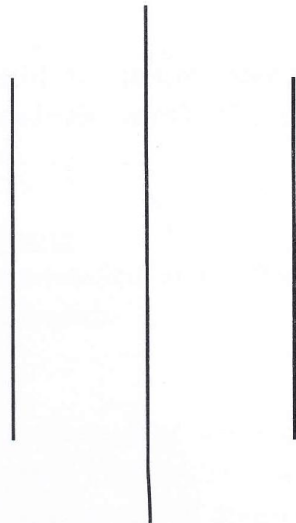


Curriculum of Bachelor of Arts in Computer Application (BCA)



Submitted By

Computer Application Subject Committee
Faculties of Humanities and Social Science
Tribhuvan University

Submitted To

Dean's Office, Faculty of Humanities and Social Sciences
Tribhuvan University
Kirtipur, Nepal
2014



Title

The title of the program is Bachelor of Arts in Computer Application (BCA).

Objective

The objective of the Bachelor of Arts in Computer Application (BCA) at the Faculty of Humanities and Social Sciences of Tribhuvan University is to produce high quality computer application users and developers.

Duration of the Program

The program of study for Bachelor of Arts in Computer Application (BCA) is over a period of eight semesters (four academic years). The academic year begins in the September and February of each year.

Medium of Instruction and Examination

The medium of instruction and examination in the Bachelor of Arts in Computer Application (BCA) program shall be English.

Entry Requirement

The entry requirement for students in Bachelor of Arts in Computer Application (BCA) is Intermediate Level or Higher Secondary level (10+2) or equivalent in any discipline from a recognized institution with at least second division (45%) marks. Besides the basic academic requirement, an entrance examination will be conducted for all applicants by the concerned Dean's office.

Admission Procedure

The entrance test application form and the information brochure shall be provided on request at the concerned college or department. The concerned college or department scrutinizes the applications. The eligible candidates are informed to appear in the entrance test. The exact date for the entrance test is communicated to the applicants by the concerned Dean's office. The candidates shall be admitted on merit basis. The subjects and weightage of each subject for the Entrance test will be as follow:

English: 40%; Mathematics: 50% and General Knowledge: 10%

The college may also hold interviews for the candidates before their final selection for admission. The candidates, who are given provisional admission pending submission of the qualifying certificates, are required to submit all necessary documents within a week of the beginning of regular classes. Otherwise, the admission will be annulled.

Academic Schedule

The academic session of the University consists of two semesters per year. The Fall semester begins in September and the Spring Semester begins in February. For the Bachelor of Arts in Computer Application (BCA) program, student admission may commence either in the Fall semester or in the Spring semester, as approved by the university. Tribhuvan University publishes its yearly academic calendar. The affiliated colleges are required to follow the calendar.

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Student Evaluation

The students' academic performance during a semester is evaluated using the system of continuous assessment (Internal Assessment and External Assessment). The college or concerned department conducts the internal assessment during the session and the University conducts the external assessment (Final Examination) at the end of each semester. Final practical examination shall be conducted by the college or the concerned department and the university will send the external examiner.

Each course shall have internal evaluation marks of 40% evaluated by the concerned faculty member. Generally, each course will have a written end semester examination (Final Examination) of 60% marks at the end of each semester. The internal marks shall be awarded on the basis of constant assessment. Normally, final examinations are not conducted for elective courses and in courses which are offered as intensive courses conducted by reputed international scholars. The mark weightage and time allocated for different assessment is given below.

Examination Scheme (Subjects with Practical)				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20%	20% (3 Hrs.)	60% (3 Hrs.)	-	100%

Examination Scheme (Subjects without Practical)		
Internal Assessment	External Assessment	Total
40%	60% (3 Hrs.)	100%

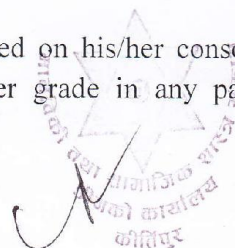
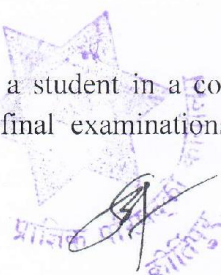
To pass in a subject, a student must obtain a minimum of 40% in that subject in internal assessment and D grade in the final examination. Students must pass 'Theory Internal Assessment', 'Practical Assessment' and 'Final Examination' separately.

The Credit System

Each course is assigned a certain number of credits depending generally upon its lecture, tutorial and practical work hours in a week. In theory subjects, one lecture per week is assigned one credit as a general rule.

Grading System

The grade (marks) awarded to a student in a course is based on his/her consolidated performance in sessional and final examinations. The letter grade in any particular



subject is an indication of a student's relative performance in that course. The pattern of grading is as follows:

Letter	Grade	Grade Point Description
A	4.0	Excellent
A-	3.7	
B +	3.3	
B	3.0	Good
B -	2.7	
C+	2.3	
C	2.0	Satisfactory
C-	1.7	
D+	1.3	
D	1.0	Work satisfying minimum requirement for credits
F	0	Failing

Only in very rare and unusual circumstances, if a student cannot finish all the required work for the course, he/she may be awarded an incomplete grade "I". If all the required work is not completed within the following semester, the grade of I will automatically be converted to an "F". A student receiving an "I" grade does not need to register for that subject in the following semester to complete the required works.

The performance of a student in a semester shall be evaluated in terms of the Semester Grade Point Average (SGPA) which is the grade point average for the semester. The cumulative grade point average (CGPA) is the grade point average for all completed semesters.

SGPA = Total honor points earned in a semester / Total number of credits registered in a semester

CGPA = Total honor points earned / Total number of credits completed

Attendance Requirement

The students must attend every lecture, tutorial and practical classes. However, to accommodate for sickness and other contingencies, the attendance requirement shall be a minimum of 80% of the classes actually held. If a student fails to attend 80% of the classes in any particular subject, he/she shall not be allowed to take the final examination in that subject.

Normal and Maximum Duration of Stay at the College

The normal duration for completing the Bachelor of Arts in Computer Application (BCA) program at the university will be four years. The maximum duration for the completion of the requirements will be the normal duration plus two years.

Course Registration

The academic record of a student is maintained in terms of the courses for which he/she registers in any semester, and the grades he/she obtains in those courses. Registration for

courses is done at the beginning of each semester. Since registration is a very important procedural part of the credit system, it is absolutely essential that all students present themselves at the college. In case of illness or any exceptional circumstance during the registration period, he/she must inform the Principal of the same. Registration in absentia may be allowed only in rare cases, at the discretion of the Principal. However, the student's nominee cannot register for courses but will only be allowed to complete other formalities.

Repeating a Course

A course may be taken only once for a grade, except when a student receives a D or F grade. Since passing of all core courses individually is a degree requirement, the student must retake the failing core course when offered and must successfully complete the course. Retaking a course in which a student has earned a D grade is optional. However, a student cannot retake more than two courses in which he/she has received D grade. The grade earned on the retake will substitute the grade earned first time the course was taken.

Elective Courses

The curriculum is oriented to have intensive study in the field of interest with course registration flexibility at least for four courses. But in future, course registration flexibility shall be increased to more number of courses.

Award of Degree

Tribhuvan University awards Bachelor of Arts in Computer Application (BCA) degree upon completion of all requirements as prescribed in the curriculum. Tribhuvan University awards grades as explained in the curriculum on the basis of individual student's relative performance. The minimum credit hours needed for Bachelor of Arts in Computer Application (BCA) degree is 126. Cumulative Grade Point Average (CGPA) for the degree shall be awarded upon completion of all requirements.

Scrutinizing of Final Examination Paper

Students may apply for re-totaling or rechecking of their grades as per University rule, upon payment of prescribed fee.

Note: The provisions of this document are not to be regarded as a binding contract between the University and the students. The University reserves the right to change any provisions or requirements contained in this document at any time, without pre-notification, within the students' term of residence.

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Bachelor of Arts in Computer Application (BCA) Course Structure

Courses	Credit Hours
Computer Application (Core Courses)	71 (4*2+3*21)
Elective Courses	12 (3+3+3+3)
Mathematics & Statistics Courses	9 (3+3+3)
Language Courses	6 (3+3)
Social Sciences & Management Courses	15 (3+3+3+3+3)
Projects & Internships	13 (2+2+6+3)
Total Credit Hours	126

First Year

First Semester

SN	Course Code	Course Title	Credit Hrs.	Lecture Hrs.	Tutorial Hrs.	Lab Hrs.
1	CACS101	Computer Fundamentals & Applications	4	4	-	4
2	CASO102	Society & Technology	3	3	-	-
3	CAEN103	English I	3	3	1	-
4	CAMT104	Mathematics I	3	3	1	1
5	CACS105	Digital Logic	3	3	-	2
Total			16	16	2	7

Second Semester

1	CACS151	C Programming	4	4	1	3
2	CAAC152	Financial Accounting	3	3	1	1
3	CAEN153	English II	3	3	1	-
4	CAMT154	Mathematics II	3	3	1	1
5	CACS155	Microprocessor and Computer Architecture	3	3	1	2
Total			16	16	5	7

Second Year

Third Semester

SN	Course Code	Course Title	Credit Hrs.	Lecture Hrs.	Tutorial Hrs.	Lab Hrs.
1	CACS201	Data Structures & Algorithms	3	3	-	3
2	CAST202	Probability and Statistics	3	3	1	1
3	CACS203	System Analysis and Design	3	3	1	-
4	CACS204	OOP in Java	3	3	1	2
5	CACS205	Web Technology	3	3	-	3
Total			15	15	3	9

Fourth Semester

1	CACS251	Operating System	3	3	1	2
2	CACS252	Numerical Methods	3	3	1	2
3	CACS253	Software Engineering	3	3	1	-
4	CACS254	Scripting Language	3	3	-	3
5	CACS255	Database Management System	3	3	1	2
6	CAPJ256	Project I	2	-	-	4
Total			17	15	4	13

Third Year

Fifth Semester

SN	Course Code	Course Title	Credit Hrs.	Lecture Hrs.	Tutorial Hrs.	Lab Hrs.
1	CACS301	MIS and e-Business	3	3	-	2
2	CACS302	DotNet Technology	3	3	-	3
3	CACS303	Computer Networking	3	3	-	2
4	CAMG304	Introduction to Management	3	3	1	-
5	CACS305	Computer Graphics and Animation	3	3	1	2
Total			15	15	2	9

Sixth Semester

1	CACS351	Mobile Programming	3	3	-	3
2	CACS352	Distributed System	3	3	1	-
3	CAEC353	Applied Economics	3	3	1	-
4	CACS354	Advanced Java Programming	3	3	-	3
5	CACS355	Network Programming	3	3	-	2
6	CAPJ356	Project II	2	-	-	4
Total			17	15	2	12

Fourth Year

Seventh Semester

SN	Course Code	Course Title	Credit Hrs.	Lecture Hrs.	Tutorial Hrs.	Lab Hrs.
1	CACS401	Cyber Law & Professional Ethics	3	3	1	-
2	CACS402	Cloud Computing	3	3	-	3
3	CAIN403	Internships	3	-	-	-
4		Elective I	3	3		
5		Elective II	3	3		
Total			15	12		

Eighth Semester

1	CAOR451	Operations Research	3	3	1	-
2	CAPJ452	Project III	6	-	-	12
3		Elective III	3	3		
4		Elective IV	3	3		
Total			15	9		

List of Electives

SN	Course Code	Course Title	SN	Course Code	Course Title
1	CAPS476	Applied Psychology	6	CACS482	Knowledge Engineering
2	CACS477	Geographical Information System	7	CACS483	Advanced DotNet Technology
3	CACS478	IT in Banking	8	CACS484	Database Programming
4	CACS479	Hotel Information System	9	CACS485	Database Administration
5	CAER480	Enterprise Resource Planning	10	CACS486	Network Administration

Course Title: **Computer Fundamentals and Applications (4 Cr.)**

Course Code: **CACS101**

Year/Semester: **I/I**

Class Load: **8 Hrs. / Week (Theory: 4 Hrs., Practical: 4 Hrs.)**

Course Description

This course offers fundamental concepts of computer and computing which includes introduction to computer system, computer software & database management system, operating system, data communication & computer network and contemporary technologies. It also aims at helping students convert theoretical concept into practical skill through the use of different application packages including word processor, spreadsheet package, presentation package and photo editing graphical package.

Course Objectives

The general objectives of this course are to provide fundamental concepts of information and communication technology and to make students capable of using different application packages in their personal as well as professional life.

Course Contents

Unit 1 Introduction to Computer System

16 Hrs.

Introduction to Computer, Characteristics of Computer, Applications of Computer, Classification of Computer, Mobile Computing, Anatomy of a Digital Computer, Computer Architecture, Memory & Its Classification, Input devices, Output Devices, Interfaces.

Unit 2 Computer Software

3 Hrs.

Introduction to Software, Types of Software, Program vs. Software, Computer Virus and Antivirus.

Unit 3 Operating System

4 Hrs.

Introduction to Operating System, Function of Operating System, Types of Operating System, Open Source Operating System.

Unit 4 Database Management System

8 Hrs.

Introduction to DBMS, Database Models, SQL, Database Design and Data Security, Data Warehouse, Data Mining, Database Administrator

Unit 5 Data Communication and Computer Network

10 Hrs.

Introduction to communication system, Mode of Communication, Introduction to Computer Network, Types of Computer Network, LAN Topologies, Transmission Media, Network Devices, OSI Reference Model, Communication Protocols, Centralized vs. Distributed System.

Unit 6 Internet and WWW

6 Hrs.

Internet: Introduction to Internet and its Applications, Connecting to the Internet, Client/Server Technology, Internet as a Client/Server Technology, Email, Video-Conferencing, Internet Service Providers, Domain Name Server, Internet Address, Internet Protocols (IP, TCP, HTTP, FTP, SMTP, POP, Telnet, Gopher, WAIS), Introduction to Intranet, Internet vs. Intranet vs. Extranet, Advantages & Disadvantages of Intranet

World Wide Web (WWW): World Wide Web and Its Evolution, Architecture of Web, Uniform Resource Locator (URL), Browsers: Internet Explorer, Netscape Navigator, Opera, Firefox, Chrome, Mozilla; Search Engine, Web Servers: Apache, IIS, Proxy Server; HTTP Protocol, FTP protocol.

Unit 7 Contemporary Technologies

13 Hrs.

Multimedia, e-Commerce, e-Learning, e-Governance, e-Banking, Hypermedia, Geographical Information System, Virtual Reality, Augmented Reality, Artificial Intelligence, Ambient Intelligence, Robotics, Bit Coin.

Laboratory Works

Laboratory works should cover all the units and topics mentioned below and a project work should be carried out by students individually implementing the concept and skill learnt in this course.

Unit 1 Operating System

10 Hrs.

- a. **GUI Based OS (5 Hrs.):** Interface, GUI vs. CUI, Introduction to Windows, Features, Elements of Windows, Task Bar, Using Menus and Submenus, Opening a Program, Opening Multiple Program, Using Short Cuts, Using My Computer, Switching off the System, Desktop and Custom Wall Papers, Screen Saver, Using Help for Interactive Learning. Using General Accessories: Notepad, Paint Tool, Clip Board, Character Map, Calculator etc.; Using Multimedia: Using CD/DVD/BD, Using Audio/Video; Using Explorer to Manage Files and Folders: Copy/Delete/Rename/Short Cuts; Recycle Bin and It Uses. Using Format, Scandisk and Disk Defragmenter, Windows Installation and Setting.
- b. **CUI Based OS (5 Hrs.):** Introduction to DOS, DOS Internal Commands, DOS External Commands.

Unit 2 Word Processor

12 Hrs.

Introduction to Word Processor, Features of Word Processor, Elements of Word Window, Creating & Saving Document, Copy Paste and Cut Paste, Format Painter, Undo and Redo, Print Preview, Printing Documents, Fonts, Effect and Character Formatting, Paragraph Formatting, Styles, Finding, Replacing and Selection, Cover Page, Blank Page, Page Break, Working with Table, Inserting Picture, Clip Art, Shapes, Smart Art and Chart, Hyperlink, Bookmarks, Cross-

Referencing, Header, Footer, Page Number, Working with Text Box, Quick Parts, Word Art, Drop Cap, Signature Line, Date & Time, Object, Equation, Symbol, Working with Themes, Page Margins, Page Orientation, Page Size, Columns Handling, Hyphenation, Watermark, Page Color, Page Borders, Indentation, Arranging Objects, Table of Contents, Footnote and Endnote, Citation and Bibliography, Captions, Inserting Index, Table of Authorities, Mail Merge, Spelling and Grammar, Thesaurus, Translation, Word Count, Comments, Tracking, Changes, Compare, Protecting Document, Document Views, Ruler, Gridlines, Document Map, Thumbnails, Zooming, Window Handling, Creating and Using Macro.

Unit 3 Spreadsheet Package

12 Hrs.

Introduction to Spreadsheet Package, Features of Spreadsheet Package, Introduction to Microsoft Excel, Elements of Excel Window, Cell Referencing in Excel: Relative, Absolute, and Mixed; Managing Workbooks, Worksheets, Windows, Working with Worksheet, Printing Worksheet, Using Formulas/functions; Formatting/Conditional Formatting Data & worksheet; Using Paste Special, Essential Worksheet Functions, Using Templates, Protecting the File and Worksheet with Passwords; Working with Graphic Objects: Clip Art, Word Art, Map; Working with Charts, Working with Internal Database, Getting More Power from Worksheet Databases, Accessing External Databases, Loan Amortization Scheduling and Calculation; Data Validation, Consolidating and Outlining, Using What- if Analysis: Data Table, Goal Seek, Scenario Manager; Understanding Pivot Tables, Constructing and Analyzing Pivot Tables, Using Custom Controls on Worksheets, Effectively Using the Macro Recorder

Unit 4 Presentation Package

6 Hrs.

Introduction, Creating and Saving Presentation; Entering, Editing, and Enhancing Text; Editing in different views- Outline View, Slide Sorter View; Creating Graphs, Editing and Enhancing Graphs; Adding ClipArt in Slide, Editing Arts, Animating Charts and Art Objects, Adding Sound, Choosing Sound Effects- Transitional, From Other Sources; Adding Sounds to Animations and Sound Objects; Recording Sound and Narration; Adding Movie in Slides, Playing and Editing Movie; Making Movie Poster and Icon; Slide Show, Setting Slide Transition, Speed and Slide Advancement; Rehearsing Slide Display Timing, Slide Notes and Comments; Editing Text Color, Creating Custom Color; Background and Schemes; Linking and Embedding Objects; Importing and Exporting Presentation; Printing Slides and Handouts

Unit 5 Photo Editing Package

20 Hrs.

Fundamentals

Graphics Basics: Bitmap Vs. Vector-Based Graphics, Color/Bit Depth and Image Resolution, Graphic File Formats, Optimizing Web Graphics, Regular Text Vs.

Anti- Aliased Text, Pixel Resize Vs. Smart Resize, Regular Graphics Vs. Interlaced Graphics, Lossy Compression Vs. Lossless Compression, Dithered Graphics Vs. Non-Dithered Graphics, Standard Selection Vs. Floating Selection, Tolerance, Opacity.

Introduction to Color: Color Modes- RGB, CMYK, Grayscale, LAB, Bitmap; Hue, Saturation, and Brightness; Browser Safe Colors; Shadows, Highlights and Midtones of an Image.

Interface, Tools and Options

Environment: About Photoshop, The Photoshop Interface, Setting up a new Photoshop document, Saving a new document, The Default Palettes, Working with Photoshop Palettes, The Photoshop Toolbox and Options bar, Using Guides and Ruler,

Image and Color Basics: Supported import and export image formats, Opening an Image in Photoshop, Creating Images In Photoshop, Saving Images In Photoshop, Basic Image Editing, Changing Image Size, Cropping an Image, Changing Color/Bit Depth, Optimizing Images using Save for Web, Working with Color in Photoshop

Tools: Parts of the Toolbox, Toolbox Shortcuts, Tools Options, Marquees, Magic wand, Lassos, Move tool, Crop tool, Slice tools, Pencil, Paintbrush, Eraser tools, History brushes, Clone stamp-Pattern stamp, Healing brush tool, Retouch tool, Gradient, Paint bucket, Burn-Dodge-Sponge, Blur-Sharpen-Smudge, Shapes-line- rectangle-polygon-custom shapes, Path selection tool, Pen tool, Type tools, Notes tool-Audio annotation, Eyedropper-Color sampler-Measure tool, Hand-Zoom, Quick mask-Screen modes, Jump to Image Ready, Back ground and Foreground.

Transforms: Using Free transform, Move, Rotate, Scale, Skew, Distort, Perspective, Flip-vertical, horizontal, Invert, Rotate 180°, Rotate 90° CW, Rotate 90° CCW,.

Layers, Channels and Actions

Photoshop Layers: About Layers-Fill and Adjustment Layers, The Layer Palette, Naming Layers, Creating Layers, Deleting Layers, Viewing Layers, Moving Layers, Layer Opacity, Locking Layers, Merging Layers, Layer Modes and Blending Options, Image Compositing Using Layers.

Photoshop Channels: About Channels, The Channel Palette, Creating and Viewing Channels, Modifying Channels, Deleting Channels, Alpha Channels and Masks.

Actions: Using the Action Palette, Recording Action, Playing Action, Editing Action, Loading a Saved Action.

Restoring and Enhancing Images

Restoration of Photos: Restoring Damaged Photos, Photo Retouching.

Photo Enhancement and Color Correction: Changing Levels, Changing Curves, Color Balance, Changing Brightness and Contrast, Changing Hue Saturation and Brightness, Changing a Grayscale Image to a Colored Image, Histogram, Gradient Map, Desaturate, Invert, Color Replace, Selective Color, Equalize, Threshold, Channel Mixer, Posterize, Changing Background using Layer Composting

Text Editing and Special Effects

Text Editing in PhotoShop: About the Type Layer, Creating Vertical and Horizontal Types, Point and Paragraph Text Creation, Using Horizontal and Vertical Type Mask Tools, Using Character Palette for Text Editing, Choosing a Font, Changing the Type Color, Choosing a Type Size, Specifying Kerning and Tracking, Using Fractional Character Widths, Specifying Baseline Shift, Applying Underline and Strikethrough, Text Alignment and Justification, Specifying Anti-Aliasing, Creating Text Warp, Rasterizing Type, Converting Type to Shapes, Adding Effects to Text

Photoshop Special Effects and Filters: About Special Effects, Using Filters, Basic Filter Examples, Artistic Filters, Distorting Filters, Filter Combinations, Plug-in Filters.

Web Application and Animation

Adobe ImageReady: About Image Ready, Opening Image Ready, The Image Ready Interface, Image Maps, Image Slicing, Basic Animation.

Photoshop for Building Web Interface: About the Interface

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Text Books

- 1 Alexis Leon, Mathews Leon, "Fundamentals of Information Technology, 2/e", Vikas Publishing House Pvt Limited, 2009, ISBN: 9788182092457
- 2 E Balagurusamy, "Fundamentals of Computers," Tata McGraw Hill Education PVT.Ltd., 2009, ISBN: 9780070141605
- 3 Peter Norton's, "Introduction to Computers", 7th Edition, Tata McGraw-Hill, 2010, ISBN: 9780070671201

Reference Books

- 1 Brad Dayley & DaNae Dayley, "Adobe Photoshop CS6 Bible", Wiley Publishing Inc., 2012, ISBN: 978-1-118-12388-1
- 2 Faithe Wempen, "Microsoft Office Power Point 2007 Bible (With CD)", Wiley Publishing Inc., 2007, ISBN: 978-0470043684
- 3 Herb Tyson, "Microsoft Office Word 2007 Bible (With CD)", Wiley Publishing Inc., 2007
- 4 Jim Boyce, "Windows 7 Bible ", Wiley Publishing Inc., 2009, ISBN: 978-0470509098
- 5 John Walkenbach, "Microsoft Office Excel 2007 Bible (With CD)", Wiley Publishing Inc., 2007, ISBN: 978-0470044032
- 6 Pradeep Sinha and Priti Sinha, "Computer Fundamentals (with CD)", 6th Edition, BPB Publications, 2003, ISBN: 9788176567527
- 7 Ramesh Rimal & et. al., "Computer Science-I, Revised Edition", Buddha Academic Publishers and Distributors Pvt. Ltd. Nepal, 2013
- 8 Ramesh Rimal & et. al., "Computer Science-II, Revised Edition", Buddha Academic Publishers and Distributors Pvt. Ltd. Nepal, 2013



Course Title: **Society and Technology (3 Cr.)**

Course Code: **CACS102**

Year/Semester: **I/I**

Class Load: **3 Hrs. / Week (Theory: 3 Hrs.)**

Course Description

This course covers several topics of sociology and impact of technology on society that includes basic concept of sociology, organizing social life, social system & social stratification of Nepalese societies, society & technology and research in social sciences which are essential to make computer professionals more responsible towards their society and social norms & values.

Course Objectives

The main objective of this course is to make the students familiar with the disciplines of sociology. The goal is to enable them to analyze the Nepalese society and culture; and to understand the relationship between individual, Society and Culture.

Course Contents

Unit 1 Basic Concept of Sociology

6 Hrs.

Definition of Sociology, Nature and Scope of Sociology, Relationship of Sociology with Other Social Sciences.

Unit 2 Organizing Social Life

6 Hrs.

Society: Population size and Distribution, Culture Community, Norms and Values, Status and Role, Institutions: Marriage, Family, Kinship and Groups.

Unit 3 Social System & Social Stratification of Nepalese Societies.

9 Hrs.

Social Processes & Socialization. Social and Cultural Change in Nepal, Factors of Social and Cultural Change in Nepal, Caste/Ethnicity based Stratification, Gender based Stratification, Religion based Stratification, Ecological based Stratification, National Integration: Historical Process of Nationhood, Cultural Integration (Language, Rituals and Customs).

Unit 4 Society and Technology

12 Hrs.

Technological Society, Technological Changes in Third World Society, Social and Cultural bases of Technological change, Process and Patterns of Diffusion of Innovation, Consequences of Technological Development on Nepalese Society. Accountability of Computer Professionals towards Society.

Unit 5 Research in Social Science

12 Hrs.

Concept of Research in Social Science, Understanding the Concept of Research Methods, Techniques and Tools: Interview, Focus Group Discussion, Observation, Qualitative, Quantitative and Mixed Method in Social Research,

Research Proposal and its Components: Identification of Research Problem, Formulation of Objectives, Research Design, Formation of hypothesis/research questions, Sampling design, tool and methods of data collection, Analysis and Presentation of Data, Research Report Writing and Presentation, Computer Softwares on Social Science Research.

