes) 5.4 Color Grading Styles and LUTs
• Understand workflow from raw footage to final render. • Learn techniques for efficient exporting and video compression. • Review industry-standard output formats.	**Unit VI: Post-Production Workflow Rendering, Project and Portfolio Development (12 Hours)** 6.1 Project Organization and Timeline Editing 6.2 Rendering and Exporting for Web and Broadcast 6.3 Best Practices in File Naming, Versioning, and Archiving 6.4 Case Studies of Real VFX Projects 6.5 Planning and executing a final VFX project 6.6 Portfolio development and presentation

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

4. Method of Instructions

General Instructional Technique: Lecture, Discussion, Reading, Simulation, Practical

Specific Instructional Technique: Practical works, Project Based Learning, Self-Directed Learning, Industry Insights and Case Study.

5. Practical Activities: Laboratory Work

This course emphasizes hands-on production using video cameras and post-production tools. Students will develop video projects that apply VFX principles and compositing techniques.

Some important lab activities include:

- Capturing and editing video sequences using DSLR/mobile camera
- Designing a title animation using After Effects or Blender
- Creating green-screen compositing and background replacement
- Using motion tracking to attach graphics to moving subjects
- Syncing audio and applying color grading to scenes
- Developing a final short video or VFX demo reel

Note:

- *Motivate students to create small project work integrating all the above concepts.*
- *Each of the above lab sessions should cover more than 4 hours of practical work.*

6. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

External Evaluation	Marks	Internal Evaluation	Weight	Marks
Semester-End Examination	50	**Theory**		
		Attendance & Class Participation	10%	30
		Assignments	20%	
		Presentations/Quizzes	10%	
		Internal Assessment	60%	
		Practical		
		Attendance & Class Participation	10%	20
		Lab Report/Project Report	20%	
		Practical Exam/Project Work	40%	
		Viva	30%	50
Total External	50	Total Internal		
Full Marks: 50 + 50 = 100				

Students' Requirements

Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such a score will be given NOT QUALIFIED (NQ) to appear in the Semester-End Examinations. Students are advised to attend all the classes, formal exams, tests, etc., and complete all the assignments within the specified time period. *Students are required to complete all the requirements defined for the completion of the course.*

7. Prescribed Books and References

Textbooks

- Christiansen, M. (2021). *Adobe After Effects Classroom in a Book*. Adobe Press.

References

- Gress, J. (2014). *Visual Effects and Compositing*. New Riders.
- Wohl, M. (2012). *Editing Techniques with Final Cut Pro*. Peachpit Press.
- Brinkmann, R. (2008). *The Art and Science of Digital Compositing*. Morgan Kaufmann.
- Adobe Inc. – Official Documentation and Tutorials.

Web References

- https://helpx.adobe.com/after-effects
- https://www.videocopilot.net/tutorials/
- https://motiondesign.school
- https://blender.org

Multimedia Development Tools

Pokhara University
Faculty of Management Studies

Course code: MMT 484	Full marks: 100
Course title: **Multimedia Development Tools (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Multimedia Technology	Program: BCSIT

1. Course Description

This course provides a comprehensive overview of advanced multimedia systems, with a focus on design, compression, and streaming standards. It helps students build practical skills in image editing, graphic design, sound engineering, video making, motion graphics, and 2D/3D animation. Students work on hands-on labs using tools like Photoshop, Premiere Pro, Audacity, Blender, and Unity. The course highlights multimedia applications in Nepalese industries, including e-learning, digital marketing, and infotainment. It also covers web-based multimedia integration with different advanced programming tools. Creativity and new ideas in interactive multimedia solutions for local and global markets are highly encouraged.

2. General Objectives

The general objectives of this course are;

- Develop comprehensive knowledge of multimedia systems architecture, data compression techniques, streaming technologies, and global standards.
- Acquire practical expertise in professional multimedia tools for image editing, graphic design, audio engineering, video production, motion graphics, and animation.
- Apply multimedia solutions effectively across diverse domains such as online education, digital marketing, entertainment, web development, and mobile applications.
- Design and present professional portfolios and freelance profiles through capstone projects that demonstrate integrated multimedia competencies.
- Develop creativity and innovation in producing interactive multimedia solutions for both local and international markets, fostering readiness for global career opportunities.