Teaching Methods

The general teaching methods includes class lectures, group works and discussions, case studies, guest lectures, research work, project work, assignments and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching method as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
40	-	60 (3 Hrs.)	-	100

Text Books

1. Andersen, M. L. & Taylor, H. F. (2007). Understanding sociology. New Delhi: Cengage Learning India Private Limited.
2. Bista, D.B. (1996). People of Nepal. Kathmandu: Ratna Prakashan
3. Creswell, J. W. (2011). Research design: qualitative, quantitative and mixed methods approach. New Delhi: SAGE
4. Haralambos M & Heald R. M . (2006). Sociology: Themes and perspectives. New Delhi: Oxford University Press

Reference Books

1. Bryman, A. (2008). *Social research methods (3rd ed.)*. New York, New Delhi: Oxford University Press.
2. Central Department of Sociology and Anthropology (1987-2009). *Occasional papers in sociology and anthropology*. Kathmandu.

Course Title: **English I (3 Cr.)**

Course Code: **CACS103**

Year/Semester: **I/I**

Class Load: **4 Hrs. / Week (Theory: 3 Hrs., Tutorial: 1 Hr.)**

Course Description

This course aims at helping students combine the knowledge of the English language with their technical knowledge with special emphasis on vocabulary acquisition and grammatical accuracy. It offers up-to-date technical content, authentic reading and listening passages covering a wide range of topics like the use of virtual reality in industry, personal computing, viruses and security, information systems, and multimedia. Letter-writing section offers a complete guide to writing work-related letters and comprehensive glossary of technical terms forms a useful mini-dictionary of computing terminology.

Course Objectives

The main objectives of the course are to:

- impart effective language skills to students and enable them to use language accurately, clearly and concisely,
- acquaint students with language used in computer study through extensive reading activity,
- help them to enhance their ability to use language in a proper way with specific focus on grammatical accuracy and writing competence,
- enable students to improve work-related letter writing skills with special attention to presentation and structure, and
- familiarize them with innovation in computer science while introducing them with the language used in this field.

Course Contents

A. LEARNING THE LANGUAGE

Unit One

9 Hrs.

I. Personal Computing

The Processor

Language Focus A: Contextual Reference

II. Portable Computers

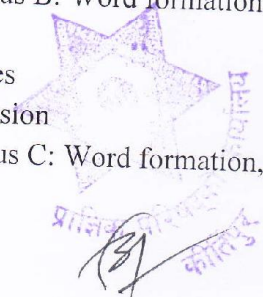
Operating Systems

Language Focus B: Word formation, prefixes

III. Online Services

Data Transmission

Language Focus C: Word formation, suffixes



Unit Two

12 Hrs.

- I. Computer Software
Comparing Software Packages
Language Focus D: Making Comparisons
- II. Computer Networks
Network Configurations
Language Focus E: Time Sequence
- III. Computer in Education
CALL
Language Focus F: Giving Examples
- IV. Virtual Reality
VR Input Devices
Language Focus G: Classifying

B. ORGANIZING AND WRITING TEXTS

Unit Three

9 Hrs.

- I. Programming and Languages
C Languages
Language Focus H: Organizing Information
- II. Computer Viruses
Computer Security
Language Focus I: Listing
- III. Computers in the Office
Computer System
Language Focus J: The Passive

Unit Four

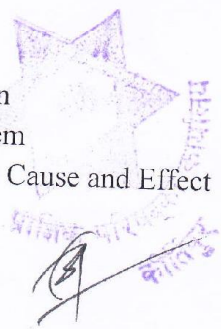
6 Hrs.

- I. Computers in Medicine
Data Storage and Management
Language Focus K: Explanations and Definitions
- II. Robotics
Robot Characteristics
Language Focus L: Compound Noun

Unit Five

9 Hrs.

- I. Machine Translation
AI and Expert System
Language Focus M: Cause and Effect



Course Title: **Mathematics I (3 Cr.)**

Course Code: **CACS104**

Year/Semester: **II**

Class Load: **5 Hrs. / Week (Theory: 3 Hrs., Tutorial: 1 Hr., Practical: 1 Hr.)**

Course Description

This course includes several topics from algebra and analytical geometry such as set theory and real & complex number; relation, functions and graphs; sequence and series; matrices and determinants; permutation & combination; conic section and vector in space which are essential as mathematical foundation for computing.

Course Objectives

The general objective of this course is to provide the students with basic mathematical skills required to understand Computer Application Courses.

Course Contents

Unit 1 Set Theory and Real & Complex Number

7 Hrs.

Concept, Notation and Specification of Sets, Types of Sets, Operations on Sets (Union, Intersection, Difference, Complement) and their Venn diagrams, Laws of Algebra of Sets (without proof), Cardinal Number of Set and Problems Related to Sets. Real Number System, Intervals, Absolute Value of Real Number. Introduction of Complex Number, Geometrical Representation of Complex Number, Simple Algebraic Properties of Complex Numbers (Addition, Multiplication, Inverse, Absolute Value)

Unit 2 Relation, Functions and Graphs

8 Hrs.

Ordered pairs, Cartesian product, Relation, Domain and Range of a relation, Inverse of a relation; Types of relations: reflexive, symmetric, transitive, and equivalence relations. Definition of function, Domain and Range of a function, Inverse function, Special functions (Identity, Constant), Algebraic (linear, Quadratic, Cubic), Trigonometric and their graphs. Definition of exponential and logarithmic functions, Composite function.(Mathematica)

Unit 3 Sequence and Series

7 Hrs.

Sequence and Series (Arithmetic, Geometric, Harmonic), Properties of Arithmetic, Geometric, Harmonic sequences, A. M., G. M., and H. M. and relation among them. Sum of Infinite Geometric Series. Taylor's Theorem (without proof), Taylor's series, Exponential series.

Unit 4 Matrices and Determinants

8 Hrs.

Introductions of Matrices, Types of Matrices, Equality of Matrices, Algebra of Matrices, Determinant, Transpose, Minors and Cofactors of Matrix. Properties of determinants (with out proof), Singular and non-singular matrix, adjoin and

inverse of matrices. Linear transformations, orthogonal transformations; rank of matrices. (Matlab)

Unit 5 Analytical Geometry

8 Hrs.

Conic Sections: Definitions (Circle, Parabola, Ellipse, Hyperbola and Related Terms), Examples to Explain The Defined Terms, Equations and Graphs of The Conic Sections Defined Above, Classifying The Defined Conic Sections by Eccentricity and Related Problems, Polar Equations of Lines, Circles, Ellipse, Parabolas, and Hyperbolas. (Mathematica / Matlab)

Vectors in Space: Vectors in Space, Algebra of Vectors in Space, Length, Distance Between Two Points, Unit Vector, Null Vector. Scalar Product, Cross Product of Two and Three Vectors and Their Geometrical Interpretations and Related Examples. (Matlab)

Unit 6 Permutation and Combination

7 Hrs.

Basic Principle of Counting, Permutation of a. Set of Objects All Different b. Set of Objects Not All Different c. Circular Arrangement d. Repeated Use of The Same Object. Combination of Things All Different, Properties of Combination.

Laboratory Works

Mathematica and/ or Matlab should be used for above mentioned topics.

Teaching Methods

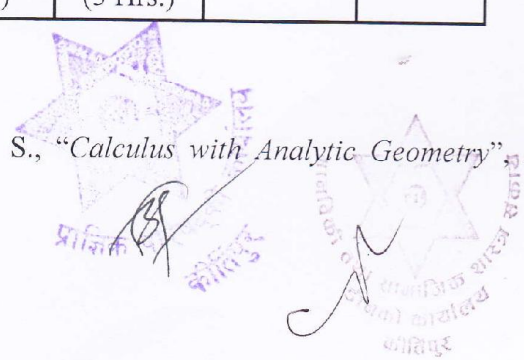
The general teaching pedagogy includes class lectures, group works, case studies, guest lectures, research work, project work, assignments (theoretical and practical), tutorials and examinations (written and verbal). The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

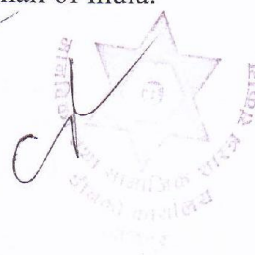
Text Book

1. Thomas, G. B, Finney, R. S., “Calculus with Analytic Geometry” Addison - Wesley, 9th Edition.



Reference Books

1. Bajracharya D. R., Shreshtha, R. M. & et al, “*Basic Mathematics I, II*” Sukunda Pustak Bhawan, Nepal
2. Budnick, F. S., “*Applied Mathematics for Business, Economics and the Social Sciences*”, McGraw-Hill Ryerson Limited.
3. Monga, G. S., “*Mathematics for Management and Economics*”, Vikas Publishing House Pvt. Ltd., New Delhi.
4. Paudel, K. C., GC. F. B., and et. al, “*Higher Secondary Mathematics*”, Asmita Publication & Distributors Pvt. Ltd, Nepal.
5. Upadhayay, H. P., Paudel, K.C & ct al, “*Elements of Business Mathematics*”, Pinnacle Publication.
6. Yamane, T. “*Mathematics for Economist*”, Prentice-hall of India.



Course Title: **Digital Logic (3 Cr.)**

Course Code: **CACS105**

Year/Semester: **I/I**

Class Load: **5 Hrs. / Week (Theory: 3 Hrs, Practical: 2 Hrs.)**

Course Description

This course presents an introduction to Digital logic techniques and its practical application in computer and digital system.

Course Objectives

The course has the following specific objectives:

- To perform conversion among different number systems
- To simplify logic functions
- To design combinational and sequential logic circuit
- To understand industrial application of logic system.
- To understand Digital IC analysis and its application
- Designing of programmable memory

Course Contents

Unit 1 Introduction

2 Hrs.

- 1.1 Digital Signals and Wave Forms
- 1.2 Digital Logic and Operation
- 1.3 Digital Computer and Integrated Circuits (IC)
- 1.4 Clock Wave Form

Unit 2 Number Systems

5 Hrs.

- 2.1 Binary, Octal, & Hexadecimal Number Systems and Their Conversions
 - 2.1.1 Representation of Signed Numbers-Floating Point Number
 - 2.1.2 Binary Arithmetic
- 2.2 Representation-of BCD-ASCII-Excess 3 -Gray Code -Error Detecting and Correcting Codes.

Unit 3 Combinational Logic Design

16 Hrs.

- 3.1 Basic Logic Gates NOT, OR and AND
- 3.2 Universal Logic Gates NOR and NAND
- 3.3 EX-OR and EX-NOR Gates
- 3.4 Boolean Algebra:
 - 3.3.1 Postulates & Theorems
 - 3.3.2 Canonical Forms - Simplification of Logic Functions
- 3.5 Simplification of Logic Functions Using Karnaugh Map.
 - 3.5.1 Analysis of SOP And POS Expression
- 3.6 Implementation of Combinational Logic Functions
 - 3.6.1 Encoders & Decoders

- 3.6.2 Half Adder, & Full Adder
- 3.7 Implementation of Data Processing Circuits
 - 3.7.1 Multiplexers and De-Multiplexers
 - 3.7.2 Parallel Adder -Binary Adder-Parity Generator /Checker-
Implementation of Logical Functions Using Multiplexers.
- 3.8 Basic Concepts of Programmable Logic
 - 3.8.1 PROM
 - 3.8.2 EPROM
 - 3.8.3 PAL
 - 3.8.4 PLA

Unit 4 Counters & Registers

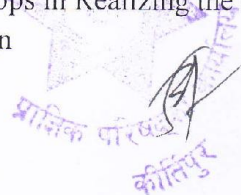
16 Hrs.

- 4.1 RS, JK, JK Master - Slave, D & T Flip flops
 - 4.1.1 Level Triggering and Edge Triggering
 - 4.1.2 Excitation Tables
- 4.2 Asynchronous and Synchronous Counters
 - 4.2.1 Ripple Counter: Circuit and State Diagram and Timing Waveforms
 - 4.2.2 Ring Counter: Circuit and State Diagram and Timing Waveforms
 - 4.2.3 Modulus 10 Counter: Circuit and State Diagram and Timing Waveforms
 - 4.2.4 Modulus Counters (5, 7, 11) and Design Principle, Circuit and State Diagram
 - 4.2.5 Synchronous Design of Above Counters, Circuit Diagrams and State Diagrams
- 4.3 Application of Counters
 - 4.3.1 Digital Watch
 - 4.3.2 Frequency Counter
- 4.4 Registers
 - 4.4.1 Serial in Parallel out Register
 - 4.4.2 Serial in Serial out Register
 - 4.4.3 Parallel in Serial out Register
 - 4.4.4 Parallel in Parallel out Register
 - 4.4.5 Right Shift, Left Shift Register

Unit 5 Sequential Logic Design

6 Hrs.

- 5.1 Basic Models of Sequential Machines
 - Concept of State
 - State Diagram
- 5.2 State Reduction through Partitioning and Implementation of Synchronous Sequential Circuits
- 5.3 Use of Flip-Flops in Realizing the Models
- 5.4 Counter Design



Laboratory Works

1. Gates using Active and Passive Elements
2. Half Adder and Full Adder
3. 16:1 Multiplexer
4. 1:16 Demultiplexer
5. Digital Watch by Counters
6. Shift Resistors

Teaching Methods

The general teaching methods includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and exams, depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Text Books

1. Floyd, "Digital Fundamentals", PHI.
2. Morris Mano, "Digital Design", Prentice Hall of India.
3. Tocci.R.J, "Digital systems-Principles & Applications"-Prentice Hall of India.

Reference Books

1. B. R. Gupta and V.Singhal, "Digital Electronics" 4th Edition, S.K Kataria & sons, India.
2. Fletcher.W.I., "An Engineering Approach to Digital Design", Prentice Hall of India.
3. Millman & Halkias, "Integrated Electronics".
4. V.K.PURI, "Digital Electronics", TMH.

Course Title: **C Programming (4 Cr.)**

Course Code: **CACS151**

Year/Semester: **I/II**

Class Load: **8 Hrs. / Week (Theory: 4 Hrs, Tutorial: 1 Hr., Practical: 3 Hrs)**

Course Description

This course includes both theoretical as well as practical concept of programming. Practical skill of programming are provided using C language which includes basic concept of C, operators and expressions, basic input/output function, control structures, array & string, function, pointer, structure and union, file handling and graphics in C.

Course Objectives

The general objectives of this course are to provide fundamental concepts of programming language, programming technique and program development using C programming language.

Course Contents

Unit 1 Programming Language

10 Hrs.

Introduction to Programming Language, Types of Programming Language, Language Processor, Program Errors, Features of Good Program, Different Programming Paradigm, Software Development Model, Program Development Life Cycle, System Design Tools.

Unit 2 Programming Technique

5 Hrs.

Introduction to Programming Technique, Top down & Bottom up Approach, Cohesion and Coupling, Structured Programming, Deterministic and Non-deterministic Technique, Iterative and Recursive Logic, Modular Designing & Programming.

Unit 3 Basic Concept of C

5 Hrs.

Introduction, History, Features, Advantages and Disadvantages, Structure of C program, Compiling Process, C Preprocessor and Header Files, Library Function, Character Set, Comments, Tokens and its types, Data types, Escape Sequences, Preprocessors Directives.

Unit 4 Operators and Expressions

3 Hrs.

Arithmetic Operator, Relational Operator, Logical Operator, Assignment Operator, Increment/decrement Operator, Conditional Operator, Bitwise Operator, Comma Operator, sizeof Operator, Operator Precedence and Associativity, Expressions and its Evaluation, Type Casting in Expression, Program Statement.

Unit 5 Input and Output

3 Hrs.

Input/Output Operation, Formatted I/O (scanf, printf), Unformatted I/O (getch-putch, getche, getchar-putchar and gets-puts)

Unit 6 Control Structure

6 Hrs.

Introduction, Type of Control Structure (Branching:if, if else, if elseif and switch case, Looping: while, do while and for and Jumping: goto, break and continue), Nested Control Structure.

Unit 7 Array

6 Hrs.

Introduction, Declaration, Initialization, One Dimensional Array, Multi Dimensional - Array, Sorting (Bubble, Selection), Searching Sequential), String Handling.

Unit 8 User Defined Function

5 Hrs.

Introduction, Components, Function Parameters, Library Function vs. Users Defined Function, Different Forms of Function, Recursion, Passing Array to Function, Passing String to Function, Accessing a function (Call By Value & Call By Reference), Macros, Storage Class.

Unit 9 Pointer

6 Hrs.

Introduction, The Address(&) and Indirection(*) Operators, Declaration & Initialization, Pointer to Pointer, Pointer Expressions, Pointer Arithmetic, Passing Pointer to a Function, Pointer and Array, Array of Pointer, Pointer and String, Dynamic Memory Allocation.

Unit 10 Structure

5 Hrs.

Introduction, Declaration, Initialization, Nested Structure, Array of structure, Array within Structure, Passing Structure & Array of Structure to function, Structure & Pointer, Bit Fields, Union and Its Importance, Structure vs. Union.

Unit 11 Data File Handling

4 Hrs.

Introduction, Types of File, Opening & Closing Data File, Read & Write Function, Writing & Reading Data To and From Data File, Updating Data File, Random Accessing Files, Printing a File.

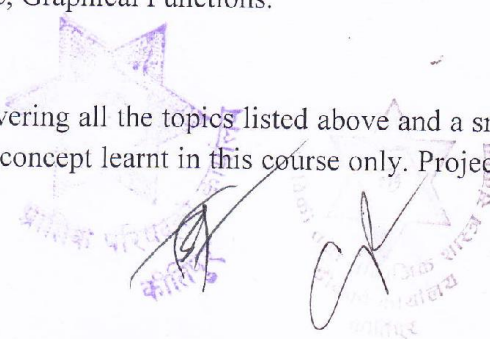
Unit 12 Introduction to Graphics

2 Hrs.

Initialization, Graphical Mode, Graphical Functions.

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course only. Project should be assigned on individual basis.



Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

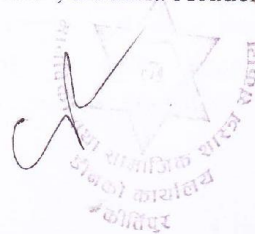
Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 hrs.)	-	100

Text Books

1. Brain W. Kerighan & Dennis Ritchie, "*The C Programming Language*", Second Edition, Prentice Hall, 1988, ISBN: 978-0131103627
2. Byrons S. Gotterfried, "*Programming with C, 3/e*", McGraw Hill Education India, 2013, ISBN: 978-0-07-014590-0

Reference Books

3. Al Kelley, Ira Pohl, "*A Book on C*", 4th Edition, Pearson Education, 1998, ISBN: 978-0201183993
4. Deitel & Deitel, "*C: How to program*", 7th Edition, Pearson Education, 2012, ISBN: 9780273776840
5. E Balagurusamy, "*Programming in ANSI C, Sixth Edition*", Tata Mc GrawHill, 2012 ISBN: 9781259004612
6. Yeshvant Kanetkar, "*Let us C*", 13th Edition, BPB Publication, 2013, ISBN: 978-81-8333-163-0
7. Ramesh Rimal & et. al., "*Computer Science-II, Revised Edition*", Buddha Academic Publishers and Distributors Pvt. Ltd. Nepal, 2013



Course Title: **Financial Accounting (3 Cr.)**

Course Code: **CACS152**

Year/Semester: **I/II**

Class Load: **5 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1 Hr., Practical: 1 Hr.)**

Course Description

This course includes both theoretical as well as practical concept of financial accounting so that students can understand working principle of financial accounting and hence can use the concept in developing application related to financial sector.

Course Objectives

The general objective of this course is to develop conceptual understanding of the fundamentals of financial accounting system.

Course Contents

Unit 1 Theoretical Framework

4 Hrs.

Meaning and Scope of Accounting: Meaning of Accounting, Procedural Aspects of Accounting, Evolution of Accounting as a Social Science, Objectives of Accounting, Functions of Accounting, Sub-fields of Accounting, Users of Accounting Information, Relationship of Accounting with Other Disciplines, Limitation of Accounting, Role of Accountant in the Society.

Accounting Concepts, Principles and Conventions: Accounting Concepts, Principles & Conventions – an Overview, Qualitative Characteristics of Financial Statements, Fundamentals Accounting Assumptions.

Accounting Standards: Concepts, Objectives, Benefits & An Overview of Nepal Accounting Standards

Accounting Policies: Meaning, Selection of Accounting Policies and Changes in Accounting Policies

Unit 2 Accounting Process

10 Hrs.

Books Of Accounts Leading to The Preparation of Trial Balance, Journal Entries, Double Entry System, Advantage of Double Entry System, Concepts of Transaction and Events, Classification of Accounts, Golden Rules of Accounting, Advantages of Journal, Ledger, Trial Balance, Subsidiary Books Including Cash Books, Capital and Revenue Expenditures and Receipts, Contingent Assets and Contingent Liabilities, Errors Including Rectifications Thereof.

Unit 3 Bank Reconciliation Statement

4 Hrs.

Introductions, Ascertaining the Causes of Differences of Bank Balance in Bank. Column of the Cash-Book and in Pass- Book, Procedure for Reconciling the Cash- Book Balance with the Pass-Book Balance, Importance of Bank Reconciliation Statement.

Unit 4 Depreciation Accounting

4 Hrs.

Concepts of Depreciation, Objectives for Providing Depreciation, Methods for Providing Depreciation, Accounting for Depreciation

Unit 5 Inventories

4 Hrs.

Meaning, Basis and Technique of Inventory Valuation, Inventory Recording System, Stock Taking

Unit 6 Preparation of Final Accounts for Sole Proprietors

10 Hrs.

Concept of Closing Entries in respect of Trading and Profit & Loss Account, Concept of Accrual Basis of Accounting, Matching Concept and Dual Aspects, Concept on Manufacturing Account, Preparation of Balance Sheet, Arrangement and Classification of Assets and Liabilities

Unit 7 Introduction to Company Accounts

9 Hrs.

Meaning of Company, Salient Features of Company, Types of Company, Preparation of Financial Statements, Share Capital and its types, Debentures and its types, Distinction between Debentures and Shares, Issue of Shares and Debentures, Redemption of Preference Shares

Laboratory Works

Laboratory works should be carried out using any accounting packages (such as Tally, Fact etc.) to implement the concepts discussed in the above mentioned topics.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), tutorials and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Text Book

1. Andrew Thomas & Anne Marie Ward, "*Introduction to Financial Accounting 7/e*", Mc Graw Hill 2012 ISBN: 9780077132682

Reference Books

1. Narayanaswamy, R., "*Financial Accounting: A Managerial Perspective*", Prentice Hall of India, New Delhi.
2. Porter, Gary A. Norton, Curtis L., "*Financial Accounting: The Impact on Decision Makers*", The Dryden Press, USA.



Course Title: **English II (3 Cr.)**
Course Code: **CACS103**
Year/Semester: **I/II**
Class Load: **4 Hrs. / Week (Theory: 3 Hrs., Tutorial: 1 Hr.)**

Course Description

The course consists of literary reading, business communication skills along with critical reasoning to inculcate cognitive ability and workplace communicative competence in the students. It consists of science fiction stories, business writing and exercises based on critical reasoning. The course aims to enhance language proficiency and stimulate creative and critical thinking and analysis.

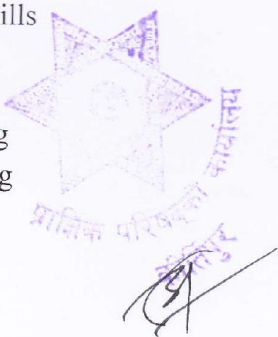
Course Objectives

The course has following specific objectives:

- To impart reading skills in students and make them comprehend and analyze literary texts.
- To frame students' logical capability including analyzing reasoning, assessing credibility, making sound decisions and solving dilemmas.
- To help students to develop confidence and expertise in composing effective professional documents.

Course Contents

<u>Unit1</u> Science Fiction Stories	10 Hrs.
1. H. G. Wells: "The Land Ironclads"	
2. Jack Williamson: "The Metal Man"	
3. Brian Aldiss: "Who can Replace a Man?"	
4. J. G. Ballard: "Billenium"	
5. William Gibson: "Burning Chrome"	
<u>Unit2</u> Business Communication	9 Hrs.
1. Rules of Good Writing	
2. Fax Message and Electronic Mails	
3. Memos, Reports and Meetings	
<u>Unit3</u> Persuasive Communication	3 Hrs.
1. Notices, Advertisements and Leaflets	
<u>Unit4</u> Oral Communication	3 Hrs.
1. Oral Presentation Skills	
<u>Unit5</u> Critical Reasoning	20 Hrs.
1. Analyzing Reasoning	
2. Evaluating Reasoning	



3. Reasoning Implications
4. Evaluating Evidence and Authorities
5. Two Skills in the Use of Language
6. Exercising the skills of Reasoning
7. Constructing Reasoning

Teaching Methods

The course expects students' effective participation and instructors' proper guidance to fulfill the objectives of the course. The teacher should engage students in language activities and minimize lectures. Student centered teaching method will engage students in the pursuit of learning and bring about positive results.

Evaluation

Internal Evaluation: 40%

Attendance - 5

Presentation/classroom participation- 5

Writing sample- 15

Mid-term test- 15

Final Evaluation: 60%

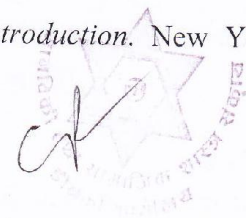
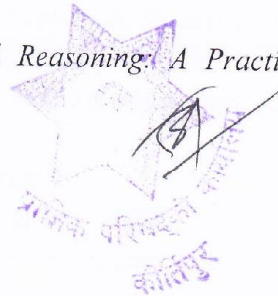
Critical response on stories

Business writing tasks

Logical reasoning activities

Text Books

1. Shippey, Tom. *The Oxford Book of Science Fiction Stories*. London: OUP, 2003.
2. Taylor, Shirley. *Communication for Business: A Practical Approach*. London: Longman, 2005.
3. Thompson, Anne. *Critical Reasoning: A Practical Introduction*. New York: Rutledge, 2009.



Course Title: **Mathematics II (3 Cr.)**

Course Code: **CACS154**

Year/Semester: **I/II**

Class Load: **5 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1 Hr., Practical: 1 Hrs)**

Course Description

This course includes the topics from calculus and computational methods such as limits and continuity, differentiation & its applications, integration and its applications, differential equation and different computational techniques which are essential as mathematical foundation for computing.

Course Objectives

This course makes students able to cognize the concept Calculus, Computational methods and their applications in the area of Social Science and Computer Application.

Course Contents

Unit 1 Limits and Continuity

6 Hrs.

Limit of a function, Indeterminate forms, Algebraic properties of limit (without proof), Theorems on Limits of Algebraic and Transcendental Function. Continuity of a function, types of discontinuity. Exercises on evaluation of limits and test of continuity. (Mathematica)

Unit 2 Differentiation

6 Hrs.

Ordered Pairs, Cartesian Product, Relation, Domain and Range of a Relation, Inverse of a Relation; Types of Relations: Reflective, Symmetric, Transitive, and Equivalence Relations. Definition of Function, Domain and Range of a Function, Inverse function, Special Functions (Identity, Constant), Algebraic (Linear, Quadratic, Cubic), Trigonometric and Their Graphs. Definition of Exponential and Logarithmic functions, Composite Function. (Mathematica)

Unit 3 Application of Differentiation

8 Hrs.

The derivatives and slope of the curve; Increasing and decreasing function; convexity of curves; maximization and minimization of a function; Differentiation and marginal analysis; price and output; Competitive equilibrium of firm, Illustrations. Drawing graphs of algebraic function by using first and second order derivatives. (Mathematica)

Unit 4 Integration and Its Applications

8 Hrs.

Riemann Integral; Fundamental Theorem (Without Proof); Technique of Integration; Evaluation and Approximation of Definite Integrals; Improper Integrals; Applications of Definite Integrals; Quadrate, Rectification; Volume and Surface Integral. Trapezoidal and Simpson's Rules of Numerical Integration. (Mathematica)

Unit 5 Differential Equations**7 Hrs.**

Differential Equation and its Order and Degree, Differential Equations of First Order and First Degree; Differential Equations with Separable Variables, Homogeneous and Exact Differential Equations.

Unit 6 Computational Method**10 Hrs.**

Linear Programming Problem (LPP), Graphical Solution of LPP in Two Variables, Solution of LPP by Simplex Method (up to 3 variables), Solution of System of Linear Equations by Gauss Elimination Method, Gauss Seidel Method and Matrix Inversion Method, Bisection method, Newton- Raphson Method for Solving Non-linear Equations. (Excel/Matlab)

Laboratory Works

Mathematica and/ or Matlab should be used for above mentioned topics.

Teaching Methods

The general teaching pedagogy includes class lectures, group works, case studies, guest lectures, research work, project work, assignments (theoretical and practical), tutorials and examinations (written and verbal). The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Text Book

1. Thomas, G. B, Finney, R. S., "*Calculus with Analytic Geometry*", Addison - Wesley, 9th Edition.

Reference Books

1. Monga, G. S., "*Mathematics for Management and Economics*", Vikas Publishing House Pvt. Ltd., New Delhi.
2. Upadhayay, H. P., Paudel, K.C & et al, "*Elements of Business Mathematics*", Pinnacle Publication.
3. Budnick, F. S., "*Applied Mathematics for Business, Economics, and the Social Sciences*", McGraw-Hill Ryerson Limited.

4. Paudel, K. C., GC. F. B., and et al, "*Higher Secondary Mathematics*", Asmita Publication & Distributors Pvt. Ltd, Nepal.
5. Bajracharya D. R., Shreshtha, R. M. & et al, "*Basic Mathematics I, II*", Sukunda Pustak Bhawan, Nepal
6. Sthapit, A.B., Bajracharya, P. M. and et al, "*Fundamentals of Business Mathematics*", Buddha Academic Publisheres & Distributors Pvt. Ltd., Nepal
7. Yamane, T. "*Mathematics for Economist*", Prentice-hall of India.
8. Snedden. I., "*Elements of Partial Differential Equation*", Hill Book Company-McGraw.



Course Title: **Microprocessor and Computer Architecture (3 Cr.)**

Course Code: **CACSI55**

Year/Semester: **I/II**

Class Load: **6 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1 Hr., Practical: 2 Hrs.)**

Course Description

This course is an introduction to microprocessor and computer architecture. It covers topics in both the physical design of the computer (organization) and the logical design of the computer (architecture).

Course Objectives

The course has following specific objectives:

- To explain the microprocessor.
- To explain the assembly language programming.
- To explain the overview of computer organization.
- To explain the principle of CPU system.
- To explain the principle of memory system
- To explain the principle of data flow.

Course Contents

Unit 1 Fundamental of Microprocessor

5 Hrs.

Introduction to Microprocessors, Microprocessor systems with bus organization, Microprocessor architecture and operation, 8085 Microprocessor and its operation, 8085 instruction cycle, machine cycle, T states, Addressing modes in 8085, Introduction to 8086.

Unit 2 Introduction To Assembly Language Programming

10 Hrs.

Assembly Language Programming Basics, Classification of Instructions and Addressing Mode, 8085 Instruction Sets, Assembling, Executing and Debugging the Programs, Developing Counters and Time Delay Routines, Interfacing Concepts

Unit 3 Basic Computer Architecture

4 Hrs.

Introduction: History of computer architecture, Overview of computer organization, Memory Hierarchy and cache, Organization of hard disk.

Instruction Codes: Stored Program Organization-Indirect Address, Computer Registers, Common bus system, Instruction set, Timing and Control-Instruction Cycle

Unit 4 Microprogrammed Control

10 Hrs.

Basic Computer Design of Accumulator: Control of AC Register, ALU Organization; Control Memory-Address Sequencing: Conditional Branching, Mapping of Instruction-Subroutines; Micro Program: Symbolic Micro

Program, Binary Micro Program; Design of Control Unit: Basic Requirement of Control Unit, Structure of Control Unit, Micro Program Sequencer.

Unit 5 Central Processing Unit

10 Hrs.

General Register Organization: Control Word, Stack Organization and Instruction; Formats-Addressing Modes.

Data Transfer and Manipulation: Data Transfer Instructions, Data Manipulation Instructions, Arithmetic Instructions, Logical and Bit Manipulation Instructions, Shift Instructions.

Program Control: Status Bit Conditions, Conditional Branch Instructions, Subroutine Call and Return, Program Interrupt, Types of Interrupts

Unit 6 Pipeline, Vector Processing and Multiprocessors

6 Hrs.

Parallel Processing, Pipeline Examples: Four Segment Instruction Pipeline, Data Dependency, Handling of Branch Instructions; Vector Processing: Vector operations, Matrix Multiplication;

Laboratory Works

8085 Assembly Language program

1. Multi byte Addition & Subtraction, Multi byte decimal addition & subtraction.
2. Adder and subtractor circuit.
3. Study of 8259 programmable interrupt controller - Development of interrupt service routine.
4. Keyboard/display controller - Keyboard scan - blinking and rolling display.
5. Parallel data transfer
6. Study of Microcomputer development system.

Teaching methods

The general teaching pedagogy includes class lectures, group works, case studies, guest lectures, research work, project work, assignments (theoretical and practical), tutorials and examinations (written and verbal). The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

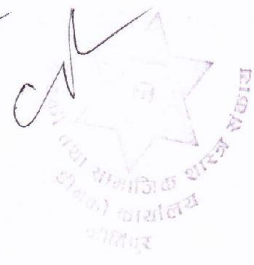
Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Text Book

1. Morris Mano.M., Computer System architecture, PIII.

Reference Books

1. Hamacher.V.C.,Vranesic.Z.G and Zaky.S.G., "Computer Organisation", McGraw Hill, New York.
2. Hayes,"Computer System Architecture",Mc Graw Hill.



Course Title: **Data Structures and Algorithms (3 Cr.)**
Course Code: **CACS201**
Year/Semester: **II/III**
Class Load: **6 Hrs. / Week (Theory: 3 Hrs., Practical: 3 Hrs.)**

Course Description

This course includes fundamental concept of data structures such as stack, queue, list, linked list, trees and graph; application of these data structures along with several algorithms.

Course Objectives

The general objective of this course is to provide fundamental concepts of data structures, different algorithms and their implementation.

Course Contents

Unit 1 Introduction to data structure 2 Hrs.

Definition, Abstract Data Type, Importance of Data structure.

Unit 2 The Stack 3 Hrs.

Introduction, Stack as an ADT, POP and PUSH Operation, Stack Application: Evaluation of Infix, Postfix, and Prefix Expressions, Conversion of Expression.

Unit 3 Queue 3 Hrs.

Introduction, Queue as an ADT, Primitive Operations in Queue, Linear and Circular Queue and Their Application, Enqueue and Dequeue, Priority Queue

Unit 4 List 2 Hrs.

Introduction, Static and Dynamic List Structure, Array Implementation of Lists, Queues as a List

Unit 5 Linked Lists 5 Hrs.

Introduction, Linked List as an ADT, Dynamic Implementation, Insertion & Deletion of Node To and From a List, Insertion and Deletion After and Before Nodes, Linked Stacks and Queues, Doubly Linked Lists and Its Advantages

Unit 6 Recursion 4 Hrs.

Introduction, Principle of Recursion, Recursion vs. Iteration, Recursion Example: TOH and Fibonacci Series, Applications of Recursion, Search Tree

Unit 7 Trees 5 Hrs.

Introduction, Basic Operation in Binary tree, Tree Search and Insertion/Deletion, Binary Tree Traversals (pre-order, post-order and in-order), Tree Height, Level, and Depth, Balanced Trees: AVL Balanced Trees, Balancing Algorithm, The Huffman Algorithm, Game tree, B-Tree

Unit 8 Sorting

5 Hrs.

Introduction, Internal and External Sort, Insertion and Selection Sort, Exchange Sort, Bubble and Quick Sort, Merge and Radix Sort, Shell Sort, Binary Sort, Heap Sort as Priority Queue, Efficiency of Sorting, Big 'O' Notation

Unit 9 Searching

5 Hrs.

Introduction to Search Technique; essential of search, Sequential search, Binary search, Tree search, General search tree, Hashing: Hash function and hash tables, Collision resolution technique, Efficiency comparisons of different search technique

Unit 10 Graphs

5 Hrs.

Introduction, Graphs as an ADT, Transitive Closure, Warshall's Algorithm, Types of Graph, Graph Traversal and Spanning Forests, Kruskal's and Round-Robin Algorithms, Shortest-path Algorithm, Greedy Algorithm, Dijkstra's Algorithm

Unit 11 Algorithms

5 Hrs.

Deterministic and Non-deterministic Algorithm, Divide and Conquer Algorithm, Series and Parallel Algorithm, Heuristic and Approximate Algorithms

Laboratory Works

There shall be 10 lab exercises based on C or Java

1. Implementations of different operations related to Stack
2. Implementations of different operations related to linear and circular queues
3. Solutions of TOH and Fibonacci Series using Recursion
4. Implementations of different operations related to linked list: singly and doubly linked
5. Implementation of trees: AVL trees, Balancing of AVL
6. Implementation of Merge sort
7. Implementation of different searching technique: sequential, Tree and Binary
8. Implementation of Graphs: Graph traversals
9. Implementation of Hashing
10. Implementations of Heap

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

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Evaluation

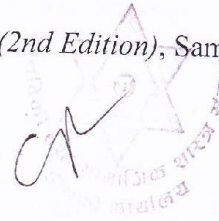
Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 hrs.)	-	100

Text Book

1. Y. Langsam, M.J. Augenstein and A. M. Tenenbaum, "Data Structures using C and C++", PHI

Reference Books

1. G. W. Rowe, "Introduction to Data Structure and Algorithms with C and C++", PHI
2. Robert Lafore, Data Structures and Algorithms in Java (2nd Edition), Sams Publishing.



Course Title: **Probability & Statistics (3 Cr.)**

Course Code: **CACS202**

Year/Semester: **II/III**

Class Load: **5 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1 Hr., Practical: 1 Hr.)**

Course Description

This course covers basic concept of statistics, measurement of central tendency, correlation & regression analysis, probability, sample survey, sample survey methods and design of experiment. These topics are essential tools for research.

Course Objective

The general objectives of this course are to provide fundamental concept of Statistics, Probability, Sample Survey and their applications in the area of Social Science and Computer Application.

Course Contents

Unit 1 Introduction to Statistics

3 Hrs.

Meaning, Scope and Limitations of Statistics, Types and Sources of Data, Methods and Problems of Collection of Primary and Secondary Data.

Unit 2 Descriptive Statistics

6 Hrs.

Measure of Central Tendency (Arithmetic Mean, Median, Partition Values, Mode); Measure of Dispersion (Absolute and Relative Measures: Range, Quartile Deviation, Mean Deviation, Standard Deviation, and Coefficient of Variation)

Unit 3 Correlation and Regression Analysis

6 Hrs.

Correlation: Definition, Scatter diagram, Karl Pearson's coefficient of correlation, Numerical problems for determination of Correlation Coefficients.

Regression: Definition, Dependent and Independent Variables, Least Square method only, Numerical Problems.

Unit 4 Probability

8 Hrs.

Definition of Probability, Two basic Laws of Probability(without proof), Conditional Probability; Probability Distributions (Binomial, Poisson and Normal); simple numerical problems.

Unit 5 Sample Survey

6 Hrs.

Concept of Population and Sample; Needs of Sampling; Censuses and Sample Survey; Basic Concept of Sampling; Organizational Aspect of Sample Survey; Questionnaire Design; Sample Selection and Determination of Sample Size; Sampling and Non Sampling Errors.

Unit 6 Sample Survey Methods

10 Hrs.

Types of Sampling; Simple Random Sampling with and without Replacement;

Stratified Random Sampling; Ratio and Regression Method of Estimation under Simple and Stratified Random Sampling; Systematic Sampling; Cluster Sampling; Multistage Sampling; Probability Proportion to Size Sampling (PPS), Estimation of Population Total and its Variance. Sampling Distributions (t , x^2 , z) and Related Problems.

Unit 7 Design of Experiment

6 Hrs.

Concept of Analysis of Variance (ANOVA), F -Statistic and its Distribution, Linear Model in ANOVA, Analysis of One Way, Two Way Classification (1 and m observations per cell) in Fixed Effect Model.

Laboratory Works

Techniques for using the computer as a tool in the analysis of statistical problems will be introduced. SPSS software should be used for data analysis

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

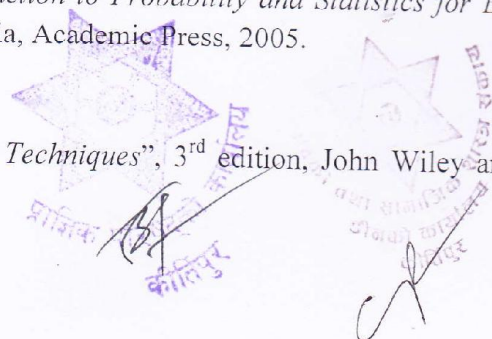
Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Text Books

1. Mukhopadhyay P., "Theory and Methods of Survey Sampling", Prentice Hall of India, New Delhi, 1998.
2. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, India, Academic Press, 2005.

Reference Books

1. Cochran W.G., "Sampling Techniques", 3rd edition, John Wiley and Sons, Inc. New York, 1977.



2. Hogg & Tanis, "*Probability and Statistical Inference*", 6th edition, First Indian Reprint, 2002
3. Montgomery Douglas C., "*Design and Analysis of Experiments*", 5th edition, John Wiley & Sons Inc., 2001.
4. Upadhyay, H. P., Paudel, K.C & et al, "*Elements of Business Mathematics*", Pinnacle Publication.



Course Title: **System Analysis and Design (3 Cr.)**

Course Code: **CACS203**

Year/Semester: **II/III**

Class Load: **4 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1 Hr.)**

Course Description

This course mainly focuses on different aspect of system analysis and design such as foundation, planning, analysis, design, implementation and maintenance.

Course Objectives

The general objective of this course is to provide concepts related to information systems development in a systematic approach including foundations, planning, analysis, design, implementation and maintenance.

Course Contents

Unit 1 System Development Fundamentals

9 Hrs.

a. The Systems Development Environment

Introduction, Modern Approach of System Analysis and Design, Information System and its Type, Developing Information Systems and the Systems Development Life Cycle, The Heart of the Systems Development Process, The Traditional Waterfall SDLC, Approaches for Improving Development, CASE Tools, Rapid Application Development, Service-Oriented Architecture, Agile Methodologies, eXtreme Programming, Object- Oriented Analysis and Design

b. The Origins of Software

Introduction, System Acquisition, Reuse

c. Managing the Information Systems Project

Introduction, Managing Information Systems Project, Representing and Scheduling Project Plans, Using Project Management Software

Unit 2 Planning

7 Hrs.

a. System Development Projects: Identification and Selection

Introduction, Identifying and Selecting Systems Development Projects, Corporate and Information Systems Planning

b. System Development Projects: Initiation and Planning

Introduction, Initiating and Planning Systems Development Projects, Process of Initiating and Planning IS Development Projects, Assessing Project Feasibility, Building and Reviewing the Baseline Project Plan

Unit 3 Analysis

13 Hrs.

a. System Requirements

Introduction, Performing Requirements Determination, Traditional Methods for Determining Requirements, Contemporary Methods for Determining System Requirements, Radical Methods for Determining System Requirements,

Requirements Management Tools, Requirements Determination Using Agile Methodologies

b. System Process Requirements

Introduction, Process Modeling, Data Flow Diagramming Mechanics, Using Data Flow Diagramming in the Analysis Process, Modeling Logic with Decision Tables

c. System Data Requirements

Introduction, Conceptual Data Modeling, Gathering Information for Conceptual Data Modeling, Introduction to E-R Modeling, Conceptual Data Modeling and the E-R Model, Representing Super-types and Sub-types, Business Rules, Role of Packaged Conceptual Data Models – Database Patterns

Unit 4 Design

12 Hrs.

a. Designing Databases

Introduction, Database Design, Relational Database Model, Normalization, Transforming E-R Diagrams into Relations, Merging Relations, Physical File and Database Design, Designing Fields, Designing Physical Tables

b. Designing Forms and Reports

Introduction, Designing Forms and Reports, Formatting Forms and Reports, Assessing Usability

c. Designing Interfaces and Dialogues

Introduction, Designing Interfaces and Dialogues, Interaction Methods and Devices, Designing Interfaces and Dialogues in Graphical Environments

Unit 5 Implementation and Maintenance

4 Hrs.

a. System Implementation

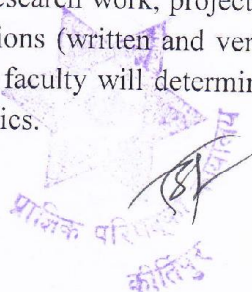
Introduction, System Implementation, Software Application Testing, Installation, Documenting the System, Training and Supporting Users, Organizational Issues in Systems Implementation

b. System Maintenance

Introduction, Maintaining Information Systems, Conducting Systems Maintenance

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.



Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
40	-	60 (3 Hrs.)	-	100

Text Book

1. Jeffrey A. Hoffer, Joey George, Joe Valacich, "*Modern Systems Analysis and Design*", 6/E, Prentice Hall India.

Reference Book

2. Jeffery Whitten, Lonnie Bentley, "*Systems Analysis and Design Methods*", 7/E, McGraw-Hill



Course Title: **Object Oriented Programming in Java (3 Cr.)**
Course Code: **CACS204**
Year/Semester: **II/III**
Class Load: **6 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1, Practical: 2 Hrs.)**

Course Description

This course covers preliminary concepts of object-oriented approach in programming with basic skills using Java. Control structures, Classes, methods and argument passing and iteration; graphical user interface basics Programming and documentation style.

Course Objectives

The general objectives of this course are to provide fundamental concepts of Object Oriented Programming and make students familiar with Java environment and its applications.

Course Contents

Unit 1 Introduction to Java

2 Hrs.

Definition, History of Java, The Internet and Java's Place in IT, Applications and Applets, Java Virtual Machine, Byte Code- not an Executable code, Procedure-Oriented vs. Object-Oriented Programming, Compiling and Running a Simple Program, Setting up your Computer for Java Environment, Writing a Program, Compiling, Interpreting and Running the Program, Handling Common Errors

Unit 2 Tokens, Expressions and Control Structures

5 Hrs.

Primitive Data Types: Integers, Floating-Point types, Characters, Booleans; User-Defined Data Types, Declarations, Constants, Identifiers, Literals, Type Conversion and Casting, Variables: Variable Definition and Assignment, Default Variable Initializations; Command-Line Arguments, Arrays of Primitive Data Types, Comment Syntax, Garbage Collection, Expressions, Using Operators: Arithmetic, Bitwise, Relational, Logical, Assignment, Conditional, Shift, Ternary, Auto-increment and Auto-decrement; Using Control Statements(Branching: if, switch; Looping: while, do-while, for; Jumping statements: break, continue and return)

Unit 3 Object Oriented Programming Concepts

9 Hrs.

Fundamentals of Classes: A Simple Class, Creating Class Instances, Adding methods to a class, Calling Functions/Methods; Abstraction, Encapsulation, Using 'this' keyword, Constructors, Default constructors, Parameterized constructors, More on methods: Passing by Value, by Reference, Access Control, Methods that Return Values, Polymorphism and Method Overloading, Recursion; Nested and Inner Classes.

Unit 4 Inheritance & Packaging

3 Hrs.

Inheritance: Using 'extends' keyword, Subclasses and Superclasses, 'super' keyword usage, Overriding Methods, Dynamic Method Dispatch; The Object class, Abstract and Final Classes, Packages: Defining a Package, Importing a Package: Access Control; Interfaces: Defining an Interface, Implementing and applying interfaces.

Unit 5 Handling Error/Exceptions

2 Hrs.

Basic Exceptions, Proper use of exceptions, User defined Exceptions, Catching Exception: try, catch; Throwing and re-throwing: throw, throws; Cleaning up using the finally clause.

Unit 6 Handling Strings

2 Hrs.

Creation, Concatenation and Conversion of a String, Changing Case, Character Extraction, String Comparison, Searching Strings, Modifying Strings, String Buffer.

Unit 7 Threads

3 Hrs.

Create/Instantiate/Start New Threads: Extending java.lang.Thread, Implementing java.lang.Runnable Interface; Understand Thread Execution, Thread Priorities, Synchronization, Inter-Thread Communication, Deadlock

Unit 8 I/O and Streams

2 Hrs.

java.io package, Files and directories, Streams: Byte Streams and Character Streams; Reading/Writing Console Input/Output, Reading and Writing files, The Serialization Interface, Serialization & Deserialization.

Unit 9 Understanding Core Packages

3 Hrs.

Using java.lang Package: java.lang.Math, Wrapper classes and associated methods (Number, Double, Float; Integer, Byte; Short, Long; Character, Boolean); Using java.util package: Core classes (Vector, Stack, Dictionary, Hashtable, Enumerations, Random Number Generation).

Unit 10 Holding Collection of Data

3 Hrs.

Arrays And Collection Classes/Interfaces, Map/List/Set Implementations: Map Interface, List Interface, Set Interface, Collection Classes: Array List, Linked List, Hash Set and Tree Set; Accessing Collections/Use of An Iterator, Comparator.

Unit 11 Java Applications

8 Hrs.

About AWT & Swing, About JFrame (a top level window in Swing), Swing components (JLabel, About text component like JTextField, JButton, Event Handling in Swing Applications, Layout Management using Flow Layout, Border Layout, Grid Layout, Using JPanel, Choice components like JCheck Box, JRadio

Button, Borders components, JCombo Box & its events, JList & its events with MVC patterns, Key & Mouse Event Handling, Menus in swing, JText Area, Dialog boxes in swing, JTable for Displaying Data in Tabular form, MDI using JDesktop Pane & JInternal Frame, Using IDE like Netbeans, JBuilder for building java applications using Drag & Drop), Adapter classes

Unit 12 Introduction to Java Applets

1 Hr.

Definition, Applet lifecycle methods, Build a simple applet, Using Applet Viewer, Adding Controls: Animation Concepts.

Unit 13 Database Programming using JDBC

2 Hrs.

Using Connection, Statement & Result Set Interfaces for Manipulating Data with the Databases

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course. Project should be assigned on Individual Basis.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 hrs.)	-	100

Text Books

1. Deitel & Dietel, "Java: How to program", 9th Edition, Pearson Education, 2011, ISBN: 9780273759768
2. Herbert Schildt, "Java: The Complete Reference", Seventh Edition, McGraw-Hill 2006, ISBN: 0072263857

Reference Books

1. Bruce Eckel, "*Thinking in Java*", 4th Edition, Prentice Hall, 2006, ISBN: 0-13-187248-6
2. Cay Horstmann and Grazy Cornell, "*Core Java Volume I-Fundamentals*", Ninth Edition, Prentice Hall, 2012, ISBN: 978-0137081899
3. E. Balagurusamy, "*Programming with Java: A Primer*", 4th Edition, Tata McGraw Hill Publication, India,



Course Title: **Web Technology (3 Cr.)**
Course Code: **CACS205**
Year/Semester: **II/III**
Class Load: **6 Hrs. / Week (Theory: 3 Hrs, Practical: 3 Hrs.)**

Course Description

This course covers different aspect of web technology such as HTML, CSS, issues of web technology, client tier, server tier and advanced server side issue.

Course Objectives

The general objectives of this course are to provide fundamental concepts of Internet, Web Technology and Web Programming.

Course Contents

Unit 1 HTML and CSS

15 Hrs.

HTML Basic: HTML Tag Reference, Global Attributes, Document, Structure Tags, Formatting Tags, Text Level Formatting, Block Level Formatting, List Tags, Hyperlink Tags, Executable Content Tags.

Image & Imagemaps: Introduction, Client-Side Imagemaps, Server-Side Imagemaps, Using Server-Side and Client-Side Imagemaps Together, Alternative Text for Imagemaps.

Tables: Introduction To HTML Tables and Their Structure, The Table Tags, Alignment, Aligning Entire Table, Alignment within a Row, Alignment within a Cell, Attributes, Content Summary, Background Color, Adding a Caption, Setting the Width, Adding a Border, Spacing Within a Cell, Spacing between the Cells, Spanning Multiple Rows or Columns, Elements that can be Placed in a Table, Table Sections and Column Properties, Tables as a Design Tool.

Frames: Introduction to Frames, Applications, Frames document, The <FRAMESET> tag, Nesting <FRAMESET> tag, Placing content in frames with the <FRAME>Tag, Targeting named Frames, Creating Floating Frames, Using IHidden Frames.

Forms: Creating Forms, The <FORM> tag, Named Input fields, The <INPUT> tag, Multiple lines text windows, Drop Down and List Boxes, Hidden, Text, Text Area, Password, File Upload, Button, Submit, Reset, Radio, Checkbox, Select, Option, Forms and Scripting, Action Buttons, Labeling input files, Grouping related fields, Disabled and read-only fields, Form field event handlers, Passing form data.

Style Sheets: Definition, Importance, Different Approaches to Style Sheets, Using Multiple Approaches, Linking to Style Information in Separate File, Setting up Style Information, Using the <LINK>Tag, Embedded Style Information, Using <STYLE>Tag, Inline Style Information.

Unit 2 Issue of Web Technology

3 Hrs.

Architectural Issues of Web Layer, Tier Technology: 2-Tier, 3-Tier and n-Tier.

Unit 3 The Client Tier

10 Hrs.

Representing Content; Introduction to XML; Elements and Attributes; Rules for Writing XML; Namespaces; Schema: Simple Types and Complex Types, XSD Attributes, Default and Fixed Values, Facets, Use of Patterns, Order Indicators(All, Choice, Sequences), Occurrence Indicators (Maxoccurs, Minoccurs), DTD: Internal Declaration, Private External Declaration, Public External Declaration, Defining Elements and Attributes; XSL/XSLT; Xpath; Xquery; SAX; DOM , Creating XML Parser.

Unit 4 The Server Tier

8 Hrs.

Web Server Concept, Creating Dynamic Content, Using Control Flow to Control Dynamic Content Generation, Sessions and State, Error Handling, Architecting Web Application, Using Tag Libraries, Writing Tag Libraries.