3. Contents in Detail

Specific objectives	Contents
• Describe multimedia architecture, workflows, and key compression and streaming techniques for efficient content delivery. • Explore global multimedia standards (JPEG, MPEG, MP4) and their applications.	**Unit I: Advanced Multimedia Concepts (3TH+2PR=5 Hours)** 1.1 Multimedia architecture and workflow 1.2 Real-time vs. non-real-time systems 1.3 Multimedia compression and streaming 1.4 Multimedia standards (JPEG, MPEG, MP4) 1.5 Nepalese market applications: e-learning, digital marketing, infotainment

• Explore advanced image manipulation, branding assets, and UI/UX design principles using vector and raster graphics. • Apply color theory with digital palettes and design social media posts, logos, and UI kits.	**Unit II: Image Editing & Graphic Design (5TH + 3PR = 8 Hours)** 2.1 High-resolution image manipulation 2.2 Branding and UI/UX asset creation 2.3 Vector vs. Raster Graphics 2.4 Color theory and digital palettes 2.5 Tools: Adobe Illustrator, Figma, Canva
• Explore multi-track editing, mixing techniques, and apply noise reduction with audio effects for enhanced sound quality. • Apply advanced audio engineering tools for creative sound design.	**Unit III: Audio Engineering & Sound Design (5TH + 3PR = 8 Hours)** 3.1 Multi-track editing and mixing 3.2 Noise reduction and audio effects 3.3 Podcast and voice-over production 3.4 MIDI and digital audio formats 3.5 Tools: Audacity, Adobe Audition, FL Studio
• Explore storyboarding, scripting, and apply transitions, effects, and titling to enhance visual storytelling in videos. • Utilize different advanced tools for professional video editing and motion graphics.	**Unit IV: Video Editing & Motion Graphics (5TH + 3PR= 8 Hours)** 4.1 Storyboarding and scripting 4.2 Transitions, effects, and titling 4.3 Color grading and audio syncing 4.4 Exporting for web and mobile 4.5 Tools: Adobe Premiere Pro, DaVinci Resolve, CapCut
• Explore animation principles, rigging, and apply keyframes, tweening, and morphing for smooth 2D/3D animations. • Develop 3D modeling, rendering skills, and create interactive animations.	**Unit V: 2D/3D Animation & Interactive Media (4TH + 3PR = 7 Hours)** 5.1 Principles of animation and rigging 5.2 Keyframes, tweening, morphing 5.3 3D modeling and rendering 5.4 Interactive animations 5.5 Tools: Blender, Adobe After Effects, Unity
• Explore multimedia embedding using animation libraries for dynamic web experiences. • Design responsive multimedia content for various devices and develop web-based storytelling with interactivity.	**Unit VI: Multimedia Authoring & Web Integration (3TH + 2PR = 5 Hours)** 6.1 HTML5/CSS3 multimedia embedding 6.2 JavaScript animation libraries 6.3 Responsive design for multimedia 6.4 Web-based storytelling and interactivity 6.5 Tools: HTML5, GSAP, Android Studio
• Plan and execute real-world multimedia projects integrating images, audio, video, and animations.	**Unit VII: Capstone Project & Portfolio Development (5Th + 2PR = 7 Hours)** 7.1 Real-world multimedia project planning 7.2 Integration of image, audio, video, and animation 7.3 Portfolio creation and presentation

• Build a professional portfolio, freelance profiles, and gain market readiness.	7.4 Freelance readiness and market exposure 7.5 Tools: Behance, GitHub Pages, OBS Studio

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

4. Methods of Instruction

- Lecture and discussion
- Practical Lab
- Demonstration
- Presentation
- Case study

5. Practical Activities

The laboratory work should involve hands-on implementation and evaluation of concepts through unit-wise case studies, utilizing appropriate advanced software tools as needed in the appropriate context and market situation. Students should work in groups to visualize and present their findings using Multimedia Development Tools.

- Lab Work-1: Multimedia storyboard creation using OBS Studio, Google Slides
- Lab Work-2: Social media post, logo design, UI kit design
- Lab Work-3: Podcast production, Mixed voice-over with sound effects
- Lab Work-4: Promo video editing, Social media reels creation
- Lab Work-5: 2D Animation,3D object modeling
- Lab Work-6: Animated webpage prototype
- Lab Work-7: Portfolio website, Freelance profile setup

6. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s) conducted by the Office of the Controller of Examination of Pokhara University, the internal evaluation of a student may consist of class attendance, class participation, quizzes, assignments, presentations, written exams, etc. The tabular presentation of the evaluation system is as follows.