Unit 5 Introduction to Advanced Server Side Issues

9 Hrs.

Database Connectivity; Creating an SQL statement: Select, Insert, Update, and Delete; Authentication: Anonymous Access, Authentication by IP address and Domain, Integrated Windows Authentication; Cookies; File Handling; Form Handling

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course. Project should be assigned on individual basis.

Teaching Methods

The general teaching pedagogy includes class lectures, group works, case studies, guest lectures, research work, project work, assignments (theoretical and practical), tutorials and examinations (written and verbal). The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20		60 (3 Hrs.)	20 (3 Hrs.)	100

Text Books

1. Harvey M. Deitel, Paul J. Deitel & Abbey Deitel, "*Internet and World Wide Web: How to Program*", 5th Edition, Pearson Education, 2012, ISBN: 9780273764021
2. Thomas A. Powell, "*HTML & CSS: The Complete Reference*", McGraw Hill, Fifth Edition, 2010, ISBN: 978-0-07-174170-5

Reference Books

1. Matt J. Crouch, "*ASP.NET and VB.NET Web Programming*", Pearson Education Asia, 2002
2. Rahul Banerjee, "*Internetworking Technologies*", Prentice-Hall of India Limited, Fourth Edition, 2000
3. Thomas A. Powell, "*Web Design: The Complete Reference*", Tata McGraw Hill, Second Edition, 2002



Course Title: **Operating System (3 Cr.)**

Course Code: **CACS251**

Year/Semester: **II/IV**

Class Load: **6 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1, Practical: 2 Hrs.)**

Course Description

This course includes the topics that help students understand operating system and its functionality along with its types.

Course Objectives

The general objectives of this subject are to provide the basic feature, function and interface with the hardware and application software to run the computer smoothly.

Course Contents

Unit 1 Introduction to Operating System

2 Hrs.

History, Introduction and Generation of Operating System, Objectives (Resource Manager and Extended Machine), Types of Operating system, Function of Operating system.

Unit 2 Operating System Structure

2 Hrs.

Introduction, Layered System, Kernel, Types of Kernel (Monolithic/Macro Kernel and Micro / Exo-Kernel), Client-Server Model, Virtual Machines, Shell.

Unit 3 Process Management

15 Hrs.

Process Concepts(3 Hrs.): Definitions of Process, The Process Model, Process States, Process State Transition, The Process Control Block, Operations on Processes (Creation, Termination, Hierarchies, Implementation), Cooperating Processes, System Calls (Process Management, File management, Directory Management).

Threads (1 Hr): Definitions of Threads, Types of Thread Process (Single and Multithreaded Process), Benefits of Multithread, Multithreading Models (Many-to-One Model, One-to-One Model, Many-to Many Model).

Inter-Process Communication and Synchronization(6 Hrs.): Introduction, Race Condition, Critical Regions, Avoiding Critical Region: Mutual Exclusion And Serializability; Mutual Exclusion Conditions, Proposals for Achieving Mutual Exclusion: Disabling Interrupts, Lock Variable, Strict Alteration (Peterson's Solution), The TSL Instruction, Sleep and Wakeup, Types of Mutual Exclusion (Semaphore, Monitors, Mutexes, Message Passing, Bounded Buffer), Serializability: Locking Protocols and Time Stamp Protocols; Classical IPC Problems (Dining Philosophers Problems; The Readers and Writers Problem, The Sleeping Barber's Problem)

Process Scheduling(5 Hrs): Basic Concept, Type of Scheduling (Preemptive Scheduling, Nonpreemptive Scheduling, Batch, Interactive, Real Time Scheduling), Scheduling Criteria or Performance Analysis, Scheduling Algorithm (Round-Robin, First Come First Served, Shortest-Job- First, Shortest Process Next, Shortest Remaining Time Next, Real Time, Priority Fair Share, Guaranteed, Lottery Scheduling, HRN, Multiple Queue, Multilevel Feedback Queue); Some Numerical Examples on Scheduling.

Unit 4 Deadlocks

4 Hrs.

System Model, System Resources: Preemptable and Non-Preemptable; Conditions for Resource Deadlocks, Deadlock Modeling, The OSTRICH Algorithm, Method of Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm, Deadlock Detection: Resource Allocation Graph, Recovery from Deadlock.

Unit 5 Memory Management

7 Hrs.

Basic Memory Management (3 Hrs.): Introduction, Memory Hierarchy, Logical Versus Physical Address Space, Memory Management with Swapping: Memory Management with Bitmaps and with Linked List; Memory Management without Swapping, Contiguous-Memory Allocation: Memory Protection, Memory Allocation, Fragmentation (Inter Fragmentation and External Fragmentation); Non-Contiguous Memory Allocation, Fixed Partitioning Vs. Variable Partitioning, Relocation and Protection, Coalescing and Compaction.

Virtual Memory (4 Hours): Background, Paging, Structure of Page Table: Hierarchical Page Table, Hashed Page Table, Inverted Page Table, Shared Page Table; Block Mapping Vs. Direct Mapping, Demand Paging, Page Replacement and Page Faults, Page Replacement Algorithms: FIFO, OPR, LRU, SCP; Some Numerical Examples on Page Replacement, Thrashing, Segmentation, Segmentation With Paging.

Unit6 Input/ Output Device Management

4 Hrs.

Principle of I/O Hardware: I/O Devices, Device Controllers, Memory Mapped I/O, Direct Memory Access; Principle of I/O Software: Goals of I/O Software, Program I/O, Interrupt -Driven I/O, I/O Using DMA; I/O Software Layers: Interrupts Handler, Device Drivers, Device Independent I/O Software, User - Space I/O Software; Disk: Disk Hardware; Disk Scheduling: Seek Time, Rational Delay, Transfer Time; Disk Scheduling Algorithms: FCFS Scheduling, SSTF Scheduling, SCAN Scheduling, C-SCAN Scheduling, Lock Scheduling

Unit 7 File System Interface Management

2 Hrs.

File Concept: File Naming, File Structure, File Type, File Access, File Attributes, File Operation and File Descriptors; Directories: Single-Level Directory Systems, Hierarchical Directory Systems, Path Names, Directory Operation; Access

Methods: Sequential, Direct; Protection: Types of Access, Access Control List, Access Control Matrix

Unit 8 Security Management

3 Hrs.

Introduction, Security Problems, User Authentication: Passwords, password Vulnerabilities, Encrypted password, One Time Password and Biometrics password; User Authorization, Program Threats: Trojan Horse, Trap Door, Stack and Buffer Overflow; System Threats: Worms, Viruses, Denial of Services.

Unit 9 Distributed Operating System

4 Hrs.

Introduction, Advantages of Distributed System over Centralized System, Advantages of Distributed System over Independent PCs, Disadvantages of Distributed System, Hardware and Software Concepts, Communication in Distributed Systems, Message Passing, Remote Procedure Call, Process in Distribution System, Clock Synchronization.

Unit 10 Case Study

2 Hrs.

DOS and Windows Operating System, Unix Operating System, Linux Operating System

Laboratory Works

Lab works should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course. Project should be assigned on Individual Basis.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

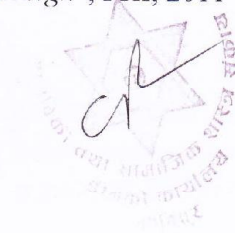
Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Text Books

1. Andrew S. Tanenbaum, "*Modern Operating System 6/e*", PHI, 2011/12
2. Silberschatz, P.B. Galvin, G. Gagne, "*Operating System Concepts 8/e* ", Wiley India, 2014 ISBN : 9788126520510

Reference Books

1. Andrew S. Tanenbaum, "*Distributed Operating System*", Pearson
2. D M Dhamdhare, "*System Programming and Operating System*", Tata McGraw-Hill, 2009
3. P. Pal Choudhury, "*Operating Systems Principles and Design*", PHI, 2011



Course Title: **Numerical Methods (3 Cr.)**

Course Code: **CACS252**

Year/Semester: **II/IV**

Class Load: **6 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1, Practical: 2 Hrs.)**

Course Description

This course covers solution of nonlinear equations, interpolation and approximation, numerical differentiation and integration and solution of linear algebraic equation, ordinary differential equations and partial differential equations. It provides knowledge for numerical analysis.

Course Objectives

The general objectives of this subject are to make students familiar with the theory of numerical analysis for solving algebraic and transcendental equations, solution of ordinary and partial differential equations, numerical differentiation and integration.

Course Contents

Unit 1 Solution of Nonlinear Equations

10 Hrs.

Introduction, Types of Equation, Errors in Computing, The Bisection Method; The Method of False Position, Newton- Raphson Method, Solution of System of Nonlinear Equation, Fixed Point Iteration and Convergence

Unit 2 Interpolation and Approximation

8 Hrs.

Introduction, Errors in Polynomial Interpolation, Lagrange's Polynomials, Newton's Interpolation using Difference and Divided Differences, Cubic Spline Interpolation, Least Squares Method for Linear and Non-linear Data.

Unit 3 Numerical Differentiation and Integration

5 Hrs.

Introduction to Numerical Differentiation, Newton's Differentiation Formulas, Numerical Integration (Trapezoidal Rule, Simpson's 1/3 rule, 3/8 rule); Romberg Integration; Numerical Double Integration.

Unit 4 Solution of Linear Algebraic Equations

10 Hrs.

Review of the existence of solutions and properties of matrices, Consistency of a Linear System of Equations, Gaussian Elimination Method, Gauss-Jordan Method, Inverse of matrix using Gauss Elimination Method, Method of factorization, Iterative Methods(Jacobi & Gauss-Seidel Iteration),Power Method.

Unit 5 Solution of Ordinary Differential Equations

7 Hrs.

Introduction to Differential Equations, Initial Value Problem, Taylor Series Method, Picard's Method, Euler's Method and Its Accuracy, Heun's method,

Runge-Kutta Methods, Solution of Higher Order Equations, Boundary Value Problems, Shooting Method and Its Algorithm.

Unit 6 Solution of Partial Differential Equations

5 Hrs.

Introduction to Partial Differential Equations, Deriving Difference Equations, Laplacian Equation and Poisson's Equation.

Laboratory Works

Laboratory works will consist of program development and testing of Non-linear Equations, Interpolation, Numerical Differentiation and Integration, Linear Algebraic Equations, Ordinary and Partial Differential Equations using C or C++Builder.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Text Books

1. C.F. Gerald and P.O. Wheatley, "Applied Numerical Analysis", 4th Edition, Addison Wesley Publishing Company, New York
2. S. S Sastry, "Introduction to Methods of Numerical Analysis",- Prentice- Hall India

Reference Books

1. W. Cheney and D. Kinciad, "Numerical Mathematics and Computing", 2nd edition, Brooks/Cole Publishing Co., 1985
2. W.H. Press, B.P. Flannery et. al., "Numerical Recipes in C", 1st Edition, Cambridge Press, 1998.

3. S. Yakwitz and F. Szidarovszky, "*An Introduction to Numerical Computations*",
2nd Edition, Macmillan Publishing Co., New York.
4. S.S. Sastry, "*Engineering Mathematics Volume two*", Prentice-Hall of India.



Course Title: **Software Engineering (3 Cr.)**
Course Code: **CACS253**
Year/Semester: **II/IV**
Class Load: **4 Hrs. / Week (Theory: 3 Hrs, Tutorial: 1)**

Course Description

This course includes the topics that provide fundamental concept and standard of software engineering so that students will be able to develop software and/or handle software project using the global standard of software.

Course Objectives

This Course is designed to provide the students with the basic competencies required to identify requirements, documents the system design and maintain a developed system. It presumes a general understanding of computers and programming which are covered in the first and second semester of the degree.

Course Contents

Unit 1 Introduction

4 Hrs.

Definition of Software, Type of Software, Characteristic of Software, Attributes of Good Software, Definition of Software Engineering, Software Engineering Costs, Key Challenges that Software Engineering Facing, System Engineering and Software Engineering, Professional Practice.

Unit 2 Software Development Process Model

8 Hrs.

Software Process, Software Process Model: The Waterfall Model, Evolutionary Development, Component-Based Software Engineering (CBSE); Process Iteration: Incremental Delivery, Spiral Development; Rapid Software Development: Agile Methods, Extreme Programming, Rapid Application Development, Software Prototyping; Rational Unified Process (RUP), Computer Aided Software Engineering (CASE): Overview of CASE Approach, Classification of CASE tools.

Unit 3 Software Requirement Analysis and Specification

10 Hrs.

System and Software Requirements, Type of Software Requirements: Functional and Non-Functional Requirements, Domain Requirements, User Requirements; Elicitation and Analysis of Requirements: Overview of Techniques, View Points, Interviewing, Scenarios, Use-Case, Ethnography, Requirement Validation, Requirement Specification, Feasibility.

Unit 4 Software Design

10 hrs.

Design Concept: Abstraction, Architecture, Patterns, Modularity: Cohesion, Coupling; Information Hiding, Functional Independence, Refinement; Architectural Design: Repository Model, Client Server Model, Layered Model, Modular Decomposition; Procedural Design Using Structured Methods, User

Interface Design: Human-Computer Interaction, Information Presentation, Interface Evaluation; Design Notation.

Unit 5 Coding

2 Hrs.

Programming Language and Development Tools, Selecting Languages and Tools, Good Programming Practices

Unit 6 Software Testing and Quality Assurance

6 Hrs.

Verification and Validation, Techniques of Testing: Black-box and White-box Testing, Inspections; Level of Testing: Unit Testing, Integration Testing, Interface Testing, System Testing, Alpha and Beta Testing, Regression Testing; Design of Test Cases, Quality Management Activities, Product and Process Quality, Standards: ISO9000, Capability Maturity Model (CMM);

Unit 7 Software Maintenance

3 Hrs.

Evolving Nature of Software, Different Types of Maintenance: Fault Repair, Software Adaptation, Functionality Addition or Modification; Maintenance Prediction, Re-Engineering, Configuration Management (CM): Importance of CM, Configuration Items, Versioning;

Unit 8 Managing Software Projects

2 Hrs.

Needs for the Proper Management of Software Projects, Management Activities: Project Planning, Estimating Costs, Project Scheduling, Risk Management, Managing People;

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
40	-	60 (3 Hrs.)	-	100

Course Title: Computer Graphics and Animation (3 Cr.)

Course Code: CACS305

Year/Semester: III/V

Class Load: 6 Hrs. / Week (Theory: 3Hrs. Tutorial: 1 Hrs., Practical: 2 Hrs.)

Course Description

This course is designed to extend students' knowledge and practice in Graphics hardware, software, and applications. It also provides the knowledge of data structures for graphics, graphics languages, and models for 2D and 3D objects, clipping, hidden surface elimination, depth buffer, raster graphics, shading, and rendering.

Course objectives

Upon completion of this course, students should be able to 1. Explain basic principle of computer graphics. 2. Develop 2D and 3D computer graphics applications. 3. Specify lighting and object's materials in computer graphics programming.

Course Contents

Unit 1: Introduction

6

1.1 Advantage of Computer Graphics and Areas of Applications

1.2 Hardware and Software for Computer Graphics. (Hard Copy, Display Technologies),

1.3 Random Scan Display System, Video Controller, Random Scan Display Processor

1.4 Raster Graphics

1.5 Scan Conversion Algorithms (Line, Circle, Ellipse)

1.6 Area Filling (Rectangle, Ellipse), Clipping (Lines, Circle, Ellipse), Clipping Polygons

Unit 2: Two dimensional and three dimensional transformations

7

2.1 2-Dimensional transformation

2.2 2-D Translation, Rotation, Scaling,

2.3 Homogeneous Coordinates, Reflection, Shear transform

2.4 3-dimensional transformation,

2.5 3-D Translation, Rotation Scaling, Reflection, Shear.

3 Unit 3: Clipping

7

3.1 Window to view port transformation

3.2 Clipping, line clipping,

3.3 Cohen –Sutherland line clipping

3.4 Polygon clipping

3.5 Sutherland and Gary Hodgman polygon clipping algorithm



Unit 4: Visible Surface Determination and computer graphics algorithm **15**

- 4.1 Image space and object space techniques
- 4.2 Hidden Surface removal—Depth comparison
- 4.3 Z-Buffer Algorithm
- 4.4 Back-Face Removal
- 4.5 The Painter's Algorithm
- 4.6 Scan-Line Algorithm
- 4.7 Light and Color and different color models (RGB,CMY, YIQ)

Unit 5: Animation and virtual reality **10**

- 5.1 Basic Principles of Animation and Types of Animation
- 5.2 Introduction to the flash interface
- 5.3 Setting stage dimensions, working with panels, panel layouts
- 5.4 Layers & Views
- 5.5 Shaping Objects – Overview of shapes, Drawing & Modifying Shapes
- 5.6 Bitmap Images & Sounds
- 5.7 Animation -Principles , Frame by frame animation, tweening, masks
- 5.8 Introduction to virtual reality

Laboratory Work

Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using Open GL.

Reference Books:

1. Foley, J. D., A. V. Dam, S. K. Feiner, J. F. Hughes, Computer Graphics Principle and Practices, Addison Wesley Longman, Singapore Pvt. Ltd.,
2. Hearn Donald, M. P. Baker, Computer Graphics, 2E, Prentice Hall of India Private Limited, New Delhi
3. Robert R & Snow D Flash CS4 Professional Bible, Wiley Publishing



Course Title: Computer Networking (3 Cr.)

Course Code: CACS303

Year/Semester: III/V

Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course offers detailed concept and structure of networking standards and principles. It includes introduction, functioning and significance of Physical Layer, Data Link Layer, Network Layer, Transport Layer, Application layer and some security mechanisms. It does not entirely focus on theoretical concept but also strongly focuses on practical skill based learning.

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of computer networking to make students capable of implementing, managing and troubleshooting the issues of computer network in their personal as well professional life.

Course Contents

Unit 1: Introduction

6 Hrs.

- 1.1 Network as an infrastructure for data communication
- 1.2 Applications of Computer network
- 1.3 Network Architecture
- 1.4 Types of computer Networks
- 1.5 Protocols and Standards
- 1.6 The OSI Reference Model
- 1.7 The TCP/IP Protocol Suite
- 1.8 Comparison between OSI and TCP/IP Reference model
- 1.9 Critiques of OSI and TCP/IP Reference model

Unit 2: The Physical Layer

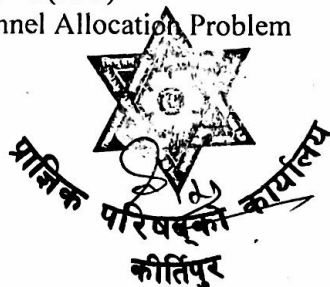
6 Hrs.

- 2.1 Functions of Physical Layer
- 2.2 Data and Signals: Analog and Digital signals, Transmission Impairment, Data Rate Limits, Performance
- 2.3 Data Transmission Media: Guided Media, Unguided Media and Satellites
- 2.4 Bandwidth Utilization: Multiplexing and Spreading
- 2.5 Switching: Circuit switching, Message switching & Packet switching
- 2.6 Telephone, Mobile and Cable network for data Communication

Unit 3: The Data Link Layer

8 Hrs.

- 3.1 Functions of Data Link Layer
- 3.2 Data Link Control: Framing, Flow and Error Control
- 3.3 Error Detection and Correction
- 3.4 High-Level Data Link Control(HDLC) & Point – to – Point protocol(PPP)
- 3.5 Channel Allocation Problem



- 3.6 Multiple Access: Random Access (ALOHA, CSMA, CSMA/CD, CSMA/CA), Controlled Access (Reservation, Polling, Token Passing), Channelization (FDMA, TDMA, CDMA)
- 3.7 Wired LAN: Ethernet Standards and FDDI
- 3.8 Wireless LAN: IEEE 802.11x and Bluetooth Standards
- 3.9 Token Bus, Token Ring and Virtual LAN
- Unit 4: The Network Layer** 8 Hrs.
- 4.1 Functions of Network Layer
- 4.2 Virtual circuits and Datagram Subnets
- 4.3 IPv4 Addresses: Address Space, Notations, Classful addressing, Classless addressing, Subnetting and Network Address Translation (NAT)
- 4.4 IPv4 Datagram format and fragmentation
- 4.5 IPv6 Address Structure and advantages over IPv4
- 4.6 Routing Algorithms: Distance Vector Routing, Link State Routing
- 4.7 Internet Control Protocols: ARP, RARP, ICMP
- 4.8 Routing protocols: OSPF, BGP, Unicast, Multicast and Broadcast
- Unit 5: The Transport Layer** 7 Hrs.
- 5.1 Functions of Transport Layer
- 5.2 Elements of Transport Protocols: Addressing, Establishing and Releasing Connection, Flow Control & Buffering, Error Control, Multiplexing & Demultiplexing, Crash Recovery
- 5.3 User Datagram Protocol (UDP): User Datagram, UDP Operations, Uses of UDP, RPC
- 5.4 Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocol, Go-Back-N (GBN), Selective Repeat (SR)
- 5.5 Transmission Control Protocol (TCP): TCP Services, TCP Features, TCP Segment Header
- 5.6 Principle of Congestion Control
- Unit 6: The Application Layer** 5 Hrs.
- 6.1 Functions of Application layer
- 6.2 Application Layer Protocols: DNS, DHCP, WWW, HTTP, HTTPS, TELNET, FTP, SMTP, POP, IMAP
- 6.3 Concept of traffic analyzer: MRTG, PRTG, SNMP, Packet tracer, Wireshark.
- Unit 7: Network Security** 5 Hrs.
- 7.1 A Model for Network Security
- 7.2 Principles of cryptography: Symmetric Key and Public Key
- 7.3 Public Key Algorithm – RSA
- 7.4 Digital Signature Algorithm
- 7.5 Communication Security: IPsec, VPN, Firewalls, Wireless Security.



Practical

1. Prepare hardware and software specification for basic computer system.
2. Determine the appropriate placement of networking devices on a network.
3. Identify networking cable standards. Create and test cross – over and straight cables.
4. Configure the IP address of the computer.
5. Create a basic network and share file and folders.
6. Install and configure windows server: Active Directory, User and Group Policy Management.
7. Set the file access permissions and quota in windows server.
8. Configure basic DNS and DHCP services in windows server.
9. Install Linux based OS and practice on basic Linux and networking commands.
10. Configure IP address and subnet in Linux Machine.
11. Install packet tracer and identify the features of packet tracer.
12. Implement the LAN topologies.
13. Demonstrate the use of VLAN.
14. Implement the both static and dynamic router configurations.
15. Install and configure DNS, DHCP, FTP and Web Servers in Linux machine.
16. Capture some packets and analyze the header using Wireshark.
17. Implement the firewall.

Teaching Methods

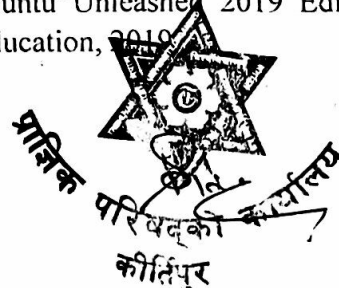
The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Reference Book

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks, 5/e", Prentice Hall, 2011.
2. Behrouz A. Forouzan, "Data Communications and networking" Tata McGraw-Hill.
3. Kurose, Ross, "Computer Networking: A Top-Down Approach", Pearson Education Limited, 2017.
4. Larry L. Peterson and Bruce S. Davie, "Computer Network: A System Approach", Morgan Kaufmann, 5/e, 2012.
5. Matthew Helmke, Andrew Hudson, Paul Hudson "Ubuntu Unleashed 2019 Edition_ Covering 18.04, 18.10, 19.04", 13/e, SAMS _ Pearson Education, 2019.



Course Title: **DotNet Technology (3 Cr.)**

Course Code: **CACS302**

Year/Semester: **III/V**

Class Load: **6 Hrs. / Week (Theory: 3 Hrs., Practical: 3 Hrs.)**

Course Description:

This course covers different concepts of .NET framework. It also covers basic to advanced features of C# language including language basics, creating types and inheritance, delegates, events, lambda expressions, LINQ, working with databases, and developing web applications using ASP.NET.

Course Objectives:

The primary objective of this course is to provide concepts of .NET framework and different concepts of C# programming language and make students familiar with their uses and applications.

Course Contents:

Unit 1: Introducing C# and the .NET Framework (7 Hrs.)

Object Orientation; Type Safety; Memory Management; Platform Support; C# and CLR; CLR and .NET Framework; Other Frameworks; Framework Overview; .NET Standard 2.0; Applied Technologies

Unit 2: The C# Language Basics (12 Hrs.)

Writing Console and GUI Applications; Identifiers and Keywords; Writing Comments; Data Types; Expressions and Operators; Strings and Characters; Arrays; Variables and Parameters; Statements (Declaration, Expression, Selection, Iteration, and Jump Statements); Namespaces

Unit 3: Creating Types in C# (12 Hrs.)

Classes; Constructors and Deconstructors; this Reference; Properties; Indexers; Static Constructors and Classes; Finalizers; Dynamic Binding; Operator Overloading; Inheritance; Abstract Classes and Methods; base Keyword; Overloading; Object Type; Structs; Access Modifiers; Interfaces; Enums; Generics

Unit 4: Advanced C# (14 Hrs.)

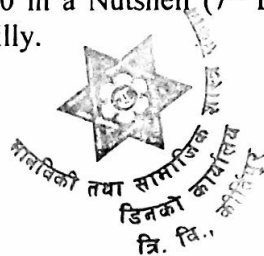
Delegates; Events; Lambda Expressions; Exception Handling; Introduction of LINQ; Working with Databases; Writing Web Applications using ASP.NET

Laboratory Work: The laboratory work includes writing console and/or GUI programs in C#

- To implement basic language features
- To create classes and objects and to implement different object-oriented features
- To implement inheritance
- To implement advanced features like delegates, event handling, lambda expressions, exception handling
- To implement LINQ and database applications

Text Books:

1. C# 7.0 in a Nutshell (7th Edition), the Definitive Reference, Joseph Albahari & Ben Albhari, O'Reilly.



2. Microsoft Visual C# Step by Step (9th Edition), John Sharp, Pearson Education.

Reference Books:

1. C# 7.0 All-in-One For Dummies (1st Edition), John Paul Mueller, Bill Sempf, Chuck Sphar, John Wiley & Sons, Inc.
2. Professional C# 7 and .NET Core 2.0 (7th Edition), Christian Nagel, John Wiley & Sons, Inc.

Teaching Methods:

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation:

Internal Assessment Format [FM = 20] – Subject Teacher				
Term Examination		Assignment	Attendance	Total
Mid-Term	Pre-Final			
5	5	5	5	20
Practical Assessment Format [FM = 20] – External Examiner will be assigned by Dean Office, FOHSS.				
Practical	Viva	Lab Reports	Total	
10	5	5	20	

Note: Assignment may be subject specific case study, seminar paper preparation, report writing, project work, research work, presentation, problem solving etc.

Final Examination Questions Format [FM = 60, Time = 3 Hrs.]