Internal Evaluation	Weight	Marks	External Evaluation	Marks
Theory		**30**	**Semester End examination**	**50**
Attendance / Class Participation	10%			
Assignments	20%			
Project Work/Presentations	10%			
Term Exam	60%			
Practical		**20**		
Attendance and Lab Participation	10%			

Lab Report	20%			
Lab Examination	40%			
Viva Examination	30%			
Total Internal Marks		**50**		
Full marks=50+50				

Students' Responsibilities

To be eligible for the Semester End Examinations, each student must secure at least 45% marks in the internal evaluation with 80% attendance in the class, to appear in the Semester End Examination. Failing to obtain such a score will be given NOT QUALIFIED (NQ) and the student will not be eligible to appear in the End-Term examinations. Students are advised to attend all the classes and complete all the assignments within the specified period. If a student does not attend the class(es), it is his/her sole responsibility to cover the topic(s) taught during the period. If a student fails to attend a formal exam, quiz, test, etc., there won't be any provision for a re-exam.

7. Prescribed Books and References

Text Books

- Vaughan, T. (2010). *Multimedia: Making it work* (8th ed.). McGraw-Hill Education.

References

- Adobe Creative Team. (2012). *Adobe Photoshop CS6 classroom in a book*. Adobe Press.
- Wright, S. (2013). *Digital compositing for film and video: Production workflows and techniques* (4th ed.). Focal Press.

Sound and Music Production

Pokhara University
Faculty of Management Studies

Course code: MMT 485 — Full marks: 100
Course title: **Sound and Music Production (Concentration)** — Pass marks: 45
Nature of the course: Theory and Practical — Credit hours: 3.0
Level: Bachelor — Total hours: 48
Concentration area : Multimedia Technology — Program: BCSIT

1. Course Description

This course offers a comprehensive introduction to sound and music production, blending theoretical foundations with practical experience. Students will learn essential audio principles, basic music theory, and techniques for recording, editing, mixing, and mastering sound using professional Digital Audio Workstations (DAWs). The course highlights both creative expression and technical proficiency, with real-world applications in podcasting, film, gaming, and multimedia. By the end of the course, students will complete an original audio project and compile a personal production portfolio.

2. General Objectives

The general objectives of this course are;

- Understand the science of sound and music theory.
- Develop technical skills in recording, editing, and producing audio.
- Gain proficiency in industry-standard tools and software.
- Create original compositions and sound designs for various applications.
- Build a professional audio portfolio suitable for academic and freelance use

3. Contents in Detail

Specific Objectives	Contents
▪ Define basic sound properties. ▪ Outline the history of sound recording. ▪ Distinguish analog and digital sound. ▪ Identify key music theory elements	**Unit I: Introduction to Sound & Music (6 Hours)** 1.1What is sound? Waveform, frequency, amplitude, pitch, timbre 1.2History and evolution of sound recording 1.3 Analog vs. digital sound 1.4 Basics of music theory: melody, harmony, rhythm
▪ Identify common microphone types and placement techniques. ▪ Distinguish between mono and stereo recording methods.	**Unit II: Sound Recording Techniques (6 Hours)** 2.1 Microphone types and placement techniques 2.2 Mono vs. stereo recording