SN	Question Type	Number of Questions	Marks per Question	Total Marks
1	Group – 'A' Objective Type Questions (Multiple Choice Questions) Attempt all the questions.	10	1	10 x 1 = 10
2	Group – 'B' Short Questions (Attempt any SIX questions.)	7	5	6 x 5 = 30
3	Group – 'C' Long Questions (Attempt any TWO questions.)	3	10	2 x 10 = 20



Course Title: **Introduction to Management (3 cr.)**

Course code: **CAMG 304**

Year/Semester: **III /V**

Class load: **3 Hrs./Week (Theory: 3Hrs)**

Course Objectives

This course aims to impart the basic management knowledge, and skills to the students so as to enhance their managerial capabilities and enable them to apply in the practical field.

Course Description

This course contains Introduction to Management, perspectives in management thought, emerging issues and challenges in management, management functions like planning, leading, controlling, organizational change and development, communication, emerging issues in quality management, technology and management.

Course Contents

Unit 1: Introduction

LH 4

Management: concepts, meaning and functions. Types of managers. Managerial roles and skills. Organization and management. Changing perspectives of organization.

Unit 2: Perspectives in Management

LH 7

Classical Perspective: scientific management, administrative management and bureaucracy. Behavioral Perspective: Hawthorne studies, human relations movement, and emergence of organizational behavior. Quantitative Perspective: management science and operations management. Integrating perspectives: systems and contingency perspectives. Emerging management issues and challenges.

Unit 3: Planning and decision making

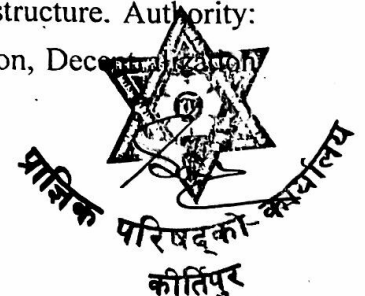
LH 7

Concept of planning, Levels of Planning: Strategic, Tactical and operational. Steps in Planning. Tools for planning. Decision Making: meaning, types and process. Decision making conditions – certainty, risk and uncertainty.

Unit 4: Organizing

LH 9

Concept of organizing, process and principles of organizing. Organization Architecture: vertical differentiation – tall versus flat hierarchies, horizontal differentiation – functional structure, multidivisional structure, geographic structure, and matrix structure. Authority: line authority and staff authority. Delegation of authority. Centralization, Decentralization



and Devolution: meaning, reasons, advantages and disadvantages. Staffing: concept and importance.

Unit 5: Leading and communication

LH 7

Concept and qualities of leadership. Transformational and transactional leadership, Leadership Styles: autocratic, democratic, and participative. Concept of managerial ethics. Motivation: concept, importance, and techniques. Communication: meaning, process, and networks. Types of communication, Barriers to effective communication.

Unit 6: Controlling and total quality management

LH 5

Concept, purpose, Process and types of controls. Essentials of effective control systems. Control tools and techniques. Quality: Concept and importance. Total Quality Management: concept, components, principles, tools and techniques. Emerging issues in quality management.

Unit 7: Organizational Change and Development

LH 5

Concept and nature, forces, paradigm shifts and areas (structure, technology, business process and behaviors) of organizational change. Resistance to change. Overcoming resistance to change. Concept of Organizational Development

Unit 8: Technology, Organization and Management

LH 4

Concept of technology, approaches to technology and organization, social networking, use of technology in people management,

References

Charles W.L. Hill and Steven L. McShane, *Principles of Management*, Tata Mc-Graw-Hill Company, New Delhi.

Griffin, Ricky W., *Management*. AITBS Publishers and Distributors, New Delhi.

Hitt, M.A., J.S. Black and Porter, L.W., *Management*, Pearson Education, New Delhi

Laurie J. M. *Management and organizational Behaviour*, Pearson, New Delhi

Evaluation:

Internal Assessment: 40 marks

External Assessment: 60 marks

Total: 100 marks

Teaching methods: The major teaching methods include the case analysis, project work, term paper, assignments, and quiz. The instructor decides the learning strategies based on the nature of session/class.



Course Title: MIS and E-Business

Course Code: CACS301

Year/Semester: III/V

Class Load: 5Hrs. /Week (Theory: 3Hrs, Practical 2Hrs.)

Course Description

This course provides the fundamental knowledge of Management Information System and E-Business and its associated infrastructure, security and protection issues, payment system and ultimately live implementation of any web application in Web server.

Objectives: The general objectives of this course is to know fundamental knowledge of MIS/E-Business and implement the web application in Web Server.

Unit 1:

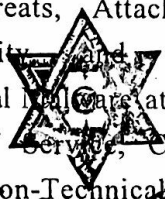
Introduction to E-Commerce: Definitions and Concepts; Defining E-Business; Pure Versus Partial EC; EC Framework, Classification of EC; Benefits of E-Commerce; Electronic Markets; Role of Internet and Web in E-Commerce; The Limitations and Barriers of EC; Social Networks and Social Network Services; **M-Commerce:** Concept, Scope, Attributes, Benefits; Location-based I-commerce, I-Commerce Infrastructure, Location-Based Services and Applications. 7LH

Unit 2:

The Network Infrastructure for E-Commerce: Introduction to Information Superhighway (I-Way), Components of the I-Way, Internet as a network infrastructure. **Wireless Application Protocol:** Wireless Application Protocol (WAP); Architecture of WAP; Working of WAP; Wireless Technologies: ADSL, WiMAX, WLAN, WMAN Wi-Fi, UMTS (3G), LTE (4G), (5G NR). Security Issues related to Wireless Communications. 8LH

Unit 3: Introduction to Management Information System: Data, information, computer based information system (CBIS), Information System Resources, Management information system, Transaction processing (TPS) system, decision support system (DSS), and executive information system (EIS), **SCM, CRMS and International Systems:** Introduction, Supply Chain Management Systems, Customer Relationships Management Systems, enterprise systems and Challenges of Enterprise Systems Implementations- Managing the implementation, International Information Systems-Outsourcing and off-shoring. 8LH

Unit 4: E-Commerce Security and Fraud Issues and Protections: Basic EC Security Terminology, The Threats, Attacks, and Attackers, **EC Security Requirements:** Confidentiality, Integrity, and Availability, Authentication, Authorization and Nonrepudiation; Technical Malware attack: Viruses, Worms, and Trojan Horses, Heartbleed, Distributed Denial of Service, Cryptoblocker, Page hijacking, Botnets, Malvertising, ransomware, sniffing; Non-Technical Malware attack: Social Phishing, Pharming, Identity



कीतिपुर

Theft and Identify Fraud, Spam Attacks; EC defense Strategy: access control(Authorization and Authentication, Biometric Systems), encryption and PKI (Symmetric Key Encryption, Asymmetric Key Encryption, Certificate Authority(CA), Secure Socket Layer (SSL). Securing e-commerce networks: Firewalls, Virtual Private Networks, Intrusion Detection Systems (IDS), intrusion prevention System (IPS). **10LH**

Unit 5: E-payment systems:

Online payment cards (credit cards, charge cards, debit cards, smart cards), processing cards in online, credit card payment procedure, e-micropayments, e-checking and its processing in online. Automated clearing house (ACH) network, mobile payments (Digital wallet), mobile payment participants and issues, international payments, emerging EC payment systems and issues: crypto currency, virtual currency. A case study of emerging trends in online payment system in Nepal. **6 LH**

Unit 6: Launching a Successful EC Website:

Planning Online Businesses (Business Plan, The cost-benefit, risk elements of a business case, funding a New Online Business, EC Model selection), The process of building a website, basic hierarchical website structure, website hosting and obtaining a domain name (cPanel management, upload EC site to the web Server), web content creation and management: (Web content, Categories and Types of Content, Content Management and Maintenance, Catalog Content and its Management), Website design criteria, Site Map and Navigation, Web page layout grid, Colors and Graphics, Website Usability, Performance, Website Promotion, implementation of Payments system, Website Promotion, Search Engine Optimization (SEO). **10LH**

Laboratory Works:

32LH

Laboratory works should be done covering all the topics listed above and a project work should be carried out by individually implementing a fully functioning e-commerce web application along with payment system.

Text Book

Efraim Turban, D. K. (2018). *Electronic Commerce: A Managerial and Social Networks Perspective*. New York: Springer

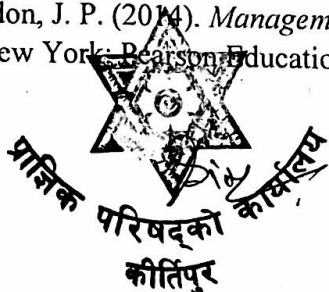
References Book

Chaffey, D. (2009). *E-Business and E-Commerce Management: Strategy, Implementation and Practice (4th Edition)*. Harlow: Prentice Hall.

Kalakota, A. B. (1996). *Frontiers of Electronic Commerce*. Pearson.

Kenneth C. Laudon, C. G. (2014). *E-commerce: business.technology.society*. New York: Pearson Education Limited.

Kenneth C. Laudon, J. P. (2014). *Management Information System: MANAGING THE DIGITAL FIRM*. New York: Pearson Education Limited.



Course Title: **Mobile Programming (3 Cr.)**

Course Code: **CACS351**

Year/Semester: **III/VI**

Class Load: **6Hrs. /Week (Theory: 3Hrs, Practical 3Hrs.)**

Course Description

This course provides the comprehensive knowledge related to the Mobile programming, which encompasses integrated development environment, infrastructure, design, and develop and testing of mobile application, which communicate with database to solve real word problem.

Objectives: The general objectives of this course is to develop mobile application that solve real word problem with use of current mobile technology.

Unit -1

Introduction to Mobile and Mobile Programming [2 HRS]

Mobile Device (Features, Categories, History, Brands, Models and Platforms), Introduction to Mobile Programming.

Unit -2

Introduction to Android Programming [4 HRS]

Android Platform, History of Android, Environment Setup, Creating an android project, Laying out the user interface (The view hierarchy, widget attributes, creating string resources, previewing the layout), Creating a new class, Setting up the project, Running on the Emulator.

Unit -3

Designing the User Interface [5 HRS]

Android layout types (Linear, Relative, Table, Absolute, Constraint), Layout attributes, Android widgets (Textview, Edittext, Checkbox, Radiobutton, Spinner etc.) and its attributes, Event Handling, working with string, string array and colors, working with resources and drawable, adding icon to the project.

Unit -4

Android Activity [4 HRS]

The Activity life cycle, Creating multiple activities, Declaring activities in the manifest, Connecting activities with intents, Passing data between activities, Getting a result back from a child activity, Getting and setting data to/from the layout file.

Unit -5

UI Fragments, Menus and Dialogs [6 HRS]

The need for UI flexibility, Introduction to fragments, Lifecycle of fragment, Creating a UI fragment, Creating a fragment class, Wiring widgets in fragment, Introduction to fragment manager, Difference between Activity and Fragments. Menus (Introduction, Types, Implementing menu in an application) Dialogs (Introduction, Creating a dialog fragment, Setting a dialog's content)



Unit -6

Listview, Gridview and Recyclerview [6 HRS]

Listview (Introduction, Features, Implementing listview in an application)

Gridview (Introduction, Features, Implementing gridview in an application)

Recyclerview (Introduction, Features, Implementing recyclerview in an application)

Unit -7

Advance Android Concepts [10 HRS]

Local database with SQLite (Establishing connection, creating database and tables, data manipulation), Introduction to API, API Types, Introduction to JSON, Retrieving contents from remote server, Sending contents to remote server, Implementing Google Maps in android application, Procedure for publishing application on Google Play Store.

Unit -8

Introduction to ios Programming [8 HRS]

Introduction to ios and ios programming, ios platform, Environment setup, Creating an Xcode project, Building the interface, Making connections, Running on the simulator.

Introduction to Swift language, Views and the view hierarchy, Storyboard and view controllers, working with widgets and its attributes, Creating a simple ios application.

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course. Project should be assigned on individual basis.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

References

1. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, *Android Programming: The Big Nerd Ranch Guide*, Big Nerd Ranch LLC, 2nd edition, 2015.
2. Christian Keur and Aaron Hillegass, *iOS Programming: The Big Nerd Ranch Guide*, 5th edition, 2015.
3. Brian Fling, *Mobile Design and Development*, O'Reilly Media, Inc., 2009.
4. Maximiliano Firtman, *Programming the Mobile Web*, O'Reilly Media, Inc., 2nd ed., 2013.



Course Title: Distributed Systems (3 Cr.)

Course Code: CACS352

Year/Semester: III/VI

Class Load: 4 Hrs. / Week (Theory: 3Hrs. Tutorial: 1 Hr.)

Course Description

The course introduces basic knowledge to give an understanding how modern distributed systems operate. The focus of the course is on distributed algorithms and on practical aspects that should be considered when designing and implementing real systems. Some topics covered during the course are causality and logical clocks, synchronization and coordination algorithms, transactions and replication, and end-to-end system design. In addition, the course explores recent trends exemplified by current highly available and reliable distributed systems.

Course objectives

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

Course Contents

Unit 1. Introduction	4 Hrs.
1.1 Characteristics	
1.2 Design Goals	
1.3 Types of Distributed Systems	
1.4 Case Study: The World Wide Web	
Unit 2. Architecture	4 Hrs.
2.1 Architectural Styles	
2.2 Middleware organization	
2.3 System Architecture	
2.4 Example Architectures	
Unit 3. Processes	6 Hrs.
3.1 Threads	
3.2 Virtualization	
3.3 Clients	
3.4 Servers	
3.5 Code Migration	
Unit 4. Communication	5 Hrs.
4.1 Foundations	
4.2 Remote Procedure Call	
4.3 Message-Oriented Communication	
4.4 Multicast Communication	
4.5 Case Study: Java RMI and Message Passing Interface (MPI)	
Unit 5. Naming	5 Hrs.
5.1 Name Identifiers, and Addresses	
5.2 Structured Naming	



5.3 Attribute-based naming	
5.4 Case Study: The Global Name Service	
Unit 5. Coordination	7 Hrs.
6.1 Clock Synchronization	
6.2 Logical Clocks	
6.3 Mutual Exclusion	
6.4 Election Algorithm	
6.5 Location System	
6.6 Distributed Event Matching	
6.7 Gossip-based coordination	
Unit 7. Consistency and Replication	5 Hrs.
7.1 Introduction	
7.2 Data-centric consistency models	
7.3 Client-centric consistency models	
7.4 Replica management	
7.5 Consistency protocols	
7.6 Caching and Replication in Web	
Unit 8. Fault Tolerance	5 Hrs.
8.1 Introduction to fault tolerance	
8.2 Process resilience	
8.3 Reliable client-server communication	
8.4 Reliable group communication	
8.5 Distributed commit	
8.6 Recovery	
Unit 9. Security	4 Hrs.
9.1 Introduction to security	
9.2 Secure channels	
9.3 Access control	
9.4 Secure naming	
9.5 Security Management	

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation System

Examination Scheme		
Internal Assessment	External Assessment	Total
40%	60% (3 Hrs.)	100%



References:

1. A.S. Tanenbaum, M. VanSteen, "Distributed Systems", Pearson Education.
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and Design", Third Edition, Pearson Education.
3. Mukesh Singhal, "Advanced Concepts in Operating Systems", McGraw-Hill Series in Computer Science.
4. Ajay D. Kshemkalyani, Mukesh Singhal, "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press
5. Christian Cachin, Rachid Guerraoui, Luís, "Introduction to Reliable and Secure Distributed Programming", Springer



Course Title: **Advanced Java Programming (3 Cr.)**

Course Code: **CACS354**

Year/Semester: **III/VI**

Class Load: **6 Hrs. / Week (Theory: 3 Hrs., Practical: 3 Hrs.)**

Course Description:

This course covers advanced features of Java programming language including, GUI programming, database programming, JavaBeans, JSP, Servlet, and Remote Method Invocation (RMI).

Course Objectives:

The primary objective of this course is to provide concepts of advanced features of Java programming and make students familiar with their uses and applications.

Course Contents:

Unit 1: GUI Programming (12 Hrs.)

Introducing Swing; Creating a Frame; Displaying Information in a Component; Working with 2D Shapes; Using Color; Using Special Fonts for Text; Displaying Images; Event Handling: Event Handling Basics, Event Classes, Event Listeners and Adapter Classes; Swing and the MVC Design Pattern; Layout Management; Basic Swing Components

Unit 2: Database Programming (7 Hrs.)

The Design of JDBC: JDBC Driver Types and Typical Uses of JDBC; the Structured Query Language; JDBC Configuration; Working with JDBC Statements; Query Execution; Scrollable and Updatable Result Sets; Row Sets

Unit 3: JavaBeans (7 Hrs.)

What Is a Java Bean? Advantages of Java Beans; Introspection; Properties, Events, and Methods Design Patterns; Using BeanInfo Interface; Bound and Constrained Properties; Persistence; Customizers; the Java Beans API; Writing JavaBeans

Unit 4: Servlets and JSP (14 Hrs.)

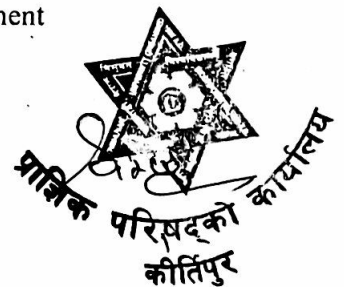
Background; The Life Cycle of a Servlet; A Simple Servlet; The Servlet API; The javax.servlet Package; Reading Servlet Parameters; The javax.servlet.http Package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking; Introduction to JSP; Using JSP; Comparing JSP with Servlet; Java Web Frameworks

Unit 5: RMI (5 Hrs.)

What is RMI? The Roles of Client and Server; Remote Method Calls; Stubs and Parameter Marshalling; the RMI Programming Model; Interfaces and Implementations; the RMI Registry; Parameters and Return Values in Remote Methods; Remote Object Activation; Simple Client/Server Application using RMI; Comparing RMI with CORBA

Laboratory Work: The laboratory work includes writing Java programs

- To create GUI applications using swing, event handling, and layout management
- To create applications to work with databases
- To create JavaBeans



- To create server side web programs using Servlet and JSP
- To create distributed applications using RMI

Text Books:

1. Core java Volume I – Fundamentals, Tenth Edition, Cary S. Horstmann, Prentice Hall
2. Core java Volume II – Advanced Features, Tenth Edition, Cary S. Horstmann, Prentice Hall
3. Java: The Complete Reference, 10th, Herbert Schildt, McGraw-Hill

Reference Books:

1. Advanced Java Programming, Uttam K. Roy, Oxford University Press
2. Java: Advanced Features and Programming Techniques, Nathan Clark

Teaching Methods:

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation:

Internal Assessment Format [FM = 20] – Subject Teacher				
Term Examination		Assignment	Attendance	Total
Mid-Term	Pre-Final			
5	5	5	5	20

Practical Assessment Format [FM = 20] – External Examiner will be assigned by Dean Office, FOHSS.				
Practical	Viva	Lab Reports	Total	
10	5	5	20	

Note: Assignment may be subject specific case study, seminar paper preparation, report writing, project work, research work, presentation, problem solving etc.

Final Examination Questions Format [FM = 60, Time = 3 Hrs.]

SN	Question Type	Number of Questions	Marks per Question	Total Marks
1	Group – 'A' Objective Type Questions (Multiple Choice Questions) Attempt all the questions.	10	1	10 x 1 = 10
2	Group – 'B' Short Questions (Attempt any SIX questions.)	7	5	6 x 5 = 30
3	Group – 'C' Long Questions (Attempt any TWO questions.)	3	10	2 x 10 = 20



Course Title: Network Programming (3 Cr.)

Course Code: CACS355

Year/Semester: III/VI

Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course is designed to extend students' knowledge and practice in analysis and design of computer networks by focusing on computer network programming. It includes introduction, Internet Address, URLs and URIs, HTTP, URLConnections, Socket Programming, IP Multicast and RMI. The JAVA programming language will be used throughout the course. It does not entirely focus on theoretical concept but also strongly focuses on practical skill based knowledge.

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of network programming to make students capable of developing, implementing, managing and troubleshooting the issues of network programming in their personal as well professional life.

Course Contents

- | | |
|---|---------------|
| Unit 1: Introduction | 3 Hrs. |
| 1.1 Network Programing Features and Scope | |
| 1.2 Network Programming Language, Tools & Platforms | |
| 1.3 Client and Server Applications | |
| 1.4 Client server model and software design | |
| Unit 2: Internet Addresses | 4 Hrs. |
| 2.1 The InetAddress Class: Creating New InetAddress Objects, Getter | |
| 2.2 Methods, Address Types, Testing Reachability and Object Methods | |
| 2.3 Inet4Address and Inet6Address | |
| 2.4 The Network Interface Class: Factory Method & Getter Method | |
| 2.5 Some Useful Programs: SpamCheck, Processing Web Server Logfiles | |
| Unit 3: URLs and URIs | 5 Hrs. |
| 3.1 URIs: URLs and Relative URLs | |
| 3.2 The URL Class: Creating New URLs, Retrieving Data From a URL, Splitting a URL into Pieces, Equality & Comparison and Conversion | |
| 3.3 The URI Class: Constructing a URI, The Parts of the URI, Resolving Relative URIs, Equality & Comparison and String Representation | |
| 3.4 x-www-form-urlencoded: URL Encoder and URL Decoder | |
| 3.5 Proxies: System Properties, The ProxyClass and The ProxySelector Class | |
| 3.6 Communicating with Server-Side Programs Through GET | |
| 3.7 Accessing Password-Protected Sites: The Authenticator Class, The PasswordAuthentication Class and The JPasswordField Class | |
| Unit 4: HTTP | 2 Hrs. |
| 4.1 The protocol: Keep-Alive | |
| 4.2 HTTP Methods | |
| 4.3 The Request Body | |



4.4 Cookies: CookieManager and CookiesStore	
Unit 5: URLConnections	5 Hrs.
5.1 Opening URLConnections	
5.2 Reading Data from Server	
5.3 Reading Header: Retrieving specific Header Fields and Retrieving Arbitrary Header Fields	
5.4 Cache: Web Cache for Java	
5.5 Configuring the Connection: protected URL url, protected boolean connected, protected boolean allowUserInteraction, protected boolean doInput, protected boolean doOutput, protected boolean ifModificationSince, protected boolean useCaches and Timeouts	
5.6 Configuring the Client Request HTTP Header	
5.7 Security Considerations for URLConnections	
5.8 Guessing MIME Media Types	
5.9 HttpURLConnection: The Request Methods, Disconnecting from the Server, Handling Server Responses, Proxies and Streaming Mode	
Unit 6: Socket for Clients	5 Hrs.
6.1 Introduction to Socket	
6.2 Using Sockets: Investigating Protocols with telnet, Reading from Servers with Sockets, Writing to Servers with Sockets	
6.3 Constructing and connecting Sockets: Basic Constructors, Picking a Local Interface to Connect From, Constructing Without Connecting, Socket Addresses and Proxy Servers	
6.4 Getting Information about a Socket: Closed or Connected?, toString()	
6.5 Setting Socket Options: TCP_NODELAY, SO_LINGER, SO_TIMEOUT, SO_RCVBUF and SO_SNDBUF, SO_KEEPALIVE, OOBINLINE, SO_REUSEADDR and IP_TOS Class of Services	
6.6 Socket in GUI Applications: Whois and A Network Client Library	
Unit 7: Socket for Servers	5 Hrs.
7.1 Using ServerSockets: Serving Binary Data, Multithreaded Servers, Writing to Servers with Sockets and Closing Server Sockets	
7.2 Logging: What to Log and How to Log	
7.3 Constructing Server Sockets: Constructing Without Binding	
7.4 Getting Information about Server Socket	
7.5 Socket Options: SO_TIMEOUT, SO_RCVBUF, SO_REUSEADDR and Class of Service	
7.6 HTTP Servers: A Single File Server, A Redirector and A Full-Fledged HTTP Server	
Unit 8: Secure Socket	4 Hrs.
8.1 Secure Communication	
8.2 Creating Secure Client Sockets	
8.3 Event Handlers	
8.4 Session Management	
8.5 Client Mode	
8.6 Creating Secure Server Socket	



8.7 Configure SSLServerSockets: Choosing the Cipher Suits, Session Management and Client Mode

Unit 9: Nonblocking I/O

3 Hrs.

9.1 An Example Client and Server

9.2 Buffers: Creating Buffers, Filling and Draining, Bulk Methods, Data Conversion, View Buffers, Compacting Buffers, Duplicating Buffers, Slicing Buffers, Marking and Resetting, Object Methods

9.3 Channels: SocketChannel, ServerSocketChannel, The Channels Class, Asynchronous Channels, Socket Options

9.4 Readiness Selection: The Selector Class, The SelectionKey Class

Unit 10: UDP

5 Hrs.

10.1 UDP Protocol

10.2 UDP Clients

10.3 UDP Servers

10.4 The DatagramPacket Class: The Constructor, The get Methods, The setter Methods

10.5 The DatagramSocket Class: The Constructor, Sending and Receiving Datagrams, Managing Connections

10.6 Socket Options: SO_TIMEOUT, SO_RCVBUF, SO_SNDBUF, SO_RUMEMADDR, SO_BROADCAST and IP_TOS

10.7 UDP Applications: Simple UDP Clients, UDP Server and A UDP Echo Client

10.8 DatagramChannel: Using DatagramChannel

Unit 11: IP Multicast

2 Hrs.

11.1 Multicasting: Multicast Address and Groups, Clients and Servers, Routers and Routing

11.2 Working with Multicast Sockets: The Constructor, Communicating with a Group

Unit 12: Remote Method Invocation (RMI)

2 Hrs.

12.1 Defining and Implementing RMI Service Interface

12.2 Creating an RMI Server and Client

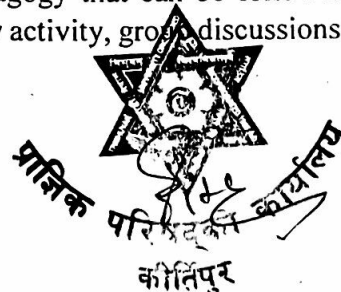
12.3 Running the RMI System

Laboratory Work

Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using Java programming Language.

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies,



guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Reference Books:

1. Elliott Rusty Harold, "Java Network Programming", O'Reilly, 2014.
2. Douglas E. Comer, David L. Stevens, "Internetworking with TCP_IP, Vol. III_ Client-Server Programming and Applications, Linux_Posix Sockets Version" Addison-Wesley, 2000.
3. David Reilly, Michael Reilly, "Java Network Programming and Distributed Computing", Addison-Wesley Professional, 2002
4. Kenneth L. Calvert, Michael J. Donahoo, "TCP-IP Sockets in Java. Practical Guide for Programmers", Morgan Kaufmann, 2008.
5. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks, 5/e", Prentice Hall, 2011.
6. Kurose, Ross, "Computer Networking: A Top-Down Approach", Pearson Education Limited, 2017.



Course Title: Applied Economics (3 Cr.)

Course Code: CAEC353

Year/ Semester: III/VI

Class Load: 3 Hrs./Week (Theory: 3 Hrs.; Tutorial: 1Hr.)

Course Description

This course of Applied Economics consists of the introduction to economic theories and application. It consists of theory of demand and supply, theory of consumer's behavior, theory of production, cost and revenue curves, theory of product pricing and factor pricing as well as contemporary macroeconomics like national income accounting, money banking and international trade with reference to Nepal.

Course Objective

This course of Applied Economics aims to enhance understanding of the economic theories and application to develop skills of students in personal and professional decision making related to business, IT and management.

Unit 1: Introduction

6 Hrs.

- a. Concept and types of microeconomics and macroeconomics
- b. Distinction between microeconomics and macroeconomics
- c. Goals and instruments of macroeconomics

Unit 2: Elasticity of Demand and Supply

6 Hrs.

- a. Concept and types of price, income and cross elasticity of demand
- b. Measurement of price, income and cross elasticity of demand: Total outlay method and Point method
- c. Uses of price, income and cross elasticity
- d. Concept of elasticity of supply and its measurement
(Numerical exercise using excel)

Unit 3: Theory of Consumer Behavior

6 Hrs.

- a. Concept of cardinal and ordinal utility analysis
- b. Cardinal utility analysis: assumptions, consumer's equilibrium, criticisms and derivation of demand curve
- c. Ordinal utility Analysis: Concept, properties of Indifference curve, marginal rate of substitution, Price Line and consumer's equilibrium, Price effect: Derivation of PCC, Income effect: Derivation of ICC, Substitution effect, Decomposition of price effect into income and substitution effect, Derivation of demand curve (Hicksian approach)
(Numerical exercise)

Unit 4: Cost and Revenue Curves

6 Hrs.

- a. Concept of cost: actual cost and opportunity cost, implicit cost and explicit cost, accounting and economic cost.
- b. Derivation of short run and long run cost curves (total, average, marginal) and shape of short run and long run average cost curves.
- c. Relationship between short run and long run AC and MC curves



- d. Concept of revenue: total revenue, average revenue, and marginal revenue, revenue curves under perfect and imperfect competition, relation between average and marginal revenue
(Numerical exercise using excel)

Unit 5: Market Structure

9 Hrs.

- Perfect competition-** meaning and characteristics of perfect competition, short run and long run equilibrium of the firm and industry (TR-TC approach and MC-MR approach), derivation of short run and long run supply curve of a firm and industry.
- Monopoly:** Meaning and characteristic of monopoly; pricing under monopoly: equilibrium of firm in short run and long run (TR-TC approach and MC-MR approach); Price discrimination and degree of price discrimination.
- Monopolistic Competition:** Meaning and characteristics of monopolistic competition; Pricing under monopolistic competition: equilibrium of firm in short run and long run; equilibrium of firm under product variation and selling expenses
- Oligopoly:** Meaning and characteristic of oligopoly; Pricing under cartel (aiming at joint profit maximization)

(Numerical exercise using excel)

Unit 6: National Income Accounting

6 Hrs.

- Circular flow of income and expenditure in two sector, three sector and four sector economy
- Meaning and different concept of national income: GDP, NDP, GNP, NNP, national income at factor cost (NI), personal income (PI), disposable personal income (DI), per capita income (PCI)
- Real and nominal GDP, GDP deflator
- Computation of National income: Product, Income and Expenditure method

(Numerical exercise using excel)

Unit 7: Money, Banking and International Trade

6 Hrs.

- Concept and functions of money- value of money-money supply –components of money supply (M_1 , M_2 , etc.)
- Inflation : Types, causes and effects of inflation
- Banking: role and functions of commercial banks , role and functions of central bank with reference to Nepal Rastra Bank
- International Trade: Distinction between internal and international trade, balance of trade and balance of payment.



Reference Books

Ackley, Gardener. (1978). *Macroeconomics: Theory and Policy*. New York: Mac Milan Publishing Co.

Caves, Frankel, Jones, *World Trades and Payments: (9th Ed.)* Pearson Education

Dominick Salvatore, *International Economics: (8th Ed.)* . Wiley India.

Dwivedi, D.N. (2001). *Macroeconomic Theory and Policy*. Tata McGraw-Hill Publishing Company Limited, New Delhi

G, Mankiw. (2007). *Economics: Principles and Applications*. South Western of Cengage Learning.

Gupta, S.B. *Monetary Economics*, S.Chand & Co;New Delhi.

Koutsoyianis, A. (1991). *Modern Microeconomics*. Hongkong: ELBS

Lipsey and Chrystal. *Economics*. Oxford University Press. (eleventh edition or latest one).

Mankiw, N. Gregory. (2009). *Principles of Microeconomics*. Cengage Learning India Private Limited, New Delhi (4th edition)

P. Samuelson and W. Nordhaus. *Economics*, Mc GrawHill International Editions. (14th edition or latest one)

Paul R. Krugman, Maurice Obstfeld, *International Economics: (8th Ed.)* Pearson Education

Pindyck, Robert S. and Daniel, Rubinfeld. (2001). *Microeconomics*. New Delhi: Prentice Hall of India

Salvatore, Dominic. (2009). *Principles of Microeconomics*. Publish in India Oxford University Press, New Delhi

Shapiro, Edward. (2004). *Macroeconomic Analysis*. New Delhi: Galgotia Publication (P) Ltd.

Practical Works

Excel or other relevant statistical software should be used to compute numerical exercise.

Teaching Methods:

The general teaching pedagogy includes class lectures, presentations, group works, case studies, guest lectures research works, project works, assignments (Theoretical and practical). The teaching faculty will determine the choice of teaching pedagogy and statistical tools as per the requirements of topics.



Evaluation

Examination Scheme				Total
Internal Assessment (40)		External Assessment (60)		100
Theory	Practical	Theory	Practical	
30	10	40	20	



Course Title: Project II (2 Cr.)
Course Code: CAPJ356
Year/Semester: III/VI
Class Load: 4 Hrs. / Week (Practical: 4 Hrs.)

Course Description

To develop small scale project based on the application development platforms and tools (JAVA, visual c++, PHP , Python or plate form of any current trend. This course provides practical skill based knowledge.

Course objectives

The objectives of this course are to provide project management skills (developing, implementing, managing collaboration) and to learn working as a team. The student will also learn about formulating project documentation.

Course Contents

Unit 1: Project Ideas and proposal guidance	4
1.1 Project concept and Scope	
1.2 Proposal writing techniques	
Unit 2: Application Development	8
2.1 Object oriented programming	
2.2 Frameworks and APIs	
2.3 Programming design patterns	
2.4 Data collection for project	
2.5 Application of GPUS	
Unit 3: Project management, team work and collaboration	8
3.1 Project management techniques	
3.1.1 Develop project management plan	
3.1.2 Project implementation, monitor and control	
3.2 Collaborative development environment	
3.2.1 Communications planning process	
3.2.2 Organizing and conducting effective meeting,	
Unit 4: Project Guidance	5
Unit 5: Project work	30



Unit 6: Project documentation guidance

5

- 4.1 documentation format
- 4.2 Table writing format
- 4.3 Figure writing format
- 4.4 Writing equation
- 4.5 References and citation techniques
- 4.6 Abstract writing

Reference Books:

1. The Project Manager's Guide to Software Engineering's Best Practices, M. C. Christensen and R.H. Thayer, IEEE computer Society
2. Angelika H. Hofmann, " Scientific Writing and Communication: Papers, Proposals, and Presentations Oxford University Press; 3 edition (November 17, 2016)



Course Name: Cyber Law & Professional Ethics (3 Cr.)

Course Code: CACS401

Year/Semester: IV/VII

Class Load: 4 Hrs. / Week (Theory: 3Hrs. Tutorial: 1 Hrs.)

Course Description:

This course presents different concepts of cyber law, cybersecurity, and ethics for IT professionals and IT Organizations. This course also presents different concepts related to intellectual properties and their protections, privacy, and social networking issues.

Course Objectives:

The primary objective of this course is to provide knowledge of cyber law, cybersecurity, privacy protection, intellectual property protection, and ethics for IT professionals and IT organizations.

Course Contents:

Unit 1: An Overview of Ethics, Ethics for IT Workers and IT Users (10 Hrs.)

Ethics, Ethics in the Business World; Corporate Social Responsibility; Fostering Corporate Social Responsibility and Good Business Ethics; Improving Business Ethics; Ethical Considerations in Decision Making; Ethics in Information Technology; Managing IT Worker Relationship; Encouraging Professionalism of IT Workers – Professional Codes of Ethics, Professional Organizations, Certifications and Licensing ; Encouraging Ethical Use of IT Resources among Users

Unit 2: Cyberattacks, Cybersecurity, and Cyber Law (12 Hrs.)

Threat Landscape – Computer Incidents, Types of Exploits; CIA Security Triad – Confidentiality, Integrity, Availability, Implementing CIA at Organizational, Network, Application, and End-User Level; Response to Cyberattack - Incident Notification Protection of Evidence and Activity Logs Incident Containment Eradication Incident Follow-Up Using an MSSP, and Computer Forensics; Cyber Law; Provision of Cyber Law and Electronic Transaction Act of Nepal

Unit 3: Privacy and Freedom of Expression (10 Hrs.)

Privacy Protection and the Law - Information Privacy, Privacy Laws, Applications, and Court Rulings; Key Privacy and Anonymity Issues - Consumer Profiling, Electronic Discovery, Workplace Monitoring, Surveillance; First Amendment Rights; Freedom Expressions: Key Issues; Social Networking Ethical Issues

Unit 4: Intellectual Property (8 Hrs.)

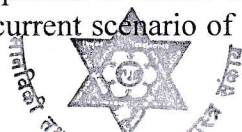
Intellectual Property, Copyright; Patent; Trade Secrets; Intellectual Property Issues: Plagiarism, Reverse Engineering, Open Source Code, Competitive Intelligence, Trademark Infringement, and Cybersquatting

Unit 5: Ethical Decision in Software Development and Ethics of IT Organizations (8 Hrs.)

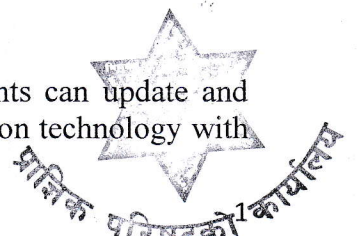
Software Quality and its Importance; Strategies for Developing Quality Software; Use of Contingent Workers; H-1B Workers; Outsourcing; Whistle-Blowing; Green Computing

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with



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the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
40		60	-	

Recommended Books:

1. Ethics in Information Technology, Sixth Edition, George W. Reynolds.
2. Ethics and Technology: Controversies, Questions, and Strategies for Ethical Computing, Fifth Edition, Herman T. Tavani, John Wiley and Sons, 2016.
3. Ethics for Information Age, Eighth Edition, Michael J. Quinn, Pearson.

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Course Title: Cloud Computing (3 Cr.)

Course Code: CACS402

Year/Semester: IV/VII

Class Load: 6 Hrs. / Week (Theory: 3Hrs. Practical: 3 Hrs.)

Course Description

This course offers detailed concept, applications, principles and implementation of cloud computing. It includes introduction, Cloud Computing Architecture, Cloud Virtualization, Cloud Programming Models, Cloud security and applications. It does not entirely focus on theoretical concept but also strongly focuses on practical skill based learning.

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of cloud computing to make students capable of designing, implementing and managing the issues of cloud computing in their personal as well professional life.

Course Contents

Unit 1: Introduction to Cloud Computing [6 Hrs.]

- 1.1 Overview of Cloud Computing
- 1.2 Evolution of Cloud Computing
- 1.3 Characteristics of Cloud Computing
- 1.4 Types of cloud and its Cloud services
- 1.5 Benefits and challenges of cloud computing
- 1.6 Applications cloud computing
- 1.7 Cloud Storage
- 1.8 Cloud services requirements,
- 1.9 cloud and dynamic infrastructure
- 1.10 Cloud adoption

Unit 2: Cloud Computing Architecture [6 Hrs]

- 2.1 Cloud reference model
 - 2.1.1 Platform as service
 - 2.1.2 Software as a service
 - 2.1.3 Infrastructure as service
- 2.2 Cloud deployment models
 - 2.2.1 Public clouds
 - 2.2.2 Private clouds
 - 2.2.3 Community cloud
 - 2.2.4 Hybrid clouds
- 2.3 Cloud design and implementation using SOA,
- 2.4 security, trust and privacy

Unit 3: Cloud Virtualization technology [10 Hrs]

- 3.1 Overview of Virtualization techniques
- 3.2 Types of Virtualization
- 3.3 Implementation Levels of Virtualization Structures
- 3.4 virtualization benefits

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- 3.5 server virtualization
- 3.6 hypervisor management software
- 3.7 virtual infrastructure requirements

Unit 4: MapReduce(8 Hrs)

- 4.1 Introduction to parallel computing
- 4.2 Map-reduce model
- 4.3 Applications of map reduce
- 4.4 Parallel efficiency of Map-Reduce
- 4.5. MapReduce infrastructure

Unit 5: Cloud security [6 Hrs]

- 5.1 Introduction to Security,
- 5.2 Cloud Security challenges and Risks,
- 5.3 Software-as-a-Service Security
- 5.4 Security Monitoring
- 5.5 Security Architecture Design
- 5.6 Data Security
- 5.7 Application Security
- 5.8 Virtual Machine Security
- 5.9 Identity Management and Access Control

Unit 6: Cloud platforms and applications [12 Hrs]

- 6.1 Web services
- 6.2 AppEngine
- 6.3 Azures Platform
- 6.4 Aneka
- 6.4 Open challenges
- 6.5 Scientific applications
- 6.6 Business and Consumer applications

Practical Works

1. The practical work consists of all features of cloud computing and field visit.
2. Visit the cloud service provider (cloud industries) nearby you and prepare a report based on organizational structure and technology implemented consulting with your subject teacher.

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

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Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Text Books

1. Dr. Kumar Saurabh, Cloud Computing
2. Raj Kumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing

Reference Books

1. David S. Linthicum, Cloud Computing and SOA Convergence in your enterprise
2. Barrie Sosinsky, Cloud Computing Bible
3. Saurabh, K. (2011). Cloud Computing – Insights into New -Era Infrastructure, Wiley India.

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Course Title: Internship (3 Cr.)

Course Code: CAIN403

Year/Semester: IV/VII

Class Load:

Course Description: The internship course is practical industry experiencing course. This course is expected to provide opportunity for career exploration and development in industry. It includes applying theoretical and practical knowledge for solving real world problems while working in industry.

Course Objectives: The objective of this course is to expose and penetrate final year students into market space industry so as to acquire experience. It gives students the opportunity to enter the real world industry so that students will be pragmatic and able to start their professional career.

Course Details:

Nature of Internship:

The internship work should be related to computer applications and information technologies. The nature of work during internship should impart practical knowledge in computer system and its applications development, administration and management. The internship period should be minimum of 8 (Eight) weeks. Students should start their internship within 3 to 4 weeks of start of seventh semester. The internship can be practiced at government, non-government organizations having appropriate computer system applications and information technology usages. Generally, the internship is an individual activity however can be practiced together in groups in the host organization. However, each student must prepare and submit individual internship report on the basis of his/her work done during the internship period. Students working in group at the same organization should be able to distinguish their nature of work. Each student should be facilitated with a mentor and supervisor. Mentor from the intern providing company is assigned to guide each student during internship in the company. Supervisor from college/campus is assigned to supervise each student during internship.

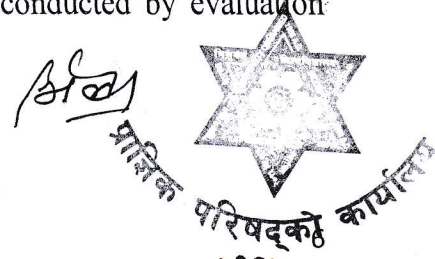
Phases of Internship:

The following are the phases of internship evaluation:

1. **Proposal Submission:** Students must submit and present project proposal after 2nd week of start of the internship.
2. **Mid-Term:** Students must submit progress report and defend midterm progress of their internship work in the 12th week of the seventh semester.
3. **Final Submission:** Students must submit and orally defend the internship work during last week of the seventh semester but before final board examination. Students must have to submit the internship final report to their respective department before at least ten days of final defence date. The report should be submitted in standard format as prescribed. The hard/soft copy of report should be made available to the external expert before a week of presentation date. A viva voice will be conducted by evaluation committee.

Provision of Supervision:

V. Sharma



There should be a regular faculty of campus/college assigned as a supervisor. The role of supervisor is to guide the students throughout the internship and provide constructive suggestions. A supervisor can supervise at most five internship students in a class section.

Provision of Mentorship:

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

Evaluation Scheme:

1. **Proposal Defense** of 5% of total marks based on internship proposal and its presentation.
2. **Midterm** of 75% of total marks based on the progress of the work of internship.
3. **Final Defense** of 20% of total marks based on presentation of internship work and viva-voice.

The 5 marks of the proposal defense will be evaluated by the research c`ommittee formed by HOD/Coordinator/Supervisor as a part of proposal defense. The 75 marks of the midterm will be evaluated by the HOD/Coordinator, Supervisor and Mentor as a part of midterm defense. Out of the 75 marks, the HOD/Coordinator will evaluate for 5 marks, the supervisor will evaluate for 35 marks and the mentor examiner will evaluate for 35 marks. The marks from the mentor should be provided to the corresponding campus/college in confidential manner. The remaining 20 marks of final defense will be evaluated by the external examiner from the university.

Out of 100 marks, the 80 marks (Proposal + Midterm Evaluation) will be considered as internal assessment while the 20 marks (Final Defense) will be considered as external assessment. Each student in the internship should get passed in each of the internal and external assessments individually. Any student failing to pass each of the assessments will be considered as fail.

The evaluation committee and evaluation criteria should be as follow;

a. Evaluation committee

- Internship Supervisor
- Mentor from Intern Company
- HOD/Coordinator
- External Examiner

b. Focus of the evaluation

- Presentation skills
- Level of work done during internship
- Understanding of internship activities
- Internship report
- Viva/Question answer

Report Contents:

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1. Prescribed content flow for the internship proposal

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

2. Prescribed content flow for the internship report

1. Cover & Title Page
2. Certificate Page
 - i. Mentors' Recommendation from Company
 - ii. Supervisors' Recommendation
 - iii. Examiners' Approval Letter
3. Acknowledgement
4. Abstract Page / Executive Summary
5. Table of Contents
6. List of Abbreviations, List of Figures, List of Tables, List of Abbreviations
7. Main Report
8. References
9. Bibliography (if any)
10. Appendices (Screen Shots/ Source Codes)

3. Prescribed chapters in the main report

1. Chapter 1: Introduction

- 1.1. Introduction (Introduce the project/ work done during internship)
- 1.2. Problem Statement
- 1.3. Objectives
- 1.4. Scope and Limitation
- 1.5. Report Organization

2. Chapter 2: Introduction to Organization

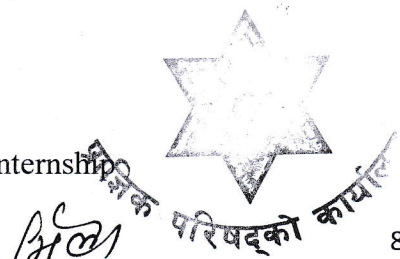
- 2.1. Organization Details
- 2.2. Organizational Hierarchy
- 2.3. Working Domains of Organization
- 2.4. Description of Intern Department/Unit

3. Chapter 3: Background Study and Literature Review / Related Works

- 3.1. Background Study (Description of fundamental theories, general concepts and terminologies related to the internship project)
- 3.2. Literature Review (Review of the similar projects during internship, theories and results similar the projects during internship)

4. Chapter 4: Internship Activities

- 4.1. Roles and Responsibilities
- 4.2. Weekly log (Technical Details of Activities)
- 4.3. Description of the Project(s) Involved During Internship



4.4. Tasks / Activities Performed

5. Chapter 5: Conclusion and Learning Outcomes

5.1. Conclusion

5.2. Learning Outcome

While writing above chapters students should avoid basic definitions. They should relate and contextualize the above mentioned concepts with their project work done during internship at the host organization.

Citation and Referencing

The listing of references should be listed in the references section. The references contain the list of articles, books, urls that are cited in the document. The books, articles, and others that are studied during the study but are not cited in the document can be listed in the bibliography section.

The citation and referencing standard should be APA referencing standard. The text inside the document should be cited accordingly. The APA referencing standard can be found in the web at <https://apastyle.apa.org/>

Report Format Standards

A. Page Number

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

B. Page Size and Margin

- The paper size must be a page size corresponding to A4. The margins must be set as
Top = 1; Bottom = 1; Right = 1; Left 1.25

C. Paragraph Style

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

D. Text Font of Document

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

E. Section Headings

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

F. Figures and Tables

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

Final Report Binding and Submission:

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

Look and Feel: Golden Embracing with Black Binding

A final approved signed copy of the report should be submitted to the Dean Office, Exam Section, FOHSS.

Teaching Methods:

The major teaching methods that can be followed for this course includes industry practice, class lectures, group discussions, presentations, and demonstrations.

Evaluation

Examination Scheme			
Internal Assessment		External Assessment	Total
Proposal Defence	Midterm Defence	Final Defence	
5	75	20	100

M. S.

प्राज्ञिक परिषद्को कार्यालय
कीर्तिपुर

Elective Courses

Course Title: Image Processing (3 Cr.)

Course Code: CACS404

Year/Semester: IV/VII

Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2Hrs.)

Course Description

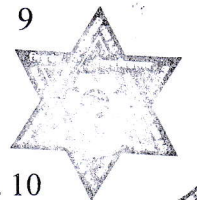
This course presents introduction to several topics on image processing techniques and their applications. It also explores the students to real-world applications of image processing.

Course objectives

Upon completion of this course, students should be able to 1. Explain the basic concepts of digital image processing and various image transforms. 2. Develop a broad range of image processing techniques and their applications. 3. To familiarize the with the image enhancement, image restoration and image segmentation techniques.

Course Contents

	Hours
Unit 1: Fundamental of Image processing Image representation, basic relationship between pixels, elements of DIP system, elements of visual perception-simple image formation model, Sampling and Quantization, Color fundamentals and models, File Formats, Image operations. Brightness, contrast, hue, saturation, Mach band effect	8
Unit 2: Image Enhancement Image Transforms, Fourier Transform and Discrete Fourier Transform, Fast Fourier Transform. Cosine Transform, Frequency domain image enhancement, low pass filtering, high pass filtering, homomorphic filter, Gaussian filter Spatial domain image enhancement, point processing, contrast stretching, clipping and thresholding, digital negative, intensity level slicing. Histogram processing: equalization, modification, Spatial filtering – averaging, Smoothing and sharpening, median filtering, spatial low, high and band pass filters	12
Unit 3: Image Restoration: Image Restoration - Image degradation model - Noise modeling – Blur, Inverse filtering- removal of blur caused by uniform linear motion, Weiner filtering, Morphological operation, erosion and dilation,	9
Unit4: Image coding and compression Need for compression, redundancy, pixel coding, run length coding, Huffmancoding, Elements of information theory, Error free compression, Lossy compression, Image compression standards- JPEG& MPEG, wavelet based image compression.	9
Unit 5: Image segmentation and feature extraction Image Segmentation: Thresholding, Region based segmentation, edges, line and curve detection, edge operators, Image Features and Extraction ,Types	10



प्रादेशिक 10
परिषद्को कार्यालय
कीर्तिपुर 11



अ.प.

of features, feature extraction , Texture , Feature reduction algorithms,
 Image classification, clustering techniques,
 Case Studies in Image Security, Steganography and Digital watermarking,
 Visual effects, Case studies in Medical Imaging and remote sensing.

Evaluation

Evaluation Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	100
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Laboratory Work

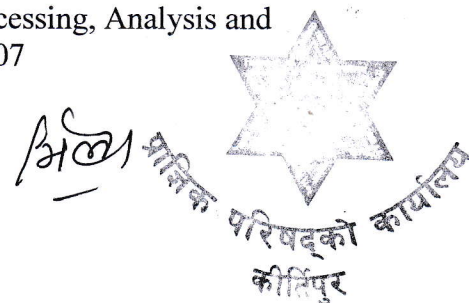
Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using software like matlab, python.

Text Books:

1. Gonzalez Rafel C, Digital Image Processing, Pearson Education, 2009.
2. S.Sridhar, Digital Image Processing, Oxford University Press, 2011

Reference Books:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis and Machine Vision, Second Edition, Thompson Learning, 2007



Course Title: Database Administration

Course Code: CACS405

Year/Semester: IV/VII

Class Load: 6 Hrs. /Week (Theory: 3Hrs, Practical 3Hrs.)

Course Description

This course provides the comprehensive knowledge about relational database management system in administrative approach to integrate in enterprise level of database in network environment which encompasses with oracle database Instances Management, database installment in network environment, implementing user role and privileges, multitenant database management, back and recovery.

Objectives: The general objectives of this course is to provide core knowledge of administrative works on relational database management system.

Unit 1 Introduction to an Oracle database 12Hrs

Overview of the Oracle Database Architecture (process, memory, storage structure), DBA roles and responsibilities, Familiar with SQL*Plus, Accepting Values at Runtime, Overview of SQL Command (DDL (Tables, Constraints, Indexes Views, Synonyms, Sequences Partitioning and Materialized Views), DML, Join and Subquery)

Unit 2 Managing Database Instances 5Hrs

Oracle Database installation, Database creation, starting up and shutting down oracle instance, Oracle Network component, communicating between Databases; Using Dynamic Performance Views, Using the Automatic Diagnostic Repository (ADR), Using the Alert Log and Trace Files, Managing Initialization Parameter Files.

Unit 3: Tablespace and Storage management

4Hrs

Working with Tablespaces and Data Files, Creating and adding tablespace and datafiles, Managing Control Files, Online Redo Logs and Archive logs; Multiplexing online redo logs and control files, database archiving.

Unit -4 Managing Users, Roles and Privileges 6Hrs

Assigning Quotas to Users, Applying the Principal of Least Privilege, Creating and Assigning Profiles, Administering User Authentication Methods, Managing Oracle Database Users, Privileges, and Roles.

Unit 5: Multitenant Database Architecture

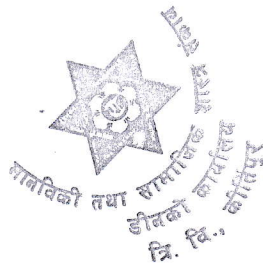
7 Hrs

Understanding the Multitenant Architecture, Pluggable Architecture; Creating CDB; Creating Pluggable Databases (PDBs) within a CDB; Manage CDBs and PDBs, Backup and Duplicate, Manage Security in Multitenant databases

Unit-6 Configure the Oracle Network Environment 5Hrs

Overview of Network Configuration, Oracle Net Listener Configuration and Management, Oracle Net Naming Methods, Networking the Net Configuration Assistant, Configure Client Connections with Net Manager, View Listener Configuration, Start and Stop the Oracle Listener, Use TNSPING to Test Oracle Net Connectivity, Connect to the Database, Configure NetServices with Enterprise Manager

Vishaya



Unit -7:Backup and Recovery5Hrs

Backup and Recovery Concepts, Database backup, restoration and recovery, defining a backup and recovery strategy, Backup and Recovery options; Data Dump; User-Managed Backup and Recovery; Configuring RMAN; RMAN Backups, Restore and Recovery, Perform CDB and PDB flashback.