▪ Explain the function of audio interfaces, mixers, and input levels. ▪ Set up a basic home or field recording environment	2.3 Audio interfaces, mixers, and input levels 2.4Studio setup (home/field recording environments)
▪ Identify popular DAWs and their core features. ▪ Perform basic multi-track editing and timeline navigation. ▪ Use MIDI tools and virtual instruments (VSTs). ▪ Export audio projects in common file formats like WAV and MP3.	**Unit III: Digital Audio Workstations (DAWs) (6 Hours)** 3.1 Introduction to DAWs: Audacity, FL Studio, Ableton Live, Reaper 3.2 Multi-track editing and timeline navigation 3.3 MIDI basics and virtual instruments (VSTs) 3.4 Exporting, bouncing, and audio file formats (WAV, MP3, FLAC)
▪ Understand beat structure using tempo, bars, and BPM. ▪ Create music using loops, samples, and layering techniques. ▪ Operate drum machines, synthesizers, and sequencers. ▪ Compose short music pieces like intros, jingles, and background scores.	**Unit IV: Music Composition & Beat Making (6 Hours)** 4.1 Beat structure: tempo, bars, BPM 4.2 Using loops, samples, and layering 4.3 Drum machines, synthesizers, sequencers 4.4 Composition for intros, jingles, background scores
▪ Edit audio using trimming, fading, and EQ techniques. ▪ Apply effects like compression, reverb, and delay. ▪ Perform noise reduction and remove clicks, pops, and sibilance. ▪ Design ambient soundscapes and audio textures.	**Unit V: Sound Editing & Effects (8 Hours)** **5.1** Trimming, fading, equalization (EQ) **5.2** Compression, reverb, delay **5.3** Noise reduction, de-clicking, de-essing **5.4** Creating ambience and sound textures
▪ Apply gain staging, panning, and balance tracks effectively. ▪ Utilize reference tracks for mixing accuracy. ▪ Understand the mastering chain including EQ, compression, and limiting. ▪ Prepare audio for distribution on various platforms.	**Unit VI: Mixing and Mastering Basics (6 Hours)** 6.1 Gain staging, panning, track balancing 6.2 Use of reference tracks 6.3 Introduction to mastering chain (EQ, compression, limiter) 6.4 Preparing audio for platforms (YouTube, Spotify, FM, etc.)
▪ Design sound elements for games, animation, and film. ▪ Create Foley effects and original audio assets. ▪ Produce podcasts and perform voice-over recordings.	**Unit VII: Sound Design & Applications (6 Hours**) 7.1 Sound design for games, animation, film 7.1 Foley art and effects creation 7.2 Podcast production and voice-overs 7.3 Licensing, copyright, and royalty-free resources

▪ Understand licensing, copyright, and use of royalty-free audio	
▪ Develop a complete audio project (music, podcast, or video sound). ▪ Present the creative process and production decisions. ▪ Compile a professional audio portfolio with personal branding elements.	**Unit VIII: Final Project & Portfolio (4 Hours)** 8.1 Project: Create a full-length music track, podcast episode, or audio for video 8.2 Present creative workflow and rationale 8.3 Portfolio preparation: audio reel, personal branding assets

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

4. Methods of Instruction

General Instructional Technique: Lecture, Discussion, Readings, Question Answer

Specific Instructional Technique: Practical works, Project Based Learning, Self-Directed Learning, Industry Insights and Case Study

5. Practical Activities: Laboratory Work

It builds the foundation on how to write a program using any high-level language. Hence, this course requires a lot of programming practice so that students will be able to develop good logic building and program developing capability which is essential throughout the course.
Some important contents that should be included in lab exercises are as follows:

1. Use Audacity or a DAW to observe waveform, frequency, and amplitude of different audio clips.
2. Experiment with different microphone types and placements to record clean audio in mono and stereo.
3. Arrange and edit multiple audio tracks using timeline navigation in software like FL Studio or Reaper.
4. Create a basic melody or rhythm using MIDI controllers and virtual instruments.
5. Compose a short beat or music track using pre-made loops and layering samples.
6. Add effects such as EQ, compression, reverb, and delay to enhance raw audio recordings.
7. Use tools like de-noise and de-ess to clean a noisy or imperfect voice recording.
8. Perform gain staging, panning, and basic mastering to prepare a track for final output.
9. Create sound effects or background audio for a short animation or video clip.
10. Complete and present a full music track, podcast, or audio-for-video project along with an organized audio portfolio.

Note:

- ***Motivate students to create small project work integrating all of the above concepts***.
- ***Each of the above lab session should cover more than 2 hours of practical work.***

6. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

External Evaluation	Marks	Internal Evaluation	Weight	Marks
Semester-End examination	40	**Theory**		40
		Attendance & Class Participation	10%	
		Assignments	20%	
		Presentations/Quizzes	10%	
		Internal Assessment	60%	
		Practical		
		Attendance & Class Participation	10%	20
		Lab Report/Project Report	20%	
		Practical Exam/Project Work	40%	
		Viva	30%	
Total External	40	Total Internal		60
Full Marks: 40 + 60 = 100				

Students' Requirements
Each student must secure at least 45% marks separately in both internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. ***Students are required to complete all the requirements defined for the completion of the course.***

7. Prescribed Books and References

Text Books

- Rumsey, F., & McCormick, T. (2014). *Sound and recording: Applications and theory* (7th ed.). Focal Press. Covers core principles of sound, recording techniques, and digital audio, aligning with the overall course structure**.**

References

- Huber, D. M., & Runstein, R. E. (2017). *Modern recording techniques* (9th ed.). Routledge. A comprehensive resource covering the full range of audio production topics, including recording, editing, mixing, and studio configuration. Suitable for both theoretical understanding and practical application.

- Senior, M. (2011). *Mixing secrets for the small studio*. Focal Press.
  Tailored for aspiring producers working with limited gear, this book offers practical mixing strategies that emphasize affordability without sacrificing quality.
- Rumsey, F., & McCormick, T. (2014). *Sound and recording: Applications and theory* (7th ed.). Focal Press. *(Prescribed Textbook)*
  This foundational text explains the core principles of sound and audio engineering, combining technical depth with accessible explanations ideal for beginners.
- Hepworth-Sawyer, R., & Hodgson, J. (2017). *Mastering audio: The art and the science*. Routledge.
  A practical guide to the mastering process, providing essential techniques for achieving professional-quality audio suitable for various distribution formats.

Advanced Animation Techniques

Pokhara University
Faculty of Management Studies

Course code: MMT 486	Full marks: 100
Course title: **Advanced Animation Techniques (Concentration)**	Pass marks: 45
Nature of the course: Theory and Practical	Credit hours: 3.0
Level: Bachelor	Total hours: 48
Concentration area : Multimedia Technology	Program: BCSIT

1. Course Description

This course provides students with a deep understanding of advanced animation techniques used in modern media production. Topics include keyframe animation, procedural animation, physics-based animation, character rigging, motion capture, and the integration of animation in game engines and virtual environments.

2. General Objectives

The general objectives of this course are;

- Understand and apply various advanced animation principles and techniques.
- Develop proficiency in 3D animation tools and workflows.
- Design and implement complex animations for multimedia applications.
- Analyze and critique animation techniques used in professional productions.

3. Contents in Detail

Specific objectives	Contents
• Understand evolution of animation technologies • Identify different animation domains	**Unit I: Introduction to Advanced Animation (4 Hours)** 1.1 History and evolution of animation 1.2 Overview of modern animation pipelines 1.3 Applications of animation in various industries 1.4 Software & Tools: Blender, Maya, Unreal Engine, Unity, MotionBuilder, Plugins and scripting tools (Python, MEL).
• Understand timeline and key frame concepts • Apply interpolation techniques	**Unit II: Key frame Animation (6 Hours)** 2.1 Basics and advance of key frame animation: Breakdown poses, secondary motion, and overlapping action, Using the graph editor for smooth motion curves. 2.2 Interpolation Method: Linear, Bezier, and stepped interpolation, Easing functions (ease-in ease-out, bounce, elastic). 2.3 Timing & Spacing: Adjusting timing for weight and impact.