Unit-8

Automate Tasks with the Scheduler4Hrs

Introduction to the Scheduler, Access Rights, Scheduler Components and Workflow, create a Job, Job Classes, Use Time Based, Event-Based Schedules, Create an Event-Based Schedule.

Laboratory Works

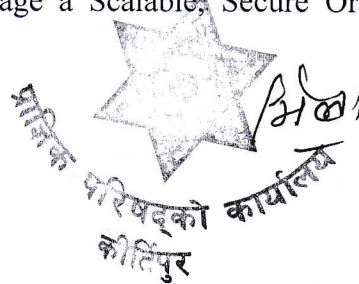
Laboratory works should be done covering all the topics listed above and a small work should be carried out using the concept learnt in each unit in the group. Work should be assigned on individual basis.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

References

1. Fernandez, I. Beginning Oracle Database 12c Administration. Apress.
2. Press, O. Oracle Database 19 C: Administration Workshop vol-I/II.
3. Thomas, B. Oracle Database 12C Administration Certified Associate. Sybex.
4. Pro Oracle Database 18c Administration: Manage and Safeguard Your Organization's Data, Michelle Malcher and Darl Kuhn, Third Edition.
5. Oracle Database 12c DBA Handbook, Manage a Scalable, Secure Oracle Enterprise Database Environment, Bob Bryla.



Course Title: Network Administration (3 Cr.)
Course Code: CACS406
Year/Semester: IV/VII
Class Load: 6 Hrs. / Week (Theory: 3Hrs. Practical: 3 Hrs.)

Course Description: The course introduces the theoretical as well as practical concepts of Network Administration. The course includes concepts of work station, server and services, Network infrastructure, Implementing different network services.

Course Objectives: The objectives of this course is to make the students to design and implement enterprise level network with its services.

Course Contents:

- Unit I: Introduction [4Hrs.]**
 Network administrator as a Profession, Network administrator professional ethics, Recent trends in network administration.
- Unit I: Work Station, Server and Services [16Hrs.]**
 Workstation: Architecture design, Hardware strategies, OS installation. Servers: Hardware Strategies, Hardware Features & Specifications. Service: Requirements, Planning and Engineering, Service Launch, Disaster Recovery.
- Unit II: Infrastructure [6Hrs.]**
 Network Architecture, Network Operations, Datacentres Overview and Running Datacentres.
- Unit III: Service Recommendation [16Hrs.]**
 Server Upgrade, centralizing a service, Service Monitoring, Namespaces, Email Service, Print Services, Data Storage, Backup and Restore, Software Repository, Web Services.
- Unit IV: [6Hrs.]**
 Preparing procurement plan/document for enterprise level network setup

Laboratory Works:

The laboratory work includes implementation of the mentioned content in syllabus using LINUX and Windows operating system.

Teaching Methods

The major teaching methods that can be followed for this course includes class lectures, laboratory activity, group discussions, presentations and case studies.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Text Book:

1. The Practice of System and network administration, 3rd Edition, Thomas A. Limoncelli, Christina J. Hogan, Strata R. Chalup
2. Mastering Windows Server 2019: The complete guide for IT professionals to install and manage Windows Server 2019 and deploy new capabilities, 2nd Edition
3. Ubuntu and Centos Linux server administration, MD. Tanvir Rahman, 2019



Course Title: Software Project Management
Course Code: CACS407
Year/Semester: IV/VII
Class Load: 5 Hrs. /Week (Theory: 3Hrs, Practical: 2Hr.)

Course Description

This course provides the comprehensive knowledge about Software Project Management, which encompasses with Software Project Planning, Scheduling, Cost Estimation, Risk management, Quality management and Configuration management.

Objectives: The general objective of this course is to provide fundamental knowledge of software project management and corresponding software tool.

Unit -1

Software Project Management Concepts 8 Hrs

Introduction, Project and Software project, Software project vs other project, Importance and Problems in software project management, Process of SPM. Characteristics of good project manager, Successful Software Project Manager, Overview of Software Project Planning.

Unit-2

Software Project Scheduling 8 Hrs

Objectives of activity planning, Work breakdown structure, Network planning model: Critical path method (CPM), Program evaluation and review technique (PERT), Precedence diagramming method (PDM), Shortening project duration, Identifying critical activities. Forward pass and Backward pass

Unit -3

Software Estimation Techniques 7 Hrs

Software Effort Estimation: Problems with over and under estimations, Basis of software Estimating, Software effort estimation techniques, expert Judgment, Estimating by analogy. Bottoms-up estimating, Top-down approach and parametric models.

Unit -4

Software Evaluation and Costing 8 Hrs

Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, cost-benefit evaluation techniques, Risk Evaluation. Selection of Appropriate Report, Project approach: Choosing technologies, choice of process models, structured methods.

Unit -5

Risk Management 5 Hrs

Risk Identification, Planning, Evaluation and Management, Categories of Risk, Framework for dealing with risk, evaluating Risks to the schedule.

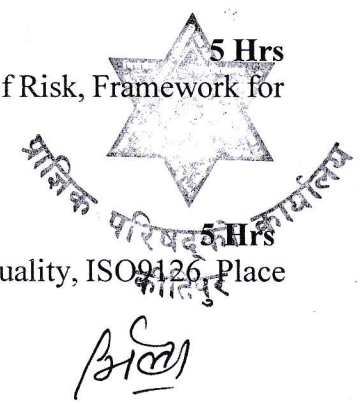
Unit -6

Software Quality Management 5 Hrs

TQM, Six Sigma, Software Quality: defining and importance software quality, ISO9126, Place of software quality in software planning.

Unit -7

V. Shetty



Software Configuration Management

7 Hrs

Concept, Requirement and Elements of SCM, Baseline, SCM Repository, Versioning and version control, SCM Process, Change Control Process. Configuration Audit and Status Reporting. Case Study: Version Control Software Tools (Git, CVS, SVN)

Laboratory Works

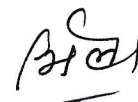
Laboratory works should be done covering all the topics listed above and a small work should be carried out using the concept learnt in each unit in the group. Work should be assigned on individual basis. Student may choose project Management tools like (MS Project, OpenProj, dot Project, Trello, Asana, ClickUp).

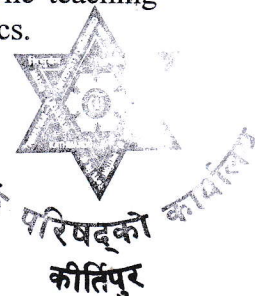
Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

References

1. Cotterell, B. H. (2018). Software Project Management. McGraw-Hill.
2. Dutt, S. C. (n.d.). Software Project Management. Pearson Education India.
3. A.S. Kelkar (n.d.). Software Project Management. PHI Learning.





Course Title: Advanced .Net Technology (3 Cr.)
Course Code: CACS408
Year/Semester: IV/VII
Class Load: 6Hrs. /Week (Theory: 3 Hrs. Practical: 3 Hrs)

Course Description

This course provides skill to develop modern software program with graphical user interface using the language C# with ASP.net. Student will build Window-based and web-based forms, adding controls and setting properties of these controls.

Course Objective

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

Course Contents

Unit 1: C# Basics

8 Hours

Introduction to .NET Architecture, Class and Object: Creating class, Interface, Creating Objects, Access Modifiers, Arrays, Inheritance, Exception Handling and Threading: try, catch, finally, throw and throws, Create multithread program, Thread lifecycle. File IO: File Stream, Stream Reader, Stream Writer, Binary Reader, Binary Writer, Serialization.

Unit 2: Windows Application

6 Hours

Windows Forms: Benefits, Window Forms Control, Properties and Event, .NET Event, MDI Forms, Form Inheritance. Dialogs, Tooltips, Resizing, Menus and Context Menus, Custom Control Creations, Handling Multiple Events, Graphics and GDI+

Unit 3: Introduction to ADO.NET

7 Hours

Benefits of ADO.NET, ADO.NET compared to classic ADO, ADO.NET architecture (Connected and Disconnected), Shared and Database-Specific Classes, Using Database connection. Working with DataSets, Managed Providers, Data Binding, Typed DataSets, Working with Data Reader, Transactions

Unit 4: ASP.NET working with Data and Security

12 Hours

Web Application Using ASP.NET, ASP.NET Architecture, Working with controls, User Interface Elements, Deployments, Web sites, Applications and Virtual Directories in IIS. Accessing Data using ADO.NET, Connecting to Data, Executing Commands, State management (Page-Level state, using Cookies to preserve state, ASP.NET Session State, Storing Object in Session State, Configuring Session State)
Validation, IIS URL Authorization, Forms Authentication and Config File encryption

Unit 5: ASP.NET AJAX and MVC

10 Hours

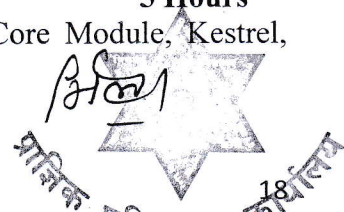
Introduction to ASP.NET AJAX, ASP.NET AJAX Server Control, ASP.NET AJAX Server Data, ASP.NET AJAX Client-side Libraries. Introduction ASP.NET MVC, Web Application Using MVC pattern Razor View and controller, Model

Unit 6: Hosting and Deploying ASP.NET Core Application

5 Hours

App Servers and Hosting Models: IIS, Nginx, Apache, ASP.NET Core Module, Kestrel, Docker and Containerization, Publish to Azure cloud

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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)

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Reference Books

1. Herbert Schildt, "C#: The Complete Reference", TMH
2. C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development, Fourth Edition, by Mark J. Price, 2019
3. ASP.NET Core in Action, by Andrew Lock, 2018
4. Ian Griffiths (2012), Programming C# 5.0, O'Reilly Media, Inc.
5. Sharp, J. (2013). Microsoft Visual C# 2013 step by step.
6. Albahari, J., Albahari, B., & Drayton, P. (2012). *C# 5.0 in a nutshell* (5th ed). Beijing ; Sebastopol: O'Reilly.



Paradigm in Citizen Services; E-Panchayat (Electronic Knowledge Based Panchayat); General Information Services of National Informatics Centre)

Other Countries (E-Governance initiative in USA; E-Governance Case Study in China – Beijing Business E-Park; Brazil’s Poupatempo or ‘Time Saver’ Centres; Sri Lanka – Kothamale Community Radio Internet Project)

Recommended Books:

4. E-Governance: Concepts and Case Studies, C.S.R. Prabhu, Second Edition, PHI Learning, 2012.
5. Strategic Planning and Implementation of E-Governance, P.K.Suri and Sushil, Springer, 2019.
6. A Study of the Practice of E-governance in the Developing Countries: A Qualitative Approach In Measuring The Maturity of E-government, Kazi Hassan Robin and Md. Mahmudul Hasan Rafee, 2012.
7. Implementing and managing e-Government, Richard Heeks, 2006.

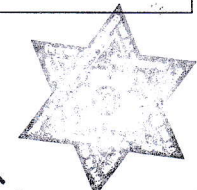
Teaching Methods:

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, tutorials, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

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कीर्तिपुर



Course Name: Artificial Intelligence (3 Cr.)

Course Code: CACS410

Year/Semester: IV/VII

Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description: The course introduces basics of artificial intelligent. It covers fundamental concepts artificial intelligence, problem solving, knowledge representation, neural networks, machine learning, natural language processing, machine vision and expert systems.

Objective:

The objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Upon the completion students will be able to:

- Gain fundamental concepts of principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in expert systems, artificial neural networks and other machine learning models.

Course Contents:

UNIT 1: INTRODUCTION

[6 Hrs.]

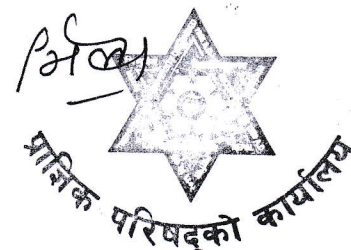
- 1.1 Intelligence, Intelligent behavior, Artificial Intelligence, Understanding AI based on thought process and behavior, Hard vs. Strong AI, Soft vs. Weak AI
- 1.2 Foundations of AI
- 1.3 Applications of AI
- 1.4 Intelligent Agents: Introduction of agents, Structure of Intelligent agent, Properties of Intelligent Agents, PEAS description of Agents, Types of Agents: Simple Reflexive, Model Based, Goal Based, Utility Based, Learning agent, Environment Types: Deterministic, Stochastic, Static, Dynamic, Observable, Semi-observable, Single Agent, Multi Agent

UNIT 2: PROBLEM SOLVING METHODS

[12Hrs.]

- 2.1 Definition of a Problem, Problem as a state space representation, Problem formulation, Well-defined problems, Constraint satisfaction problem, Water jug problem, N-Queen problem, Cryptarithmic problem, Graph coloring problem
- 2.2 Problem solving by searching, types of searching, Measuring problem solving performance, General State Space Search
- 2.3 Uninformed: Breadth-First Search, Depth-First Search, Depth-Limited Search, Iterative Deepening depth first Search, Bidirectional Search, Using uninformed search techniques for solving N-Queens Problem, Puzzle problem etc.
- 2.4 Informed search: Greedy Best-First Search, A* Search, Optimality of A*, Local search: Hill Climbing, Simulated Annealing, Using informed search techniques for solving N-Queens Problem, Puzzle problem etc.

V. Chappu



- 2.5 Game Playing, Optimal Decisions in Games, Alpha – Beta Pruning, Minimax Algorithm, Tic-Tac –Toe Problem, Stochastic Games

UNIT 3: KNOWLEDGE REPRESENTATION AND REASONING [15Hrs.]

- 3.1 Definition and importance of Knowledge, Issues in Knowledge Representation, Knowledge Representation Systems, Properties of Knowledge Representation Systems, Types of Knowledge, The Role of Knowledge
- 3.2 Knowledge representation techniques: Rule Based, Semantic Nets, Frames, Logic based
- 3.3 Propositional Logic, Syntax and Semantic of propositional logic, Proof by Resolution, Conjunctive Normal Form (CNF), Resolution Algorithm, Limitations of Propositional Logic, Forward and Backward Chaining
- 3.4 Predicate Logic, FOPL, Syntax, Semantics, Quantification, horn clauses, Inference with FOPL: By converting into PL (Existential and universal instantiation), Rules of inference, Unification and lifting, CNF for FOPL, Inference using resolution, Resolution Refutation System (RRS)
- 3.5 Handling Uncertain Knowledge, Radom Variables, Prior and Posterior Probability, Inference using Full Joint Distribution, Bayes' Rule and its use, Bayesian Networks, Reasoning in Bayesian Networks

UNIT 4: LEARNING

[4 Hrs.]

- 4.1 Concepts of machine learning
- 4.2 Rote learning, learning by analogy, inductive learning, Explanation based learning, Supervised and unsupervised learning, learning by evolution (genetic algorithm)

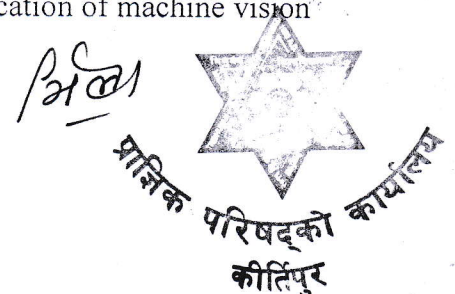
UNIT 5: NEURAL NETWORKS AND NATURAL LANGUAGE PROCESSING [7Hrs.]

- 5.1 Introduction to artificial neural network, Mathematical model of neural network, types of neural network: feed-forward, feed-back, Gate realization using neural network, Learning in neural networks: Back propagation algorithm, Hopfield network, Boltzmann machines
- 5.2 Concepts of natural language understanding and natural language generation, Steps in natural language processing, Syntax analysis, Semantic analysis, Pragmatic analysis

UNIT 6: EXPERT SYSTEM AND MACHINE VISION

[4 Hrs.]

- 6.1 Expert System, Architecture of an expert system, Stages of expert systems development.
- 6.2 Concept of Machine Vision. Steps of machine vision, application of machine vision

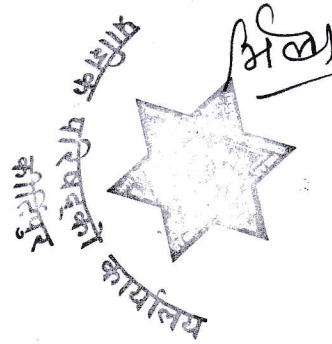


Laboratory work:

Laboratory exercises can be conducted in LISP, PROLOG or any other high level programming language. Laboratory exercises must cover the concepts of rule based intelligent agents, inference and reasoning, search techniques, neural networks, etc. for solving practical problems.

Reference Books:

1. Stuart Russel and Peter Norvig, Artificial Intelligence A Modern Approach, Pearson
2. E. Rich, K. Knight, Shivashankar B. Nair, Artificial Intelligence, Tata McGraw Hill.
3. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Benjamin/Cummings Publication
4. D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall.
5. P. H. Winston, Artificial Intelligence, Addison Wesley.



Course Title: Operational Research (3 Cr.)

Course Code: CAOR451

Year/ Semester: IV/VIII

Class Load: 4Hrs. /Week (Theory: 3 Hrs. Tutorial: 1 Hrs)

Course Description

Operations Research is the study of scientific approaches to decision-making. Through mathematical modeling, it seeks to design, improve and operate complex systems in the best possible way. The mathematical tools used for the solution of such models are either deterministic or stochastic, depending on the nature of the system modeled. In addition, the course will learn very powerful modeling and solution techniques for decision-making problems that are used today by many successful companies to help them save/earn millions of dollars. The module covers topics that include: linear programming, transportation, assignment, inventory control, replacement theory and game theory. Analytic techniques and computer packages will be used to solve problems facing business managers in decision environments

Course Objectives

The general objectives of this course to provide a broad orientation of the field of optimization, with emphasis on basic theory and methods for continuous and discrete optimization problems in finite dimension, and it also gives some insight into its use for analyzing practical optimization problems.

Unit 1: Introduction to Operations Research

5

hrs.

Introduction, History of Operations Research, Stages of Development of Operations Research
Relationship between Manager and OR Specialist, OR Tools and Techniques, Applications of
Operations Research, Limitations of Operations Research

Unit 2: Linear Programming Problem

10

hrs.

Introduction to Linear Programming, Linear Programming Problem Formulation, Formulation with
Different Types of Constraints, Graphical Analysis of Linear Programming, Graphical Linear
Programming Solution, Multiple Optimal Solutions, Unbounded Solution, Infeasible Solution, Basics
of Simplex Method, Simplex Method Computation, Simplex Method with More Than Two Variables,
Primal and Dual Problems, Economic Interpretation

Unit 3: Transportation and Assignment Problem

8

hrs.

Transportation Problems definition, linear form, Solution methods: North West corner method, least
cost method, Vogel's approximation method. Degeneracy in transportation, Modified Distribution
method, unbalanced problems and profit maximization problems. Transshipment Problems.
Assignment Problem Structure and Solution: Short-Cut Method (Hungarian Method), Unbalanced
Assignment Problem, Infeasible Assignment Problem, Maximization in an Assignment Problem,
Crew Assignment Problem.

Unit 4: Queuing Theory

6

hrs.

Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of
a queuing system, Classification of Queuing models.

V. Shrivastava



Unit 5: Inventory Control

6

hrs.

Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with deterministic demands, ABC analysis.

Unit 6: Replacement theory

6

hrs. Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy

Unit 7: Game Theory

7

hrs.

Introduction, Characteristics of Game Theory, Two Person, Zero sum games, pure strategy. Dominance theory, Mixed strategies (2x2, mx2), Algebraic and graphical methods

Teaching Methods

The general teaching pedagogy includes class lectures, presentations, group works, case studies, guest lecturers research works, project works, assignments (Theoretical and Practical). The teaching faculty will determine the choice of teaching pedagogy and encouraged to select software tools as per the requirements of topics for practical activities.

References/ Suggested Readings:

- Hillier, F.S.& Lieberman, G.J. (1995). Introduction to Operations Research, 7th edition. The McGraw-Hill Companies, Inc.
- Natarajan, A. M.; Balasubramani, P. & Tamilarasi, A. (2007). Operations Research. Pearson Education Inc.
- Sharma, J.K. (2009). Operational Research: Theory and Application. Macmillan Publishers India Ltd.
- Taha, H.A. (2017). Operations Research: A Introduction, 10th edition, Global edition, Pearson Education, Inc. Pearson Prentice Hall.
- Wagner, H. N. (2003). Operations Research by, Prentice hall. N D Vohra, Tata McGraw-Hill.
- Winston, L.W. (2004). Operations Research: Applications and Algorithms, Indian University, 4th edition.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
40		60		100



Course Title: Project III (6 Cr.)
Course Code: CACS452
Year/Semester: IV/VIII
Class Load: Hrs./Week (Practical: 12 Hrs.)

Course Description: This final year project is a practical course where students are expected to implement the concepts learnt during four years of their study so as to build a system. The course includes realization of project management, software development, and programming skills.

Course Objectives: The objective of this course is to make students able to design and develop software applications by following appropriate development methodology.

Course Details:

Nature of Project:

Students should develop a complete functioning system. The system should not be limited to the basic CRUD operations only. Being a final year project, students are highly recommended to implement appropriate algorithms relevant to the project. The project should include precise system analysis, design, implementation and result analysis. The students can work in group of at most two members. The students can choose appropriate language technologies that they have learnt till eighth semester; however it is not limited. While implementing the project, students should be able to write their own program modules rather than relying on predefined APIs or Plugins except in some unavoidable circumstances.

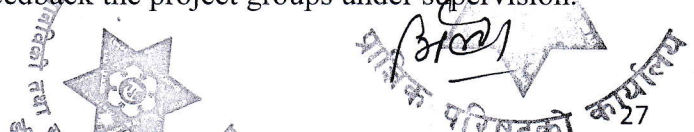
Phases of Project:

The following are the phases of project work:

4. **Proposal Submission:** Students must submit and present project proposal after 3rd week of start of the eighth semester.
5. **Mid-Term:** Students must submit progress report and defend midterm progress of their project work in the 12th week of the eighth semester.
6. **Final Submission:** Students must submit and orally defend the project work during last week of the eighth semester but before final board examination. Students must have to submit the project final report to their respective department before at least ten days of final defense date. The report should be submitted in standard format as prescribed. The hard/soft copy of report should be made available to the external expert before a week of presentation date. The final presentation should be followed by the demonstration session, where students have to demonstrate the project. A viva voce will be conducted by evaluation committee.

Provision of Supervision:

There should be a regular faculty of the campus/college assigned as a supervisor. The role of supervisor is to guide the students throughout the project and provide constructive suggestions. A supervisor can supervise at most four groups of the project in a class section. The supervisor should rigorously supervise, monitor and feedback the project groups under supervision.



Evaluation Scheme:

4. **Proposal Defense** of 10% of total marks based on project proposal and its presentation.
5. **Midterm** of 70% of total marks based on;
 - a. **Work Done 60%**
 - i. System Analysis and Design
 - ii. Implementation
 - iii. Understanding of methods used in project
 - iv. Ability to work with others
 - v. Ability to identify problems
 - vi. Amount of work performed
 - b. **Documentation 10%**
 - i. Report Organization
 - ii. Writing Style
 - iii. Completeness of Report
 - iv. Readability
 - v. Organization and analysis of data and results
6. **Final Defense** of 20% of total marks based on presentation and project demonstration and viva-voice. Each group member should present about the project followed by the demonstration of project developed. The project should be ready to run for the demo session.

The **10 marks of the proposal defense** will be evaluated by the research committee formed by HOD/Coordinator as a part of proposal defense. The **70 marks of the midterm** will be evaluated by the supervisor and internal examiner as a part of midterm defense. Out of the 70 marks, the supervisor will evaluate for 60 marks and internal examiner will evaluate for 10 marks. The remaining **20 marks of final defense** will be evaluated by the external examiner from the university.

Out of 100 marks, the **80 marks (Proposal + Midterm Evaluation)** will be considered as internal assessment while the **20 marks (Final Defense)** will be considered as external assessment. Each student in the project should get passed in each of the internal and external assessments individually. Any student failing to pass each of the assessments will be considered as fail.

The evaluation committee and evaluation criteria should be as follow;

c. Evaluation committee

- Project Supervisor
- HOD/Coordinator
- Internal Examiner (Regular Faculty)
- External Examiner

d. Focus of the evaluation

- Presentation Skills
- Project Demonstration
- Project Report
- Viva/Question Answer
- Level of Work and Understanding



- Teamwork and Contribution

Report Contents:

4. Prescribed content flow for the project proposal

1. Introduction
2. Problem Statement
3. Objectives
4. Methodology
 - a. Requirement Identification
 - i. Study of Existing System
 - ii. Literature Review
 - iii. Requirement Analysis
 - b. Feasibility Study
 - i. Technical
 - ii. Operational
 - iii. Economic
 - c. High Level Design of System (Methodology of the proposed system/ Flow Chart/ Working Mechanism of Proposed System / Description of Algorithms)
5. Gantt Chart (showing the project timeline)
6. Expected Outcome
7. References

5. Prescribed content flow for the project report

11. Cover & Title Page
12. Certificate Page
 - iv. Supervisor Recommendation
 - v. Internal and External Examiners' Approval Letter
13. Acknowledgement
14. Abstract Page
15. Table of Contents
16. List of Abbreviations, List of Figures, List of Tables, List of Abbreviations
17. Main Report
18. References
19. Bibliography (if any)
20. Appendices (Screen Shots/ Source Codes)

6. Prescribed chapters in the main report

6. Chapter 1: Introduction

- 6.1. Introduction
- 6.2. Problem Statement
- 6.3. Objectives
- 6.4. Scope and Limitation
- 6.5. Development Methodology
- 6.6. Report Organization

7. Chapter 2: Background Study and Literature Review



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- 7.1. Background Study (Description of fundamental theories, general concepts and terminologies related to the project)
- 7.2. Literature Review (Review of the similar projects, theories and results by other researchers)

8. Chapter 3: System Analysis and Design

8.1. System Analysis

8.1.1. Requirement Analysis

- i. Functional Requirements (Illustrated using use case diagram and use case descriptions)
- ii. Non Functional Requirements

8.1.2. Feasibility Analysis

- i. Technical
- ii. Operational
- iii. Economic
- iv. Schedule

8.1.3. Object Modelling using Class and Object Diagrams

8.1.4. Dynamic Modelling using State and Sequence Diagrams

8.1.5. Process Modelling using Activity Diagrams

8.2. System Design

8.2.1. Refinement of Class, Object, State, Sequence and Activity diagrams

8.2.2. Component Diagrams

8.2.3. Deployment Diagrams

8.3. Algorithm Details (if any)

9. Chapter 4: Implementation and Testing

9.1. Implementation

9.1.1. Tools Used (CASE tools, Programming languages, Database platforms)

9.1.2. Implementation Details of Modules (Description of classes/procedures/functions/methods/algorithms)

9.2. Testing

9.2.1. Test Cases for Unit Testing

9.2.2. Test Cases for System Testing

9.3. Result Analysis

10. Chapter 5: Conclusion and Future Recommendations

10.1. Conclusion

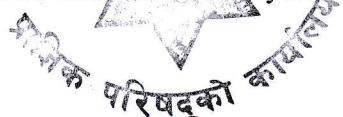
10.2. Future Recommendations

While writing above chapters students should avoid basic definitions. They should relate and contextualize the above mentioned concepts with their project work.

Citation and Referencing

The listing of references should be listed in the references section. The references contain the list of articles, books, urls, etc. that are cited in the document. The books, articles, and others that are studied during the study but are not cited in the document can be listed in the bibliography section. The citation and referencing standard should be IEEE referencing standard. The text inside the document should be cited in IEEE style. The IEEE referencing standard can be found in the web.

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Report Format Standards

G. Page Number

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

H. Page Size and Margin

- The paper size must be a page size corresponding to A4. The margins must be set as
Top = 1; Bottom = 1; Right = 1; Left 1.25

I. Paragraph Style

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

J. Text Font of Document

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

K. Section Headings

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

L. Figures and Tables

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

Final Report Binding and Submission:

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

Look and Feel: Golden Embracing with Black Binding

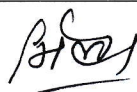
A final approved signed copy of the report should be submitted to the Dean Office, Exam Section, FOHSS.

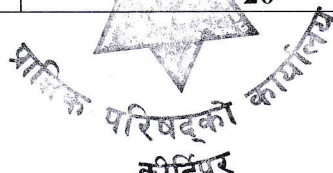
Teaching Methods:

The major teaching methods that can be followed for this course includes class lectures, laboratory activity, group discussions, presentations, and demonstrations.

Evaluation

Examination Scheme			
Internal Assessment		External Assessment	Total
Proposal Defence	Midterm Defence	Final Defence	
10	70	20	100





Elective Courses

Course Title: **Database Programming**

Course Code: **CACS453**

Year/Semester: **IV/VIII**

Class Load: **6 Hrs. /Week (Theory: 3Hrs, Practical 3Hrs.)**

Course Description

This course provides the comprehensive knowledge about database programming in relational database management system, which encompasses with overview of fundamental SQL statement, PL/SQL Block, Exception, Cursors, Record, Triggers, Procedures, Functions and Packages

Objectives: The general objectives of this course is to enhance advance programming skills in relational database management system.

Unit -1

Introduction of RDBMS

10 Hrs

Overview of the Oracle Database Architecture, Familiar with SQL*Plus, SQL*Plus Commands (DESCRIBE, LIST, APPEND, CHANGE, INPUT, DEL, CLEAR BUFFER, Using Script Files), Accepting Values at Runtime, Overview of Fundamental SQL Fundamental Command (DDL, DML, DCL, Join and Subquery)

Unit -2

PL/SQL

13 Hrs

PL/SQL Concepts, Architecture, Block structure, Executing PL/SQL Script, DBMS_OUTPUT.PUT_LINE Statement, substitution Variable feature, PL/SQL Language fundamentals, DML Statement in PL/SQL, Transaction Control in PL/SQL. Conditional Control (if, nested if, Case), Repetitive Control (While, for, simple loop, Nested, continue, loop label)

Unit -3

5 Hrs

PL/SQL Exception

Exception scope, user-defined exception, exception propagation, advance exception concepts (RAISE_APPLICATION_ERROR, EXCEPTION_INIT)

Unit -4

Database Cursors

5 Hrs

Types of cursors, cursor loop, Nested cursors cursor for loops, parameterized cursors, Nested cursors

Unit -5

Database Triggers

5 Hrs

Database Triggers BEFORE, AFTER Triggers, row and statement triggers, INSTEAD OF triggers

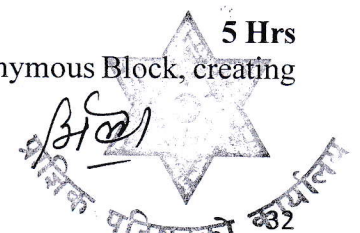
Unit -6

Record and procedures

5 Hrs

Record (Record types, Nested record) Procedure (Block Structure, Anonymous Block, creating procedure, IN, OUT parameters in Procedure)

Unit-7



Functions and Package

5 Hrs

Functions (creating and invoking function and optimizing function in execution, creating packages, extending the package, package instantiation and initialization,

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small work should be carried out using the concept learnt in each unit in individual or group.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

References

1. Benjamin Rosenzweig, E. R. (2015). Oracle PL/SQL by Example. New Yourk: Prentice Hall.
2. Gupta, S. K. (2016). Advanced Oracle PL/SQL Developer's Guide . Birmingham: Packt Publishing.
3. Lex de Haan, T. G. (2014). Beginning Oracle SQL. Apress.
4. McLaughlin, M. (2014). Oracle Database 12c PL/SQL Programming. New Delhi: McGrawHill Education.



Course Title: Geographical Information System (3 Cr.)

Course Code: CACS454

Year/Semester: IV/VIII

Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course offers detailed knowledge as well as practical skills on GIS theory, design and implementation. It includes introduction, GIS and Map, GIS data sources and structures, spatial data analysis, GIS data modeling and creating map apart from this this encourages to students to develop a real time basic GIS project.

Course objectives

The general objectives of this course are to provide theoretical knowledge as well as practical skills of geographical information system to make students capable of capturing, analyzing and visualize real world data.

Course Contents

Unit 1: Introduction	6 Hrs.
1.1 Definition, functions and Applications of GIS	
1.2 Components of GIS	
1.3 GIS as Information System	
1.4 Nature & Sources of GIS data	
1.5 Recent trends and future of GIS	
Unit 2: GIS and Map	8 Hrs.
2.1 Map and their characteristics	
2.2 Mapping concept and Techniques	
2.3 Map Projection	
Unit 3: GIS data Sources & Structures	12 Hrs.
3.1 Capturing GIS data	
3.2 Sources: Maps, GPS, Images and Databases	
3.3 Structures: Vector, Raster and TIN data structures	
3.4 GIS data modeling	
3.5 GIS database design	
Unit 4: Spatial Data Modeling and Analysis	12 Hrs.
4.1 Spatial data modeling	
4.2 Vector based analysis	
4.3 Raster based analysis	
Unit 5: GIS data modeling & Creating Maps	10 Hrs.
5.1 Surface modeling	
5.2 Hydrology modeling	
5.3 Designing and printing the map	



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Laboratory Works

Students should develop basic GIS project implementing the concepts given in course of study and may add more (if required).

Teaching Methods

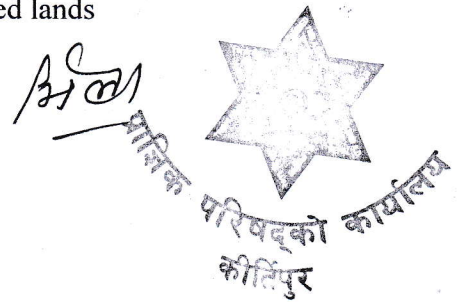
The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Reference Books

1. Kang-tsung Chang, (2010). "Introduction to Geographic Information Systems" Tata McGraw Hill, New Delhi.
2. C.P.Lo and Albert K.W.Yeung (2006). "Concepts and Techniques of Geographic Information Systems" Prentice Hall of India, New Delhi.
3. Albert, C.T.L. and Yeung, K.W. (2002). "Concepts and Techniques of Geographical Information Systems", New Delhi: Prentice Hall.
4. Chakraborty, D. and Sahoo, R.N. (2007). Fundamentals of GIS. India: Viva Books.
5. ESRI guide to GIS analysis Andy Mitchell, ESRI press, Red lands



Course Title: **Data Analysis and Visualization (3 Cr.)**
 Course Code: **CACS455**
 Year/Semester: **IV/VIII**
 Class Load: **5 Hrs. / Week (Theory: 3Hrs. Practical: 2Hrs.)**

Course Description

This course introduces to extend student’s knowledge and practice in data analysis and visualization, software, and applications. It provides the board overview of techniques of the visualization process, detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques.

Course objectives

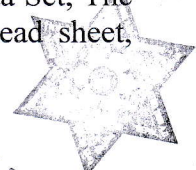
Upon completion of this course, students should be able to 1. Explain the concept of visualization in the processing and analysis of data. 2. Develop visualization methods and visualization systems using software applications. 3. Perform creative work in the field of visualization.

Course Contents

	Hours
Unit 1: Introduction to visualization Introduction of visual perception, Visual representation of data, Data Abstraction, Visual Encodings, Use of Color, Perceptual Issues, Information overloads	6
Unit 2: Creating visual representations Visualization reference model, Visual mapping, Visual analytics, Design of Visualization applications.	7
Unit 3: Non spatial data visualization Visualization of one, two and multi-dimensional data, Tabular data, quantitative values (scatter plot), Separate, Order, and Align (Bar, staked Bar, dots and line charts), Tree data, Displaying Hierarchical Structures, graph data, rules for graph drawing and labeling, text and document data, levels of text representation, visualizations of a single text document, word cloud, flow data Time series data, characteristics of time data, visualization time series data, mapping of time	15
Unit 4: Spatial Data Visualization Scalar fields, Isocontours (Topographic Terrain Maps), scalar volumes, Direct Volume Rendering(Multidimensional Transfer Functions) , Maps (dot, pixel), vector fields Defining Marks and Channels	10
Unit 5: Software tools and data for visualization The iris data set, The Detroit Data Set, The Breakfast Cereal Data Set, The Dow Jones Industrial Average Data Set (time series), MS spread sheet, Python, Matlab, Java, Tableau	10

Evaluation

Evaluation Scheme


 पञ्चजन्या विश्वविद्यालय
 खटिपुर

Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	100

Laboratory Work

Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using any one software tools mention in unit 5.

Text Books:

3. Fry, Visualizing Data. O'Reilly Media, 2008, ISBN 0596514557
4. Ware, Information Visualization: Perception for Design, 3rd ed. Morgan Kaufmann, 2012,

Reference Books:

5. Telea, Data Visualization: Principles and Practice. A. K. Peters, Ltd, 2007, ISBN 1568813066.



Course Title: **Machine Learning (3 Cr.)**
 Course Code: **CACS456**
 Year/Semester: **IV/VIII**
 Class Load: **6 Hrs. / Week (Theory: 3Hrs. Practical: 3Hrs.)**

Course Description

This course presents comprehensive introduction to several topics on basic concepts and techniques of Machine Learning (ML). It also explores the understanding of the Supervised and unsupervised learning techniques, probability based learning techniques, performance evaluation of ML algorithms and applications of ML.

Course objectives

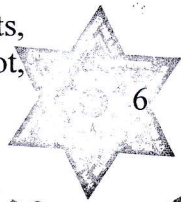
Upon completion of this course, students should be able to 1. Explain the concept of supervised, unsupervised and semi-supervised learning. 2. Develop algorithms to learn linear and non-linear models using software. 3. Perform creative work in the field machine learning to solve given problem.

Course Contents

	Hours
Unit 1: Introduction to machine learning History of machine learning, Brain-neuron learning system, Definition and types of learning, need of machine learning, Data and tools, review of statistics, training, validation and test data, theory of learning – feasibility of learning – error and noise – training versus testing, generalization bound – approximation-generalization tradeoff – bias and variance – learning curve	10
Unit 2 Introduction to Supervised Learning Classification problems, Linear Regression- Predicting numerical value, Finding best fit line with linear regression, Perceptron, learning neural networks structures, Decision tree representation, appropriate problems for decision tree learning, basic decision tree algorithm, support vector machines, Separating data with maximum margin, Finding the maximum margin,	11
Unit 3: Bayesian and instance based learning Probability theory and Bayes rule. Classifying with Bayes decision theory, Conditional Probability, Bayesian Belief Network, K-nearest neighbor	11
Unit 4: Introduction to un-supervised learning and dimensionality reduction Introduction to clustering, K- Mean clustering, different distance functions for clustering, Hierarchical clustering, Supervised learning after clustering, dimensionality reduction techniques, Principal component analysis	10
Unit 5: Measures for Performance Evaluation of ML algorithms Classification accuracy, Confusion matrix Misclassification costs, Sensitivity and specificity, ROC curve, Recall and precision, box plot, confidence interval	

Evaluation

Evaluation Scheme


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Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	100
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Laboratory Work

Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using software like matlab, python.

Text Books:

1. Tom M Mitchell, Machine Learning, First Edition, McGraw Hill Education, 2013.
2. Stephen Marsland, Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

Reference Books:

3. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.



Course Title: Multimedia System

Course Code: CACS457

Year/Semester: IV/VIII

Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course offers detailed concept and structure of Multimedia system. It includes introduction, Sound & Audio System, Images and Graphics, Video and Animation, Data Compression, Abstractions for programming, Multimedia design and applications. It does not entirely focus on theoretical concept but also strongly focuses on practical skill based learning

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of Multimedia System, applications and tools to make students capable of implementing, managing and developing the issues of multimedia application in their personal as well professional life.

Course Contents

Unit 1: Introduction

(6 Hrs)

- 1.1 Multimedia and its applications
- 1.2 Global structure of Multimedia
- 1.3 Medium
- 1.4 Multimedia system and properties
- 1.5 Characteristics of a Multimedia system
- 1.6 Challenges for Multimedia Systems
- 1.7 Components of Multimedia System
- 1.8 Multimedia building blocks
- 1.9 Scope of Multimedia

Unit 2: Sound / Audio System

(5Hrs)

- 2.1 Overview sound system
- 2.2 Producing digital audio
- 2.2 Music and speech
- 2.3 Speech Generation
- 2.4 Speech Analysis
- 2.5 Speech Transmission
- 2.6 Representation of audio files
- 2.7 Computer Music –MIDI
- 2.8 MIDI versus Digital Audio

Unit 3: Images and Graphics

(5 Hrs)

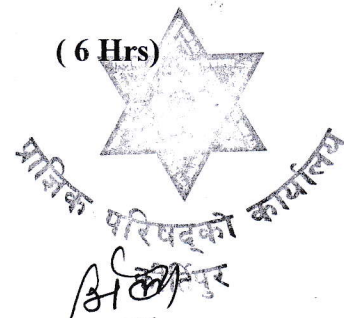
- 3.1 Uses of images and Graphics
- 3.2 Digital Image Representation
- 3.3 Image and graphics Format
- 3.4 Working with image and graphics
- 3.5 Image Synthesis, analysis and Transmission

Unit 4: Video and Animation

(6 Hrs)

- 4.1 Digital Video
- 4.2 Video signal representation
- 4.3 Computer Video Format
- 4.4 Computer- Based animation
- 4.5 Animation Language
- 4.6 Timeline and frame based animation
- 4.7 Timeline and Tween-Based animation

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- 4.8 Methods of controlling Animation
- 4.9 Display of Animation
- 4.10 Transmission of Animation

Unit 5: Data Compression

(8 Hrs)

- 5.1 Need for Data Compression
- 5.2 Compression Basics
- 5.3 Storage Space
- 5.4 Coding Requirements
- 5.5 Lossless and Lossy Compression techniques
- 5.6 Source, Entropy and Hybrid Coding
- 5.7 Lossy Sequential DCT- based Mode
- 5.8 Expanded Lossy DCT-based Mode
- 5.9 JPEG and MPEG Compression

Unit 6: Abstractions for programming

(6 Hrs)

- 6.1 Abstractions Levels
- 6.2 Libraries
- 6.3 System Software
- 6.4 Toolkits
- 6.5 Higher Programming Languages
- 6.6 Object –oriented approaches

Unit 7: Multimedia design

(6 Hrs)

- 7.1 Development phases and development teams
- 7.2 Analysis phase
- 7.3 Design Phase
- 7.4 Development phase
- 7.5 Implementation Phase
- 7.6 Evaluation and testing phase
- 7.7 Multimedia User Interface Design

Unit 8 : Multimedia Application

(6 Hrs)

- 8.1 Media preparation and composition
- 8.2 Media integration and communication
- 8.2 Media Entertainment
- 8.4 Telemedicine
- 8.5 E-learning
- 8.6 Digital video editing and production systems
- 8.7 Video conferencing
- 8.8 Video-on-demand

Laboratory Works

Labs consist of at least 8 practical experiments and two assignments covering the topics of the syllabus.

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

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Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Text Books

1. Ralf Steinmetz and Klara Nahrstedt , Multimedia: Computing, Communications and Applications, Pearson Education Asia
2. John F. Koegel Buford , Multimedia Systems, Pearson Education Asia

Reference Books

1. Fred Halsall , Multimedia Communications, Applications, Networks, Protocols and Standards, Pearson Education Asia
2. Ralf Steinmetz and Klara Nahrstedt, Multimedia fundamentals, Pearson Education Asia



Course Title: Knowledge Engineering (3 Cr.)

Course Code: CACS458

Year/Semester: IV/VIII

Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course offers detailed concept about knowledge representation, logic, reasoning and principles. It includes introduction, knowledge acquisition, knowledge representation and reasoning. It does not entirely focus on theoretical concept but also strongly focuses on practical skill based learning.

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of knowledge engineering to make students capable of analysis, design, implementing and managing of knowledge engineering in their personal as well professional life.

Course Contents

Unit 1: Introduction [6 Hrs.]

- 1.1 Overview of data. Information and knowledge
- 1.2 Knowledge engineering and Knowledge management
- 1.3 Artificial intelligence use in knowledge Engineering
- 1.4 Knowledge based system and its applications

Unit 2: Knowledge Acquisition [8 Hrs]

- 2.1 Information gathering
- 2.2 Information retrieval
- 2.3 Applications of Natural Language processing
 - 2.3.1 Morphology, lexicon, syntax and semantics
 - 2.3.2 Parsing, POS tagging, named entity tagging

Unit3: Machine Learning [12 Hrs]

- 3.1 Machine Learning and its applications
- 3.2 Supervised and unsupervised learning
- 3.3 Classification and clustering
- 3.4 Classification algorithms
 - 3.4.1 Linear classifiers
 - 3.4.2 nearest neighbor
 - 3.4.3 Support Vector Machines
 - 3.4.4 Decision tree
 - 3.4.5 Random forest
 - 3.4.6 Neural networks
 - 3.4.7 Case based reasoning

Unit 4: Knowledge representation and reasoning [7Hrs]

- 4.1 Proposition logic, predicate logic and reasoning
- 4.2 Knowledge representation languages
- 4.3 Non-monotonic reasoning
- 4.4 Probabilistic reasoning

Unit 5: Ontology Engineering [6 Hrs]

- 5.1 Overview to Ontology
- 5.2 Classifications of ontology
- 5.3 Methodology use in Ontology



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5.4 Ontology VS Language

Unit 6: Knowledge Sharing [9 Hrs]

6.1 Information Distribution and Integration

6.2 Semantic web and its applications

6.2.1 RDF and linked data

6.2.2 Description logic

6.2.3 Web Ontology language

6.3 Social web and semantics

Laboratory Works

The practical work consists of all features of knowledge engineering and case studies.

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

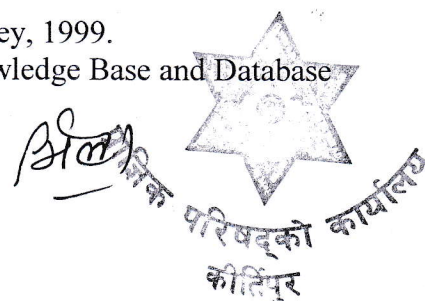
Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Text Books

3. Kendal, Simon, Creen, Malcolm, An Introduction to Knowledge engineering, Springer first edition, 2007
4. R.J. Brachman and H.J. Levesque. Knowledge representation and resoning (Elsevier 2004)

Reference Books

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A modern approach (Prentice Hall edition , second edition, 2002)
2. P. Jackson, Introduction to expert systems, Addison Wesley, 1999.
3. John Debenham, Knowledge Engineering: Unifying Knowledge Base and Database Design , Springer , 1998



Course Title: Information Security (3 Cr.)
Course Code: CACS459
Year/Semester:
Class Load: 6 Hrs. / Week (Theory: 3Hrs. Practical: 3 Hrs.)

Course Description: The course introduces the theoretical as well as practical concepts of computer and information security. The course includes concepts of cryptographic algorithms, authentication systems, access controls, malicious logics, network security and security audits.

Course Objectives: The objectives of this course are to familiarize the students with the computer security concepts, security policies and security mechanisms so that students will be able to design, implement and manage the secure computer systems.

Course Contents:

Unit I: Overview of Computer security (4 Hrs)

- 1.1. Computer Security Concepts
- 1.2. Computer Security, Information Security, Network Security
- 1.3. Threats, Attacks and Assets
- 1.4. Security Requirements
- 1.5. Security Design Principles
- 1.6. Attack Surfaces and Attack Trees
- 1.7. Computer Security Strategy

Unit II: Cryptographic Algorithms (12 Hrs)

- 2.1. Classical Cryptosystems: Caesar, Vignere, Playfair, Rail Fence Ciphers
- 2.2. Modern Ciphers: Block vs. Stream Ciphers, Symmetric vs. Asymmetric Ciphers
- 2.3. Symmetric Encryption: Fiestel Cipher Structure, Data Encryption Standards (DES), Basic Concepts of Fields: Groups, Rings, Fields, Modular Arithmetic, Galois Fields, Polynomial Arithmetic, Advanced Encryption Standards (AES)
- 2.4. Number Theory: Prime Numbers, Fermat's Theorem, Primality Testing: Miller-Rabin Algorithm, Euclidean Theorem, Extended Euclidean Theorem, Euler Totient Function
- 2.5. Asymmetric Encryption: Diffie-Helman Key Exchange, RSA Algorithm

Unit III: Message Authentication and Hash Functions (6 Hrs)

- 3.1. Message Authentication
- 3.2. Hash Functions
- 3.3. Message Digests: MD4 and MD5
- 3.4. Secure Hash Algorithms: SHA-1
- 3.5. HMAC
- 3.6. Digital Signatures

Unit IV: User Authentication (5 Hrs)

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

Unit V: Access Control (5 Hrs)



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

Unit VI: Malicious Software and Intrusion (4 Hrs)

- 6.1. Malicious Software
- 6.2. Virus and its phases, Virus Classification
- 6.3. Worm, Worm Propagation Model, State of Worm Technology
- 6.4. Trojan Horse
- 6.5. Intrusion and Intruders
- 6.6. Intrusion Detection System
- 6.7. Analysis Approaches: Anomaly Based, Signature Based
- 6.8. Honeypots

Unit VII: Network Security (5 Hrs)

- 7.1. Overview of Network Security
- 7.2. Email Security: S/MIME, Pretty Good Privacy (PGP)
- 7.3. Secure Socket Layer (SSL) and Transport Layer Security (TLS)
- 7.4. IP Security (IPSec)
- 7.5. Firewalls and their types

Unit VIII: Security Auditing (7 Hrs)

- 8.1. Security Audit
- 8.2. Security Auditing Architecture
- 8.3. Security Audit Trail
- 8.4. Implementing Logging Function
- 8.5. Audit Trail Analysis

Laboratory Works:

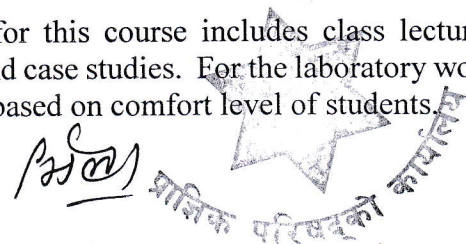
The laboratory work includes implementing and simulating the concepts of cryptographic algorithms, hash functions, digital signatures, authentication & authorization systems, and malicious logics. The laboratory work covers implementing programs for following;

- Classical ciphers like Caesar, Playfair, Railfence
- DES, AES
- Primality Testing, Euclidean Algorithm, RSA
- MD5, SHA
- Authentication systems like password based, Captcha, two factor authentication etc.
- Role Based Access Controls
- Malicious Logics

Teaching Methods

The major teaching methods that can be followed for this course includes class lectures, laboratory activity, group discussions, presentations and case studies. For the laboratory work, the instructor can choose any programming language based on comfort level of students.

Evaluation



Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Text Book:

4. William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Pearson
5. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson.

Reference Books:

1. Mark Stamp, Information Security: Principles and Practices, Wiley
2. Matt Bishop, Introduction to Computer Security, Addison Wesley
3. Matt Bishop, Computer Security, Art and Science, Addison Wesley
4. Charles P. Pfleeger and Shari Lawrence Pfleeger, Security in Computing, Pearson

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Course Name: Internet of Things (3 Cr.)

Course Code: CACS460

Year/Semester: IV/VIII

Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description: The course introduces basics of IoT. It covers introductions of IoT, Devices and platform for developing IoT Systems, Design methodology, Data Analytics for IoT, Servers & Cloud offering and IoT system security.

Objective:

The objective of this course is to introduce the students about the principles, techniques, development and applications of IoT System.

Course Contents:

Unit 1: Introduction to IoT

[8Hrs.]

- 1.1 Definition and Characteristics of IoT.
- 1.2 Physical and Logical Design of IoT.
- 1.3 IoT Enabled Technologies
- 1.4 IoT and M2M
- 1.5 Domain Specific IoTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

Unit 2: Sensor, Actuators and Interfacing

[18 Hrs.]

- 2.1 Roles of Sensors and actuators, Types of sensors: Active and passive, analog and digital, Contact and no-contact, Absolute and relative
- 2.2 Working of sensors: Position, occupancy and motion, velocity and acceleration, force, pressure, flow, Acoustic, Humidity, light, radiation, temperature, chemical, biosensor, camera.
- 2.3 Development boards: Arduino and Raspberry pi installation, interfacing and programming using python.

Unit 3: IoT Platform Design Methodology

[6 Hrs.]

Case Study on IoT System for Weather Monitor

Unit 4: Data and Analytics for IoT

[10Hrs.]

- 4.1 An Introduction to Data Analytics for IoT
- 4.2 Machine Learning
- 4.3 Big Data Analytics Tools and Technology
- 4.4 Edge Streaming Analytics
- 4.5 Network Analytics

Unit 5: IoT Physical Servers and Cloud Offering

[3Hrs.]

Cloud storage models and Communication APIs of IoT Systems

Unit 6: Securing IoT Systems

[3Hrs.]

- 6.1 IoT Security Challenges
- 6.2 IoT System's Security Practices

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Laboratory Work:

Implement the concept mentioned in the course using Python as a programming language, Arduino or Raspberry pi as a System board. All sensors mentioned in course should be implemented in a single project or separately to observe their working mechanism.

Evaluation:

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20	60	-	

Reference Books:

1. ArshdeepBahga, Vijay Madiseti, "Internet of Things (A Hands-on-Approach)", University Press India Pvt. Ltd., 2015.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Pearson Education (Cisco Press Indian Reprint).
3. Raj Kamal, "Internet of Things: Architecture and Design Principles", McGraw Hill Education, 2017.
4. Gary Smart, "Practical Python Programming for IoT", ISBN-10: 1838982469
5. Gaston C. Hillar Internet of Things with Python, ISBN-10: 1785881388