• Learn automated animation techniques • Create dynamic procedural effects	**Unit III: Procedural Animation (6 Hours)** 3.1 Introduction to procedural animation 3.2 Scripting for Animation: Python scripting in Blender/Maya for automated motion, Expressions and rig controllers 3.3 Noise-Based & Algorithmic Motion: Perlin noise for natural-looking movement (e.g., trees, water), Crowd simulation using rule-based systems (e.g., boids algorithm). 3.4 Procedural Walk Cycles: Inverse Kinematics (IK) automation, Dynamic adjustments based on terrain
• Simulate natural motion • Integrate physics engines	**Unit IV: Physics-Based Animation (6 Hours)** 4.1 Rigid body dynamics Collision detection, gravity, and force simulations, Destruction effects (fracturing, debris). 4.2 Soft body and cloth simulation: Realistic fabric movement (wind, tension), Self- collision and pinning constraints 4.3 Fluid and particle systems: Water, smoke, and fire simulations, Particle-driven effects (hair, fur, explosions).
• Rig characters for animation • Use inverse kinematics (IK)	**Unit V: Character Rigging and Skinning (8 Hours)** 5.1 Advanced Rigging Techniques: FK/IK(Forward Kinematics/Inverse Kinematics) blending for limbs, Stretchy bones and squash/stretch controls. 5.2 Facial Rigging: Blend shapes vs. joint-based facial animation, Eye tracking and lip-sync setups. 5.3 Skinning & Weight Painting: Smooth deformations with corrective shapes, Avoiding joint popping and artifacts.
• Capture real motion • Apply mocap data to characters	**Unit VI: Motion Capture and Data Retargeting (6 Hours)** 6.1 Introduction to motion capture 6.2 Retargeting motion data: Mapping MoCap (Motion Capture) data to different character skeletons, Adjusting proportions and fixing foot sliding. 6.3 Facial Motion Capture: Blend shapes vs. bone-based facial animation, Tools like Faceware, iPhone ARKit(Augmented Reality Kit) for facial tracking. 6.4 Cleaning and editing mocap data: Optical, inertial, and markerless systems, Data acquisition and cleanup (noise reduction, gap filling).
• Integrate animations into real-time engines • Optimize for performance	**Unit VII: Animation in Game Engines (5 Hours)** 7.1 Importing animations 7.2 Animation Blending & State Machines: Smooth transitions between animations (walk → run → jump), Unity Animator Controller & Unreal Blueprints. 7.3 Motion Matching & AI-Driven Animation: Dynamic motion adaptation (e.g., NPCs(Non- Player Character) reacting to

	terrain), Motion warping for contextual adjustments. 7.4 Performance Optimization: Level of Detail (LOD) for animations, Compression techniques for game-ready animations.
• Understand and apply advanced shading and lighting techniques • Analyze and implement motion blur, temporal effects, and compositing workflows	**Unit VIII: Rendering & Post-Processing (4 Hours)** 8.1 Advanced Shading & Lighting: Subsurface scattering (skin, wax),Dynamic shadows and global illumination 8.2 Motion Blur & Temporal Effects: Camera motion blur vs. object motion blur,Temporal anti-aliasing (TAA) 8.3 Compositing for Animation: Render passes (diffuse, specular, AO(Ambient Occlusion)), Post-processing in Nuke/After Effects (glows, depth of field).

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

4. Methods of Instructions

Lecture, Tutorial, Discussion, Readings and Practical works

5. Practical Activities

SN	Lists
1.	Create a short key frame animation using timeline and graph editor.
2.	Develop a procedural animation using scripting (e.g., noise, sine functions).
3.	Simulate physics-based effects such as bouncing ball or cloth dynamics.
4.	Rig a humanoid character with joints and skinning techniques.
5	Apply Inverse Kinematics (IK) and Forward Kinematics (FK) to animate a limb.
6.	Capture simple motion using free mocap tools and apply it to a 3D character.
7.	Clean and retarget mocap data using animation software.
8.	Integrate animations into a game engine and create state transitions.
9.	Create a final animation project combining multiple techniques.
10.	Present and defend the final animation project in class.

6. Evaluation System and Students' Responsibilities

Evaluation System

The internal evaluation of a student may consist of assignments, attendance, term-exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

Internal Evaluation	Weight	Marks	External Evaluation	Marks
Theory		30	Semester End	50
Attendance & Class Participation	10%			
Assignments	20%			
Presentations/Quizzes	10%			
Internal Assessment	60%			
Practical		20		
Attendance & Class Participation	10%			
Lab Report/Project Report	20%			
Practical Exam/Project Work	40%			
Viva	30%			
Total Internal		50		
Full Marks: 50 + 50 = 100				

Students' Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

7. Prescribed Books and References

Text Books

- Richard Williams, 'The Animator's Survival Kit', Faber & Faber.
- Tony White, 'Animation from Pencils to Pixels: Classical Techniques for the Digital Animator', Focal Press.

References

- Jason Osipa, 'Stop Staring: Facial Modeling and Animation Done Right', Wiley.
- Lee Montgomery, 'Tradigital 3ds Max: A CG Animator's Guide to Applying the Classical Principles of Animation', Focal Press.
- Kenny Roy, 'How to Cheat in Maya 2014: Tools and Techniques for Character Animation', Focal Press.